Lake Sturgeon
Intermediate Curriculum

Acknowledgments

We would like to give special thanks to our workshop participants for their input and feedback during the development of these curricula. We would also like to thank those that provided technical reviews including:

References

The curriculum development team has drawn on numerous resources to create this educational tool. We list some of those resources here.

American Indian and Indigenous Studies Program at Cornell University:
https://cals.cornell.edu/american-indian-indigenous-studies

Auer, Nancy. 2013. Form and function in lake sturgeon. The Great Lake Sturgeon. 9-19.

Bruch, R.M., Miller, G., and Hansen, M. 2006. Fecundity of Lake Sturgeon (Acipenser fulvescens, Rafinesque) in Lake Winnebago, Wisconsin, USA. Journal of Applied Ichthyology. Suppl.1.116-118.

Cornell University Department of Natural Resources:
https://dnr.cals.cornell.edu

Fraser River Sturgeon Conservation Society:
https://www.frasersturgeon.com

Great Lakes Fishery Commission:
www.glfc.org

Kraft, C.E., D.M. Carlson, and M. Carlson. 2006. Inland Fishes of New York (Online), Version 4.0. Department of Natural Resources, Cornell University, and the New York State Department of Environmental Conservation. www2.dnr.cornell.edu/cek7/nyfish

Little River Band of Ottawa Indians: https://lrboi-nsn.gov

Menominee Indian Tribe of Wisconsin:
https://www.menominee-nsn.gov

Penn State Department of Ecosystem Science and Management:
https://ecosystems.psu.edu

Stroud Water Research Center: https://stroudcenter.org

U.S. Fish and Wildlife Service:
https://www.fws.gov/southeast/wildlife/fishes/lake-sturgeon

Wisconsin Sea Grant: https://www.seagrant.wisc.edu

Sea Grant
New York

Dear Educators,

This lake sturgeon intermediate curriculum has been developed to raise awareness about lake sturgeon for educators, students, and their families. Our goal for the lessons in this curriculum is to provide a springboard for youth and educators into promoting/advancing environmental stewardship. By highlighting the lake sturgeon as a charismatic species, we hope to instill a broad conservation ethic that will benefit the Great Lakes region.

Lake sturgeon populations were reduced to 1% from what they were before European settlement and thousands of years of sustainable harvest and traditional use by Indigenous Peoples. European overfishing was a serious issue. Dam construction for logging, and hydroelectric energy production blocked lake sturgeon from their spawning grounds, and concentrated them in small areas making them vulnerable to fishing. In addition, industrialization and growing human populations also added pollution to the Great Lakes basin and degraded water quality. Lake sturgeon were listed as threatened in New York State in 1983. Ten years later, a stocking program began and now about 10,000 lake sturgeon are stocked every year in New York waters to maintain and enhance populations.

You and your students can help with lake sturgeon conservation efforts. Raising awareness about lake sturgeon and doing what you can to help protect their habitat is important. Share what you know about sturgeon with others, or join conservation groups like New York Sturgeon for Tomorrow. Try to reduce your impacts on lake sturgeon habitat by minimizing the waste you produce, the energy you consume, and the water you use. For more on the lake sturgeon project and conservation efforts please visit: www.nyseagrant.org/lakesturgeon.

We received extensive feedback about this curriculum from educators during two workshops. The primary comments received were to try to increase the flexibility to produce a set of lessons that target as many grade levels as possible. The Teacher Suggestions sections are ideas on how to adjust the curriculum to increase complexity or reduce it to match students' grade level. Additional resources suggested by educators as useful are also noted. We hope you find this curriculum valuable.

For the love of lake sturgeon,
New York Sea Grant
Curriculum Development Team

Table of Contents

Lake Sturgeon Lesson 1: What Can I Do?

Grade Level
Intermediate
4th-6th

Duration
One 45-minute class period
and time at home

Subject
Science
Mathematics
English Language

Materials List
• Student Worksheet
• Journal

Sturgeon Sack
USB

Learning Standards
NGSS MSLS5 (growth
and development),
NG Math – NY5 G
(Geometry)

Focus/Overview
The students will learn about some of the ways they can help protect and improve lake sturgeon habitats and their populations.

Teacher Suggestions
The lake sturgeon "What Can I Do To Help?" Tip Sheet is included in these materials and expands on the information provided here. Use the Tip Sheet and watch the lake sturgeon video series (#1 - #6 totaling 10 minutes) on the USB drive provided to get more background. Consider using an app like Kahoot to gamify student journals, and perhaps graph or otherwise visualize results as a class.

Image Credit: Jesse Lepak / NY Sea Grant

Background Information
This lesson is about lake sturgeon conservation and how to do our part to help lake sturgeon and the environments where they live.

Lake Sturgeon are Important
Lake sturgeon are the largest freshwater fish found in the Great Lakes. They are often called "living fossils" because their prehistoric appearance hasn't changed for millions of years. Lake sturgeon are an important component of many Indigenous North American cultures, and they have inspired artwork, research, habitat restoration, and other conservation efforts. Lake sturgeon can also tell us about the health of the lakes and rivers where they live. Some of the oldest lake sturgeon living today were alive at the turn-of-the-century in 1899, which means they have been exposed to human pollution and habitat damage for more than 100 years!

Many people don't know that there are lake sturgeon in waters throughout the Great Lakes region. Learning and sharing what you have learned helps others understand the value of this unique fish. Raising awareness about lake sturgeon and the waters (Great Lakes) where they live helps people think about how their human activities impact the fish and their environment. By helping to conserve lake sturgeon and their habitat, we are helping ourselves and the world we share with these ancient fish.

Student Worksheet

What Can I Do?

Directions: For one week keep a journal about the things that you are doing that could help with lake sturgeon conservation. Based on the information you collect in your journal, use the form below to track the actions you have taken that could help lake sturgeon, and improve the quality of the environments where they live. Note the activity, the number of times you did it, and the number of people that joined you. Examples of what you might do are provided on the next page, but feel free to be creative and think of something completely different that could help raise awareness about lake sturgeon and/or make the environments that they live in better.

Share something from your journal with the rest of the class. As a group, add up all the different things that you have done as a class over the course of the week and discuss the kinds of impacts you made.

How large of an impact might be made if other classes heard about what you were doing and they tried to do the same? What kind of impacts might be made if 5, 10, or 100 more classes joined yours?

Day 1
Day 2
Day 3
Day 4
Day 5
Day 6
Day 7

Name:_____ Date: _____

What Can I Do?

_____ Join a group that supports lake sturgeon conservation like NY Sturgeon for Tomorrow. (facebook.com/NY-Sturgeon-For-Tomorrow-221935594534480)

(# of times_____)   (# of others that joined to help_____)

_____ Learn more about lake sturgeon.

(# of times_____)   (# of others that joined to help_____)

_____ Tell a friend or your family about lake sturgeon and why they are important.

(# of times_____)   (# of others that joined to help_____)

_____ Picking up and properly disposing of trash and recycling.

(# of times_____)   (# of others that joined to help_____)

_____ Donate old clothes and/or toys to keep them out of the trash.

(# of times_____)   (# of others that joined to help_____)

_____ Repurpose packaging and containers to help organize your things.

(# of times_____)   (# of others that joined to help_____)

_____ Organize a trash cleanup at home or school.

(# of times_____)   (# of others that joined to help_____)

_____ Turn off lights/devices/screens when they are not in use.

(# of times_____)   (# of others that joined to help_____)

_____ Unplug chargers and other equipment with indicator lights when not in use.

(# of times_____)   (# of others that joined to help_____)

_____ Keep doors closed to limit the heater or air conditioner.

(# of times_____)   (# of others that joined to help_____)

Name:_____ Date: _____

What can I do?

_____ Walk/bike versus using motor vehicles.

(# of times_____)   (# of others that joined to help_____)

_____ Turn off the water while brushing your teeth.

(# of times_____)   (# of others that joined to help_____)

_____ Turn off the water while washing your hands.

(# of times_____)   (# of others that joined to help_____)

_____ Collect waste or rain water for plants and gardens instead of using fresh water.

(# of times_____)   (# of others that joined to help_____)

_____ Consider a short shower instead of a bath.

(# of times_____)   (# of others that joined to help_____)

_____ Wash your bike or parents' car with a bucket and sponge instead of using the hose.

(# of times_____)   (# of others that joined to help_____)

_____ Other (describe)_____

(# of times_____)   (# of others that joined to help_____)

You can also share what you did and learn more online here

Lake Sturgeon Lesson 2: Documentary Activity
Manistee Nmé: A Lake Sturgeon Success Story

Grade Level
Intermediate
4th-6th

Duration
Two 45-minute class periods

Subject
Science
Social Studies
Engineering
Technology

Materials List
- Documentary
- Video response sheet
- Follow up discussion questions

Sturgeon Sack
DVD

Learning Standards
NGSS Science - MSLS24 (Matter and Energy in Organisms and Ecosystems), MSLS25 (Interdependent Relationships in Ecosystems) - NYS Social Studies - S1 History (Elementary) S3 Geography (Elementary)

Focus/Overview
This 23-minute documentary is an engaging way to provide students with some cultural and environmental context of lake sturgeon. "*Manistee Nmé: A Lake Sturgeon Success Story* was developed as a unique, hands-on approach to lake sturgeon restoration. This DVD explores the historical significance of lake sturgeon. Members of the Little River Band of Ottawa Indians explain the significance of the lake sturgeon to their Tribal members and others. The documentary follows biologists who are helping to restore the lake sturgeon population in the Big Manistee River, Michigan. The documentary is filled with outstanding video footage, including the first underwater video ever taken of lake sturgeon in the Big Manistee River!" – from the back cover.
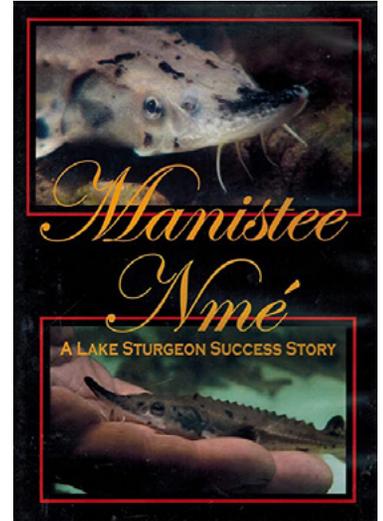
Image Credit: Little River Band of Ottawa Indians, Natural Resources Department, 2608 Government Center Drive, Manistee, MI 49660, 231-723-1594

Teacher Suggestions
Have students take notes during the video and pause the video to help students keep up while thinking about the discussion questions below. You can find more resources about Tribal connections to lake sturgeon in the additional reference materials provided.

Background Information
The Little River Band of Ottawa Indians are descendants of members of the Grand River Ottawa Bands who lived in villages located on the Manistee River, Pere Marquette River, and several villages on the Grand River system in Michigan. Only the portion of the Grand River Ottawa people now known as the Little River Band of Ottawa Indians had its status as a federally recognized Indian Tribe reaffirmed and restored by the United States in 1994.

Discussion Questions
1. What part of the video made an impression on you. Why?
2. What do you still question based on the video?
3. How would you describe the cultural value and importance of the lake sturgeon to the Little River Band of Ottawa Indians in Michigan?
4. What did you find interesting about the conservation efforts?
5. Why do you believe people participate in lake sturgeon releases?
6. What do you think you can do to help lake sturgeon populations?

Lake Sturgeon Lesson 3: Video Activity
Indigenous Relationship with Sturgeon

Grade Level
Intermediate
4th-6th

Duration
One 45-minute class period

Subject
Science
Art
Social Studies
Engineering
Technology

Materials List
• "Into the Outdoors" Link
• Video response sheet
• Follow up discussion questions

Sturgeon Sack
Invertebrate collection sieve and tray

Learning Standards
(NGSS) MSLS24, MSLS25, NYSS - S1 History (Elementary, Intermediate) S3 Geography (Elementary, Intermediate) (NGELA) - 5SL (Speaking and Listening)

Focus/Overview
The Menonimee are among the Indigenous Peoples found in the present-day Upper Great Lakes region in Michigan and Wisconsin. They are one of the 574 federally-recognized Tribal Nations, each with its own cultural practices, languages, and histories, in the United States. A map

Image Credit: Discover Media Works

posted by the non-profit organization Native Languages of the Americas at www.native-languages.org/states.htm is one resource for learning about local Indigenous Peoples in your area.

The Into the Outdoors Entertainment and Educational Network provides additional resources at: intotheoutdoors.org/topics/native-american-relationship-with-sturgeon.

Watch the two videos below as part of this lesson:

1. Serious Science: Native Relationship with Sturgeon (4:29)

2. The Menominee Fish Dance (1:31)

*Optional: Students can create their own lake sturgeon dance.

Discussion Questions
1. What were some similarities you learned from watching the two videos on different Indigenous Peoples who value lake sturgeon?

2. Why do you believe it is important for the Fish Dance to be shared with each generation?

3. How are Indigenous Peoples and others protecting and restoring the lake sturgeon today?

Video Response Worksheet

Directions:

Before watching the video write down anything you already learned or know about lake sturgeon.

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List 4 things you learned from the video:

1. _____
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2. _____
   _____

3. _____
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4. _____
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What would you like to learn more about since watching the video?

1. _____
   _____

2. _____
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Lake Sturgeon Lesson 4: Form and Function

Grade Level
Intermediate
4th-6th

Duration
Two 45-minute class periods

Subject
Physical Science
Mathematics
Engineering

Materials List
• Student Worksheet #1
• Student Worksheet #2

Sturgeon Sack
USB

Learning Standards
(NGSS) MSLS5 growth and development - MSLS24, NGELA 5SL5 (visual Presentation of knowledge and ideas)

Focus/Overview
The students will:

1. Learn about external features that make lake sturgeon unique.

2. Learn the mechanisms (science and engineering) behind how these characteristics are adapted to function for the benefit of the lake sturgeon given the fish's behaviors (e.g., how, where, and what they eat) and habitats (e.g., bottom-dwelling, open water, rivers, lakes).

3. Apply what they have learned to invent a fish of their own that has features adapted to benefit it depending on how students envision the fish's behaviors and habitats.

Image Credit: Jesse Lepak /NY Sea Grant

Teacher Suggestions
You might also challenge students and ask them to design fish that are made to perform well in different environments or habitat types such as open water, nearshore areas, or rivers and streams.

• Use the Tip Sheet and watch the lake sturgeon video series (#1 - #6 totaling 10 minutes) on the USB drive provided to get more background on lake sturgeon.

• To learn more about other fish species and their features, try visiting: www2.dnr.cornell.edu/cek7/nyfish.

• More useful resources can be found in the teacher reference materials provided with this curriculum.

Note: Fish shown below the lake sturgeon on page 3 of 4 of the lesson is a flying fish.

Lake Sturgeon Form and Function

Directions: Read the informational text about lake sturgeon form and function. Annotating informational text can help you better understand the material you're reading. For this activity you will read the passage and annotate your text. As you read:

- Highlight or underline key information.

- Make marginal notes. These notes can include stars, check marks, phrases, questions, question marks, words, etc.

Barbels
Scutes
Heterocercal tail
Ampullae of Lorenzini (electroreceptors)
Protrusible mouth
Large pectoral fins
Triangular body shape

With permission of the University of Wisconsin Zoological Museum
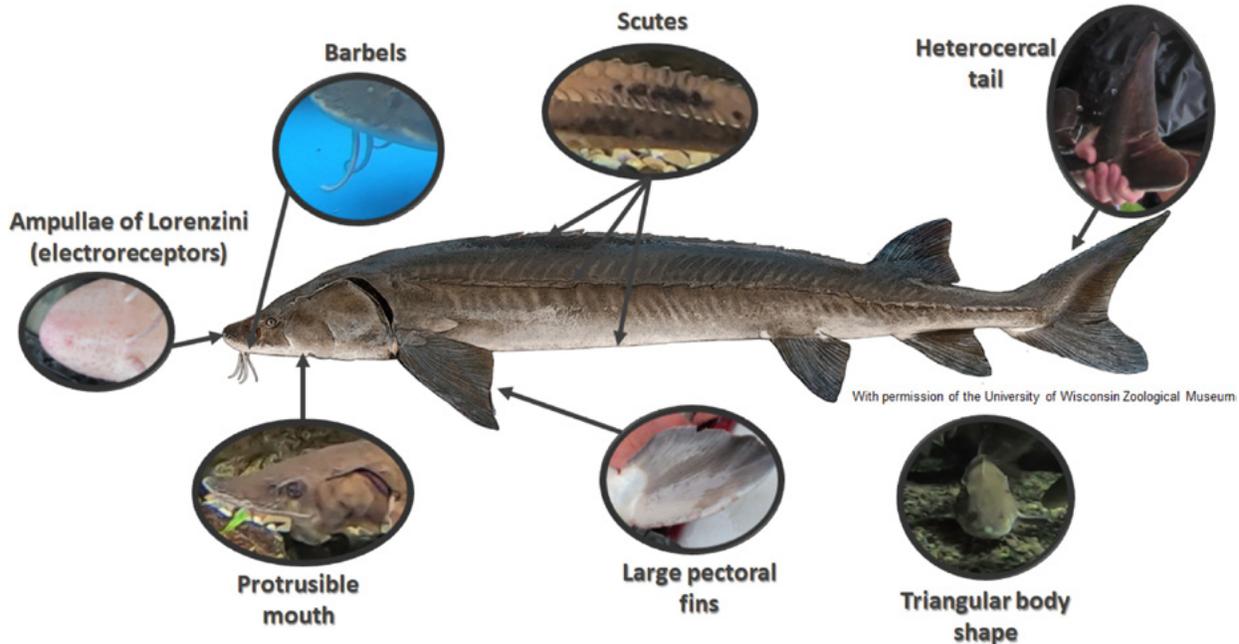
Lake Sturgeon Features

Lake sturgeon have adapted to their environment to survive for millions of years. As a result of their evolution, lake sturgeon are built to thrive and reproduce in the Great Lakes, and they have many features that help them do this successfully.

Barbels

Lake sturgeon have four sensory organs that dangle in front of their mouths. These organs are called barbels. They are used by the lake sturgeon to detect food as they pass over it. As lake sturgeon swim through lakes and rivers, their barbels drift just over the bottom, tasting for food. They are equipped to eat anything they swim over that seems tasty.

Annotations

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Lake Sturgeon Form and Function

Ampullae of Lorenzini

There is a network of fluid-filled pores concentrated around the head of lake sturgeon called the Ampullae of Lorenzini. These ampullae act as electroreceptors, allowing the lake sturgeon to detect small electrical fields emitted by some of their prey, including invertebrates and small fish. Ampullae are also used by sharks, rays, and a few other fishes, including members of the sturgeon family.

Protrusible Mouth

Lake sturgeon do not have teeth, but they do have a mouth that is very well-adapted for their style of feeding. Their "protrusible" mouth extends down from their body and acts like a vacuum, sucking up prey. Whatever the lake sturgeon takes in that it doesn't like gets spit out of the mouth or expelled through the gill plates. Maybe you have seen a fish in a tank do this.

Image Credit: Jesse Lepak/NY Sea Grant

Underside of a lake sturgeon's head.

Large Pectoral Fins

Lake sturgeon have large pectoral fins near their heads. By placing these fins at the correct angle, lake sturgeon can hold themselves against the bottom of a swiftly flowing river, and maintain that position with very little swimming effort. Given that lake sturgeon are often found in fast-flowing rivers, this ability is helpful for them when migrating, spawning, feeding, and more. Other fish have smaller fins that are more flexible for making tight turns and evading predators.

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Name:_____   Date: _____

Lake Sturgeon Form and Function

Triangular Body Shape

When you look at a lake sturgeon head-on, you can see they are shaped similar to a triangle, with the base of the triangle being their belly and the point being the top of their back. This shape, similar to their large pectoral fins, helps them maintain their position comfortably at the bottom of the lakes and rivers they call home. Other fish (called flatfish) lie flat on the bottom and have their eyes on the same side of their head, while other fish are streamlined and built to swim to find prey.

Heterocercal Tail

Lake sturgeon have a fairly unique tail shape. The upper lobe of their tail fin (caudal fin) is significantly larger than the lower lobe. When the tail of a fish is not symmetrical, the tail is called, "heterocercal" (pronounced hetero-circle), meaning "different than a circle." With this shape, the lake sturgeon tail produces force that lifts the tail, and pushes the head downward. This helps lake sturgeon maintain their position on the lake or riverbed. Most fish with heterocercal tails have larger upper lobes versus lower lobes, but some don't. One extraordinary example is shown below for comparison with a lake sturgeon. Do you know what this fish is called and how it uses its tail and other fins?

With permission of the University of Wisconsin Zoological Museum

Image Credit: Shutterstock

Annotations

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Name:_____ Date: _____

Lake Sturgeon Form and Function

Scutes

Lake sturgeon have protective armored plates, similar to some dinosaurs you may have seen depicted in movies or on television. These plates are called scutes. They have five rows of these hard structures: one along the back, two down both sides, and another two along either side of the belly. These scutes are modified scales, similar to the protective structures on dinosaurs. You can see how they start out very sharp and very visible (Photo A). As lake sturgeon grow (Photos B–F) and age, their scutes become less important as they become larger than their predators. Interestingly, saltwater species of sturgeon can have more pronounced scutes until they are larger because there are larger predators (such as sharks and seals) in the ocean.

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Image Credit: Jesse Lepak/NY Sea Grant

Name:_____ Date: _____

Lake Sturgeon Form and Function

Directions: Think about the different features of the lake sturgeon that you have learned about and what functions they help the lake sturgeon perform. Design your own original fish that has characteristics that will help it perform the functions that you see as being important for it. Describe these features and explain how the fins/scales/mouth/shape/etc. will help your fish be the best fish it can be. Think about what your fish might eat, where it lives (lake, river, ocean, pond, stream), and how it behaves (does it migrate, live in one place, live on the bottom, live at the surface, live in open water, etc.), and consider those details as you design your fish.

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Lake Sturgeon Lesson 5: Role in the Food Web

Focus/Overview
This lesson is all about what lake sturgeon eat (prey), and what might eat them (predators). The students will:

1. Learn how lake sturgeon interact with other organisms in Great Lakes and understand their role in the food web.

2. Gain experience using an invertebrate key, a chart illustrating key features of different invertebrates. This is a crucial skill for conducting many ecological studies.

3. If a field trip is possible, gain experience sampling in the field.

Image Credit: Jesse Lepak / NY Sea Grant

Teacher Suggestions
For your stream survey activity, we have included resources for invertebrate and fish identification, as well as a metal sieve and invertebrate viewing tray. Importantly, if you are interested in observing organisms in the field, be sure to contact your local state environmental agency. Considerations should include any necessary permitting, native/rare species that might be impacted, and avoiding the spread of any invasive species. The organisms collected for your survey should be returned to where they were found. Take photos to bring back to your classroom.

Here is a resource for conducting a stream survey:
https://ecosystems.psu.edu/youth/4-h-stream-teams/how-to-guides/complete-a-kick-net-study

Teacher Answer Key
The answers to the invertebrate images provided are:
Damselflies (*Odonata*; Slide #15),
Right Handed/Gilled Snail (*Gastropoda*; Slide #7),
Mayflies (*Ephemeroptera*; Slide #15),
Other Caddisflies (*Trichoptera*; Slide #12),
Mussels (*Mollusca*; Slide #7),
Stoneflies (*Plecoptera*; Slide #15),
Midge Flies (*Chironomidae*; Slide #10),
Scuds (*Amphipoda*; Slide #4)

New York Sea Grant

Name:_____   Date: _____

Student Worksheet

Lake Sturgeon Role in the Food Web

Directions: Read the information text pages that follow about lake sturgeon and its role in the food web. For this activity, read the passage and make annotations on the text. Annotating informational text is an important comprehension skill for understanding the information authors are conveying. As you read:

- Highlight or underline key information.

- Make marginal notes. These notes can include stars, check marks, phrases, questions, question marks, words, etc.

- Write a brief summary at the end of section.

- List vocabulary words that you were unsure of their meaning.

Image Credit: Jesse Lepak / NY Sea Grant

Annotations

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Lake Sturgeon Foraging

Lake sturgeon have several features that make them efficient bottom-feeders. They have sensory organs called barbels that hang in front of their mouths, and a network of pores (Ampullae of Lorenzini) concentrated on their heads (as do sharks). These features allow lake sturgeon to smell, taste, and feel their way along the bottom until they find something they like to eat. Lake sturgeon don't have teeth, but they have what is called a protrusible mouth (shown in the image above) that extends down and acts like a vacuum, sucking up prey items that live on river and lake bottoms. Whatever the lake sturgeon doesn't want to eat, such as sand or silt, it spits out or expels through its gill plates.

Name:_____ Date: _____

Lake Sturgeon Role in the Food Web

Image Credit: Jesse Lepak / NY Sea Grant

Lake Sturgeon Prey
Lake sturgeon are one of the few native fishes in the Great Lakes that can eat invasive zebra and quagga mussels. Lake sturgeon play an important role in the food web, foraging on bottom-dwelling invertebrates, small fish, and other prey. The lake sturgeon converts and uses the energy and calories of the prey to grow and reproduce to maintain its populations.

Lake Sturgeon Predators
In a food web, there are predators that, when they are smaller, often serve as prey for other organisms. As lake sturgeon grow, they become large enough to eat those organisms that used to be able to eat them. For example, lake sturgeon eggs are vulnerable to predators such as round goby, suckers, other small fishes, and crayfish.

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Name:_____ Date: _____

Lake Sturgeon Role in the Food Web

Lake Sturgeon Predators Continued

Lake sturgeon are born with protective plates called scutes that help young lake sturgeon avoid being eaten. As the scutes become larger, they become less prominent and tissue grows around them, covering them. However, even when lake sturgeon are large, they still have some predators, including people!

Image Credit: Jesse Lepak / NY Sea Grant

Another Example

The invasive sea lamprey (shown above) is a fish that can attach to lake sturgeon and draw out their fluids to get energy. Sea Lamprey are external parasites that spread throughout the Great Lakes and now impact many important fish species. The spread of sea lamprey was made possible by another top predator that has had a big influence on lake sturgeon populations, humans, who made canals that connected previously separate waterbodies. Humans are one of the few predators of adult sturgeon.

Annotations

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Information Text Response Worksheet

Summarize your reading of the Lake Sturgeon's Role in the Food Web informational text.

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Write down the words for which you didn't know the meaning. Look up and record their definitions.

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What would you like to learn more about after reading the text?

1. _____

   _____

2. _____

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Student Worksheet

Identifying Organisms in the
Lake Sturgeon Food Web

Directions Looking at the images below identify the 8 potential lake sturgeon prey items. Use the online key that can be found online at: https://stroudcenter.org/macros/key. After you identify each organism, research one fact about it.

1
Image Credit: Shutterstock 751301086

3
Image Credit: Shutterstock 1316594928

5
Image Credit: Jesse Lepak / NY Sea Grant

7
Image Credit: Shutterstock 311837897

2
Image Credit: Shutterstock 1768512062

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Image Credit: Shutterstock 1391195693

6
Image Credit: Shutterstock 797229499

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Image Credit: Shutterstock 354480866

What is the name of the organism? What is one fact about the organism you identified?

1. _____

2. _____

3. _____

4. _____

5. _____

6. _____

7. _____

8. _____

Name:_____ Date: _____

Student Worksheet

Conducting a Stream Survey

Directions

- Use a bucket and aquarium nets and sieves to collect organisms from a river or lake.

- Try brushing vegetation off rocks into a bucket or water-filled tray.

- Take notes about what you observe during your collection (see Observation Notes below).

- Use the Macroinvertebrate Identification Key online at https://stroudcenter.org/macros/key to identify the invertebrates in your collection.

- Use the images and glossary resource from *The Atlas of Common Freshwater Macroinvertebrates of Eastern North America*.

- Use other resources to identify other organisms in your collection, e.g., for fish, try Inland Fishes of New York: www2.dnr.cornell.edu/cek7/nyfish.

- Take notes about what you observe.

Image Credit: Jesse Lepak / NY Sea Grant

Observation Notes

What was the weather like, how many different species did you see, which was the largest, which was the smallest, which was the most colorful, which was the fastest, which was your favorite?

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Tale of a Great White Fish is an excellent entry point for teaching about lake sturgeon conservation efforts. Although the book focuses on the white sturgeon species that can reach 20 feet in length and spends part of its time in saltwater, its story can be tied to that of lake sturgeon in the freshwater of the Great Lakes. See the next page for more details connecting the two species. More information is also available on author Maggie de Vries' website at http://maggiedevries.com/books/animal-stories/tale-great-white-fish.

Lexile Level: 610L – 800L

Flesch-Kincaid reading level: 4.7

Language: English

Age Range: 5-12 years old

Page count: 48

Copyright: 2006, Paperback

Publisher: Greystone Kids

ISBN: 9781553653035

Grade level: Intermediate (3-6)
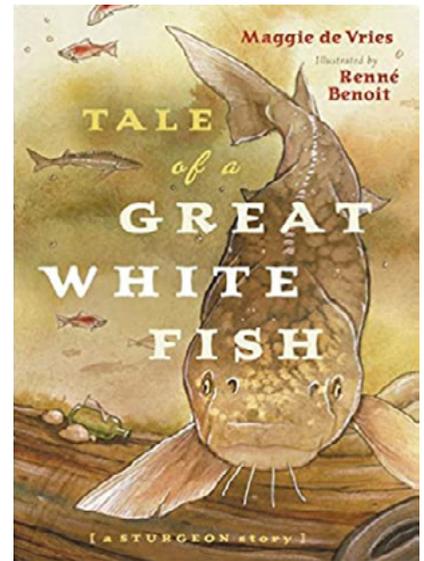
Image Credit: Renné Benoit

In *Tale of a Great White Fish*, author Maggie de Vries provides a captivating account, illustrated by Renné Benoit, of the two-century journey of one sturgeon. As with many environmentally-focused books, this book can be used in a variety of ways to promote literacy objectives as well as cross-curricular objectives for classes such as science, math, and social studies. Additionally, the text can help students better understand "conservation efforts," with examples such as the boys pushing the fish back into the water, the scientist tagging the fish to study it, and the boy who saw the fish getting involved in conservation efforts as an adult. Here are suggested subject area learning activities:

- **English Language Arts:** Discuss story sequencing, setting, point of view, personification, and non-fiction versus fiction.
- **Mathematics:** Calculate and plot the growth rate of the fish, determine a timeline for the fish's growth, exploring comparisons between age, length, and weight.
- **Social Studies:** Research the location of the Great Lakes as well as the era of the 1800s, compare the cultural differences between Indigenous and settler communities, investigate the impact of fishing in the Great Lakes region of the United States, build a visual timeline of the fish's lifespan.
- **Science:** Describe the life cycle of lake sturgeon, explore different scientific eras, engage in the study of the Great Lakes habitat, and research the impact of fish egg harvesting.

Teacher Suggestion: Prior to reading *Tale of a Great White Fish*, identify the learning objectives so students can be reading with those in mind.

Connecting the Great White Fish to the Great Lakes

There are nearly 30 types of sturgeon (the common name) located around the world. These fish belong to the *Acipenseridae* family. They date back to the Triassic Period, more than 200 million years ago! The Great White Fish described in the book is a white sturgeon (*Acipenser transmontanus*) in the Fraser River. The white sturgeon is the largest species of sturgeon in North America, reaching lengths close to 20 feet! Issues similar to those the white sturgeon faces in the book have impacted lake sturgeon in the Great Lakes. Typically, sturgeon are bottom-feeders and migrate upstream to spawn (reproduce). Sturgeon tend to return to the place where they were hatched in order to spawn. Sturgeon spend most of their lives in river deltas and estuaries. Some species, like our lake sturgeon, live in freshwater, but many live in ocean coastal areas. While some of the features and habitats diverge, they share a common threat of extinction

Image Credit: Renné Benoit

based on human impact. *Tale of a Great White Fish* describes the sturgeon's habitat being altered and Big Fish finding it difficult to return to her spawning location. These fish are targeted for their roe (eggs) which is considered an expensive delicacy called caviar. These ancient fish have been heavily exploited and have endured other conservation threats, bringing many of the species to critically endangered status, and on the brink of extinction. Lake sturgeon are protected in 19 out of 20 states where they are found, according to the U.S. Fish and Wildlife Service (www.fws.gov/southeast/wildlife/fishes/lake-sturgeon).

In New York, lake sturgeon can be found in Lake Erie, Lake Ontario, the St. Lawrence River, Oneida Lake, Onondaga Lake, Cayuga Lake, Black Lake, and the Niagara, Genesee, Raquette, Oswegatchie, Grasse, Salmon (Franklin County) and St. Regis Rivers. This curriculum guide to the lake sturgeon is just one of many efforts to raise awareness to promote aquatic conservation of this fish, "the dinosaur of the Great Lakes."

Literacy Strategies to Promote Inclusivity: *Tale of a Great White Fish* can be viewed electronically on a projector screen to help show images and read aloud to support students with auditory and visual impairments. Using a speaker system can aid students with auditory and visual disabilities. Having multiple copies of the text would allow intermediate-level students to independently read the book or read with a partner to engage in close reading techniques to solidify comprehension. For a traditional read-aloud session, educators can prepare questions that align with specific lesson goals for students of all abilities.
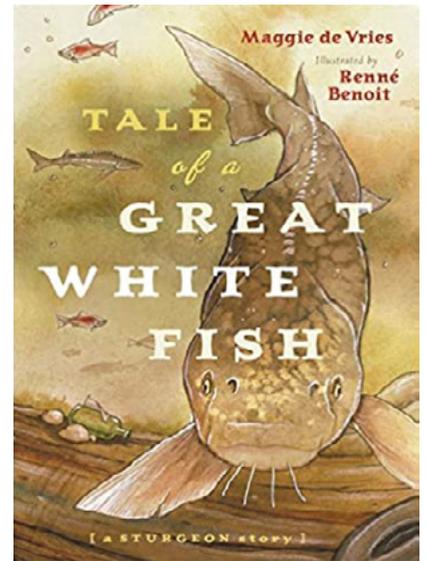
Lake Sturgeon Lesson 6: Literature Activity
Personification within *Tale of a Great White Fish*

Grade Level
Intermediate
4th-6th

Duration
One 45-minute class period

Subject
Science
English/Language Arts

Materials List
- Copy of the *Tale of a Great White Fish*
- Student Worksheet

Group Size
Individually or in pairs

Learning Standards
(NGLS) NY5.R4
(Craft and structure)

Focus/Overview
Personification is a powerful literary device that can be used by writers to influence the reader's emotion about non-human organisms, or non-living objects. In this case, the text in *Tale of a Great White Fish* has personification that helps students travel in time with Little Fish and witness how she escapes being captured throughout time.

The students will:

1. Explain what personification is.

2. Be able to identify examples within the text.

3. Describe how authors can use personification for conservation efforts.
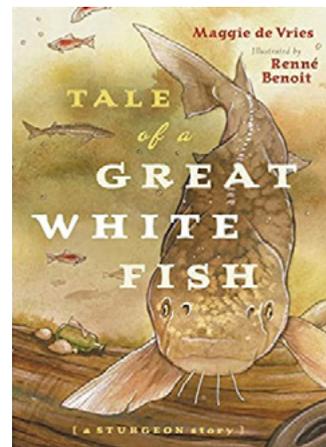

Image Credit: Renné Benoit

Teacher Suggestions
For this activity students can work individually and/or in pairs to discuss their responses. Some guiding questions could be:

1. Is there a section in the book where you felt an emotion about white sturgeon? What was it?

2. How could personification be used to influence people to care about lake sturgeon?

3. What actions did people take in the book to help save and protect white sturgeon?

4. If you were a white sturgeon, what might your life be like?

Note the artwork in the book, as it might be connected to other creative components in this curriculum.

Additional Teaching Resource
For background and a teacher-guided learning exercise on using personification as a literary device, follow this link to a Mini-Lesson on Writing with Personification created by Teri & Tiff's Creative Resources, copyright 2013:
https://www.windham-schools.org/userfiles/1024/classes/12271/learningaboutandwritingwithpersonification.pdf

Student Worksheet

Personification within *Tale of a Great White Fish*

Directions Read *Tale of a Great White Fish*. Use sticky notes to mark places within the text where you find personification being used to humanize white sturgeon. Personification is a literary device that gives human attributes to non-humans such as ideas, wildlife, or objects. It comes from the Greek word "prosopopoeia", its roots meaning "prósopon" (face, person), and "poiéin" (to make, to do) in which a non-human organism or object is given human attributes. These creatures or objects are portrayed in such a way that we feel they can act like human beings.

For example, "My poor old car wheezes like an old man going up a hill." Describing a car as behaving like an old man is personification. Thus, we can say that the car has been personified in this example. With the above definition of personification, consider personification examples within the *Tale of a Great White Fish*.
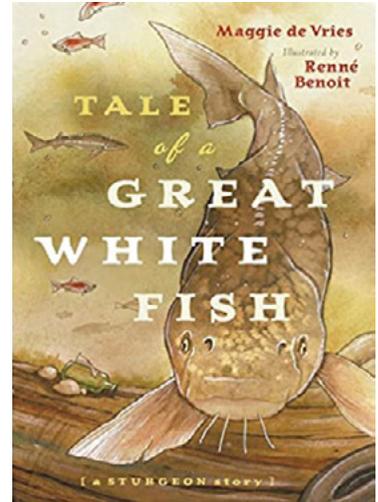
Image Credit: Renné Benoit

Find at least one example in *Tale of a Great White Fish* where you believe personification is being used. Use that example to answer the following questions.

Example and page #:

_____

_____

_____

How is personification being used in this example?

_____

_____

_____

In what ways did personifying the lake sturgeon impact you as a reader?

_____

_____

Student Worksheet

Personification within *Tale of a Great White Fish*

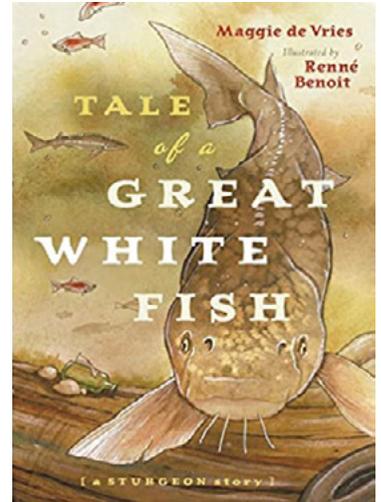In what ways do you think personifying lake sturgeon could impact conservation efforts?

_____

_____

_____

_____

_____

_____

Image Credit: Renné Benoit

What other literary devices did you notice in the tale?

_____

_____

_____

Would you recommend this book to a friend? Why or why not?

_____

_____

_____

Have you read other books about sturgeon, fish conservation, invasive species, or others? If so, please list:

_____

_____

_____

Lake Sturgeon Lesson 7: Growth Rate Graphing Activity
within *Tale of a Great White Fish*

Grade Level
Intermediate
4th-6th

Duration
Two to three 45-minute
class periods

Subject
Science
Mathematics

Materials List
• Copy of *Tale of a Great White Fish*
• Student Worksheet
• Graph paper

Group Size
Individually or in pairs

Sturgeon Sack
Book, tape measure,
vinyl sturgeon

Learning Standards
(NGLS) NY5.G (Geometry)

Focus/Overview
This activity demonstrates how mathematics is important to environmental science. Students will observe how Little Fish grows into Big Fish over time in the book, *Tale of a Great White Fish*. Graphs and figures play important roles in the modeling and understanding of complex natural systems. Although graphing concepts are taught throughout grades K-12, this activity reviews basic graphing skills in an engaging way using data about sturgeon from the book.

The students will:
1.   Construct a meaningful data table.

2.   Plot x-y data on a graph.

3.   Read and interpret data from plots.

4.   Describe plots or graphs.

5.   Make inferences on data projection.

6.   Connect growth rate of white sturgeon to data gathered.

For this activity students can work independently or in pairs. It can be helpful to pair students with a strong understanding with one who might need more support. The dialog between students can help them think about the growth rate of white sturgeon.

Image Credit: Renné Benoit

Teacher Suggestions
• If your students are unfamiliar with graphing exercises, and best-fit lines, a phenomenon-based exercise (plotting rainfall or snowfall as a function of hours for example) might be useful before this lesson.

• Challenge your students to make connections between the 1800-2000 time period in Fact Sheet #4 and what the Great White Fish experiences in the book.

• Use a tape measure to track the growth of Little Fish.

• Ask students to describe what they think life would have been like in the Great Lakes if they were a lake sturgeon at a specific year in time.

• Note the artwork in the book and relate it to other creative lessons in this curriculum.
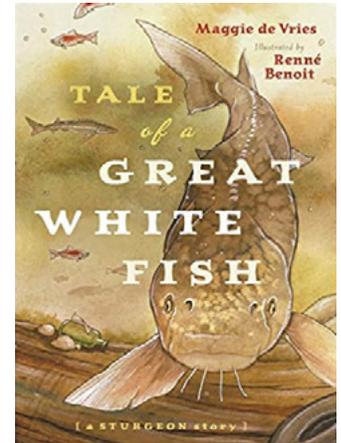
Name:_____   Date: _____

Growth Rate Graphing within
Tale of a Great White Fish

Directions Read *Tale of a Great White Fish*. Complete the data table, paying special attention to the growth rate of the white sturgeon. Scientists use growth information to track the health of fish over time. By graphing growth you are doing the same thing that fisheries scientists and managers do. Although the growth rate is dependent on food quality and temperature, most fish keep growing as they get older, unlike other animals, birds, and humans. white sturgeon continue to grow until they die. Your task is to make observations on what you notice about the growth rate of Little Fish who turns into Big Fish.

Image Credit: Renné Benoit
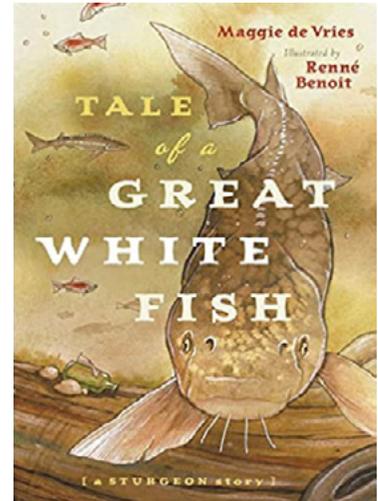
Complete the following data table

Age (years)	Page Number	Length (meters)	Weight (kilograms)

Student Worksheet

Growth Rate Graphing within
Tale of a Great White Fish

Directions Graph the information you wrote down on the previous page. Put the age of the fish on the x-axis, and length in meters on the y-axis.
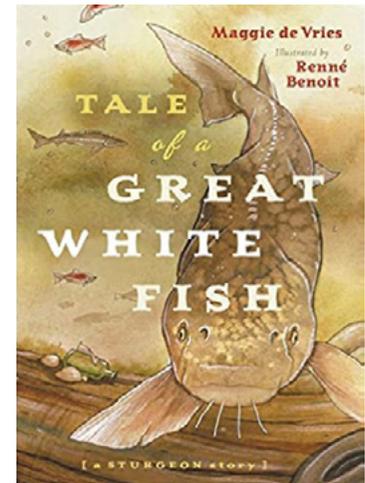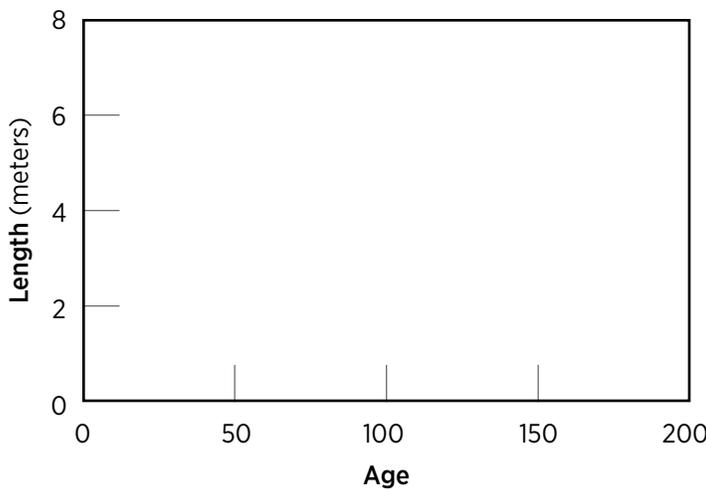
Image Credit: Renné Benoit

Directions On a separate piece of paper, create your own graph. Use a straightedge to draw a box with the same lake sturgeon ages along the x-axis (0 - 200) like the graph above. On the y-axis, plot the weight of big fish in kilograms at the ages given in the book. Try starting at 0 and going up to 1,000 kilograms by 250 for your y-axis. Be sure to label your graph like the one above.

Does your graph look like what you expected? Why or why not?

_____

_____

What are some similarities you observe about the graph you created?

_____

_____

What are some differences you observe about the graphs you created?

_____

_____

Lake Sturgeon Lesson 8: Tagging

Grade Level
Intermediate
4th-6th

Duration
One to two 45-minute
class periods

Subject
Science
Technology
Mathematics

Materials List
• Student Worksheet

Sturgeon Sack
Sample tags

Learning Standards
NGSS MSLS5 (growth
and development),
NG Math – NY5 G
(Geometry)

Focus/Overview

This lesson is all about tagging lake sturgeon and describes some of the approaches that scientists take to better understand lake sturgeon and their movements through tagging. The data used in this lesson was from an actual lake sturgeon tagged in the Niagara River and was provided by the U.S.

Image Credit: Jesse Lepak / NY Sea Grant

Fish and Wildlife Service Lower Great Lakes Fish and Wildlife Conservation Office www.fws.gov/northeast/lowergreatlakes.

The students will:
1. Learn about some of the information that scientists gain from tagging lake sturgeon.

2. Learn about lake sturgeon seasonal movement.

Teacher Answer Key

Scientists could learn many things from a tagged fish including age, length, weight, how much the fish has grown after it was tagged, how far a fish moved.

The tagged lake sturgeon spent most of its time in the river in the winter, and visited the lake most often in the summer and fall. Lake sturgeon are likely to move upstream in the spring to spawn. The lake sturgeon moved the least during the winter. It likely moved most during other parts of the year because of spawning, and also due to warmer water temperatures which increase metabolism and foraging, and also increase the availability of prey that reproduce and move more when water temperatures rise.

The lake sturgeon swam about 20 kilometers. It was likely easier for it to swim downstream (north in this case) versus south which would be going upstream from Lake Ontario towards Lake Erie (with Niagara Falls in between the two).

New York Sea Grant

Name:_____   Date: _____

Lake Sturgeon Tagging

Fisheries scientists and managers need information to understand how lake sturgeon behave, where they spend their time, what they eat, and how they grow. This information helps scientists understand the habitat requirements of lake sturgeon during certain times of their lives. Knowing about their habitats helps natural resource managers protect, maintain, or improve them so lake sturgeon populations can continue to recover. Tags are used by scientists to individually mark a lake sturgeon. Scientists will then share the tag numbers and information with other scientists, allowing them to be able to learn from the fish later.

There are different kinds of tags that can be used to collect data on lake sturgeon and other organisms. You may have heard of radio collars being placed on bears or large cats to track them, or perhaps you have seen a duck or a goose with a band on its foot. Similar tags are used for fish depending on what questions managers would like to investigate. In this lesson you will learn about acoustic telemetry tags and how they are used to track lake sturgeon movement.

Types of Tags

Here is a picture of a tagged baby lake sturgeon that was raised in a hatchery before it was placed into the wild (stocked). Prior to releasing the fish into the wild, scientists record important information about the tagged fish such as length, weight, and where it is released. The blue tag (circled) has an identification number that is unique to that fish, and a phone number to contact the entity that tagged the fish. Should a tagged fish be caught or found,

Image Credit: Jesse Lepak / NY Sea Grant

even if it's 100 years from now, scientists can learn important information such as where it came from, how far it traveled, its age, and how much it's grown.

Other tags, called acoustic telemetry tags, help scientists track movements of lake sturgeon more closely over the course of a year. These tags transmit sound data that are picked up by receivers that are placed in the water. Receivers "listen" for acoustic tags and record the information. This helps fisheries managers understand what areas, or habitats, are most used by lake sturgeon during the different seasons. Just like people, lake sturgeon use different habitats more often at different times of the year. In the Great Lakes region, people typically spend more time outdoors in the summer, and more time indoors during the winter. The maps on the next page show where a single lake sturgeon spent its time in and around the Niagara River (below Niagara Falls) and Lake Ontario in one year. The dots are locations where the tagged fish spent its time; different colors indicate different seasons.

Student Worksheet

One Lake Sturgeon's Tagged Travels

Locations of a tagged lake sturgeon over the course of a single year are represented in the maps and figures shown here. Dots mark the location where the lake sturgeon was in certain seasons.

Image NOAA © Google, Image Landsat / Copernicus
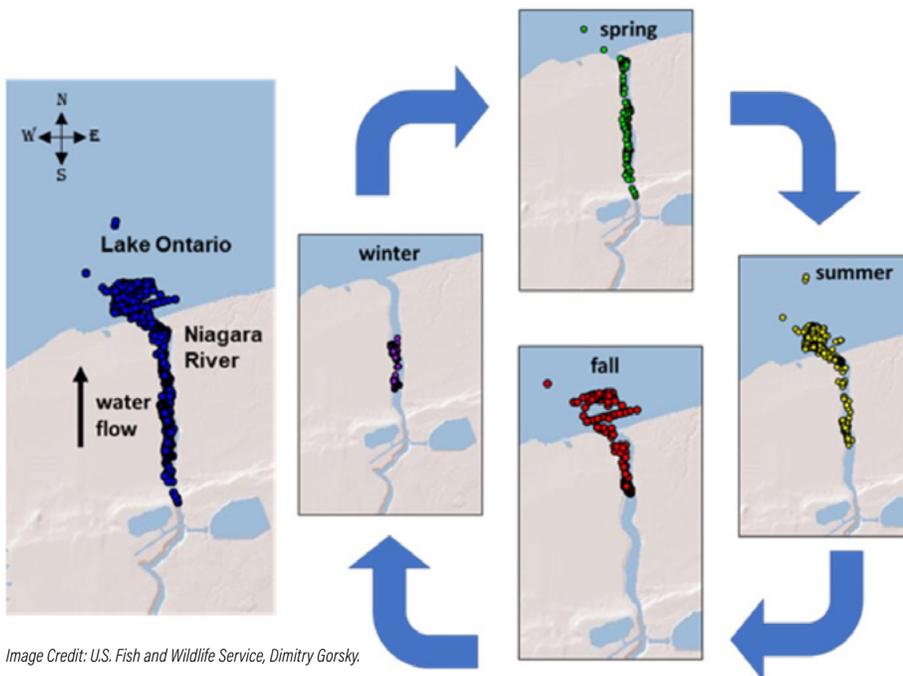
Seasonal movements of a lake sturgeon over the course of a year in the Niagara River and Lake Ontario.

Image Credit: U.S. Fish and Wildlife Service, Dimitry Gorsky.

Student Worksheet

What Can Tags Tell Us?

Directions Imagine you are a fish biologist that catches a tagged lake sturgeon. What could you learn about the tagged fish from the information (historical data) that the scientist before you collected when they first tagged that fish?

Student Worksheet

What Can Tags Tell Us?
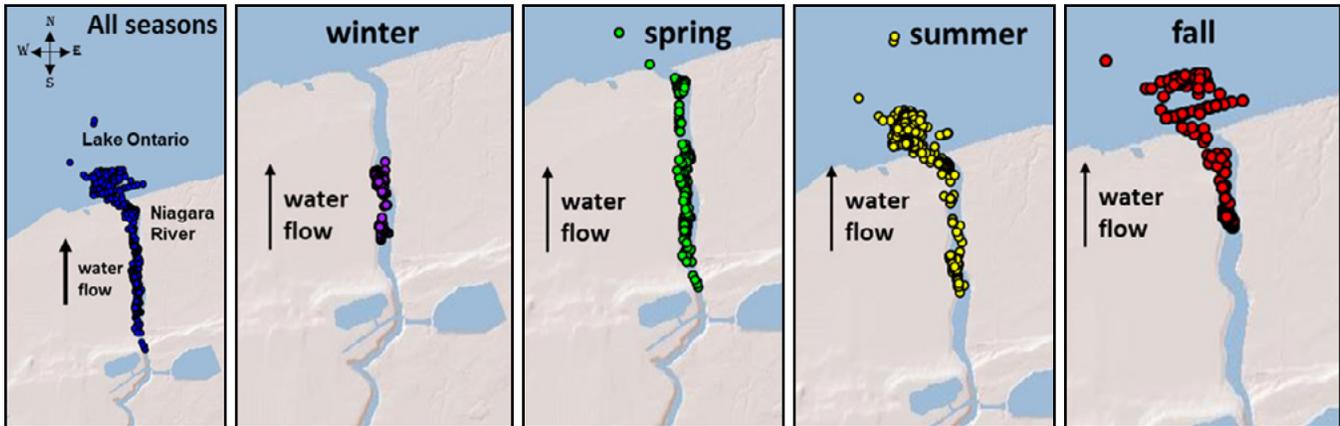
Image Credit: Dimitry Gorsky (USFWS)

In the maps showing where the lake sturgeon spent most of its time during different seasons of the year, where did the lake sturgeon spend most of its time during the winter? _____,
In which two seasons did the lake sturgeon leave the river most often?_____.

In the spring, the lake sturgeon went the farthest upstream compared to any other time during the year. Based on what you learned from earlier lessons, why might the lake sturgeon be moving upstream at that time of the year?_____

_____

_____

In what season does the lake sturgeon stay in the smallest area?_____

Why do you think there are certain times of year that lake sturgeon appear to move more and use a larger area of the lake or river? Name two reasons. Keep in mind such factors as water temperature, food, and the timing of reproduction._____

_____

_____

Student Worksheet

What Can Tags Tell Us?

Directions Below is a map of where the tagged lake sturgeon moved from spring to summer. Using the scale on the map, measure how many kilometers the lake sturgeon traveled down the Niagara River and out into Lake Ontario (from star to star on the map). How many kilometers did the lake sturgeon swim, and in which direction do you think it was easiest for the lake sturgeon to swim and why?

Image NOAA © Google, Image Landsat / Copernicus

Lake Sturgeon Lesson 9: Reproduction

Grade Level
Intermediate
4th-6th

Duration
Two 45-minute class periods

Subject
Science
Mathematics
English / Language Arts

Materials List
• Background Notes
• Student Worksheet

Learning Standards
NGSS MSLS5 (growth and development),
NG Math – NY5 G (Geometry)

Focus/Overview
The students will:

1. Create a regression figure with real and modeled data.

2. Interpret the figure.

3. Learn about variation in biological data.

4. Understand a simple version of a "model" to predict/represent a more complex process (fish growth related to increased egg production).
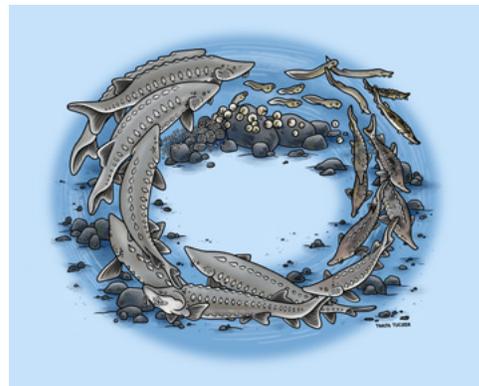

Image Credit: Taaja Tucker

Teacher Suggestions
This lesson has advanced concepts, and you may need to work more closely with your students. If your students are unfamiliar with graphing exercises and best-fit lines, a phenomenon-based exercise (plotting rainfall or snowfall as a function of hours) might be useful before this lesson. The lesson can also be simplified by plotting lake sturgeon egg numbers vs. weight data without the minimum and maximum information. Field experiences can be had by visiting lake sturgeon in aquariums nearby (see resource list) or by attending a lake sturgeon stocking event (generally in early October, email the New York State Department of Environmental Conservation at fwfish@dec.ny.gov for more info). More complex questions could be asked. For example, if a female lake sturgeon spawns when weighing 23, 28, 35, 43, and 52 kilograms in her lifetime, about how many eggs would she produce in total? (~2,000,000)

Teacher Answer Key
Answers are approximate and rounded.

25 kg lake sturgeon ~ 220,000 – 350,000 eggs (~284,000)

35 kg lake sturgeon ~ 300,000 – 485,000 eggs (~397,000)

50 kg lake sturgeon ~ 440,000 – 695,000 eggs (~568,000)

100 kg lake sturgeon ~ 880,000 – 1,388,900 eggs (~1,135,000)

It is generally easier to predict the number of eggs a smaller fish can produce because there is less variation in the number of eggs they can produce. For example, your estimate could easily be off by 100,000 in a large adult, but small adults only produce about that many eggs total, so your estimate would likely be much closer in number for a small fish.

New York Sea Grant

Name:_____   Date: _____

Lake Sturgeon Lesson: Reproduction

Directions As you read the following text, annotate your reading in the column at right.

Annotations

_____

_____

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Lake Sturgeon Eggs

Lake sturgeon were not always a prized fish species. Even though sturgeon were always an important food source to Indigenous Nations, North American settlers viewed the sturgeon as a nuisance species because they damaged fishing nets and had no commercial value. By the late 1800s, people in the United States discovered that lake sturgeon eggs were sought-after on the caviar market. As a result, lake sturgeon harvest increased considerably at that time. By 1900, the United States was producing the majority of caviar being sold in the world. In addition to caviar production, lake sturgeon were valued for their smoked meat and other products like isinglass made from sturgeon swim bladders. Isinglass was used as a beer and wine clarifier, and for specialized glues. Lake sturgeon grow slowly, take a long time to mature, and they do not spawn every year. These characteristics make lake sturgeon particularly susceptible to over-harvest, and populations declined and collapsed in some areas. As a result, in the lifetime of a single lake sturgeon, these fish all but disappeared after being on the Earth for more than 100 million years.

Challenges to Lake Sturgeon Survival

Lake sturgeon have experienced a variety of challenges in their environment. For example, dams were built that blocked sturgeon from their spawning grounds and concentrated them in small areas, vulnerable to overfishing. Humans changed stream and river flows, and our activities on land have added sediment, nutrients, and contaminants to the waters that lake sturgeon need to survive and reproduce. Additionally, a variety of different invasive species have colonized in the Great Lakes and changed the ecosystem inhabited by lake sturgeon.

Student Worksheet

Lake Sturgeon Lesson: Reproduction

Image Credit: Taaja Tucker

Annotations

_____

_____

_____

_____

_____

_____

_____

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The Response to Lake Sturgeon Decline:

Concern grew among Indigenous communities, anglers, and resource managers as lake sturgeon numbers declined. The widespread loss of economically, ecologically, and culturally important lake sturgeon became a reality, and many lake sturgeon fisheries were closed. Efforts began throughout the Great Lakes to protect, maintain, and enhance the lake sturgeon populations that remained. These efforts include improving habitat, for example, increasing water quality or access to suitable spawning grounds, and stocking baby lake sturgeon. Biologists and resource managers collect fertilized lake sturgeon eggs, hatch them and raise them in protected environments (hatcheries) before putting them back into their native habitats. This process protects small lake sturgeon from predators and other threats they might face in the wild until they are large enough to deal with these threats more successfully.

Student Worksheet

Lake Sturgeon Lesson: Reproduction

Why is Lake Sturgeon Stocking Necessary?

In many species of fish, there is an innate strategy to produce large numbers of offspring because the survival rate of young fish is much lower than for older, larger fish. In this exercise you will notice that lake sturgeon lay many eggs compared to the number of sturgeon in the environment. A single, large lake sturgeon can produce well over 1,000,000 eggs, and there are multiple spawning populations throughout the Great Lakes region. However, these millions of eggs do not all survive; some are consumed by predators and others fall victim to disease or environmental stress before they hatch. Once hatched, larval lake sturgeon must feed to grow and survive, and they are exposed to a variety of predators while they do so. Additionally, food is not always available for all the competitors in the environment. Thus, raising small lake sturgeon to a larger size in a safe setting, with quality food, can give them an advantage over their competitors and predators once they are released (stocked) as young fish into the wild.

Here is an example of a figure that can be produced from the lake sturgeon egg data provided in this lesson:
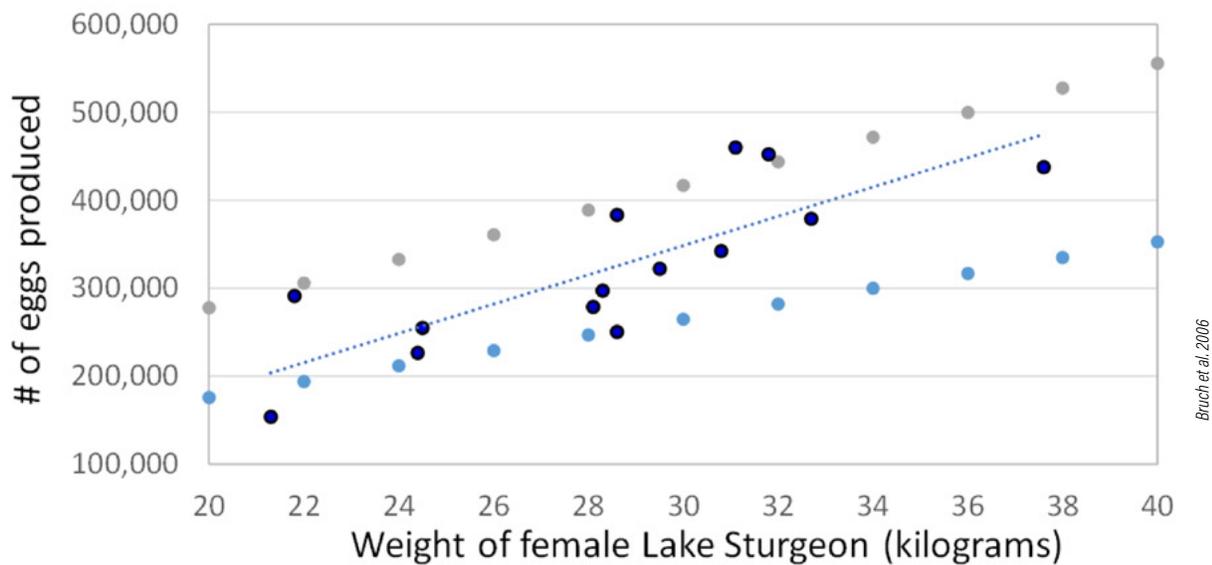
Bruch et al. 2006

● Estimated maximum (8,800 eggs/Kg)   ● Estimated minimum (14,000 eggs/Kg)   ● Wild Lake Sturgeon

Student Worksheet

Learning More About Lake Sturgeon Biology

Currently, tens of thousands of lake sturgeon are stocked each year throughout the Great Lakes. During the operations to collect, hatch, and raise lake sturgeon, scientists gather information to learn about the timing of spawning, the ages and sex of the fish, and other important factors about lake sturgeon to help make the stocking effort as successful as possible. To reach their stocking targets, biologists need to know how many fish they need to catch, and how many eggs they need to take to raise. The remaining lake sturgeon are left to reproduce naturally in the wild. Scientists have weighed lake sturgeon and counted the eggs that each fish has produced. Heavier lake sturgeon were observed to produce more eggs than lighter weight fish. Based on this data, they determined that lake sturgeon produce somewhere between 8,800 to 14,000 eggs per kilogram of adult fish weight.

Directions The chart below represents the range of egg production/kilogram of lake sturgeon from 20 to 40 kilograms of fish weight. Use graph paper to plot these data points with the x-axis (horizontal) for the weight and the y-axis (vertical) for the number of eggs. Graph the x-axis for every increase in 2 kg from 20 to 40. Graph the y-axis for egg production by increments of 100,000 from 100,000 to 600,000. Place a point on the graph for the minimum and for the maximum estimated number of eggs that corresponds to each weight. Add a proper figure number and label for the figure.

Weight (kilograms)	Estimated Minimum Number of Eggs	Estimated Maximum Number of Eggs
20	176,000	278,000
22	194,000	306,000
24	212,000	333,000
26	229,000	361,000
28	247,000	389,000
30	265,000	417,000
32	282,000	444,000
34	300,000	472,000
36	317,000	500,000
38	335,000	528,000
40	353,000	556,000

Bruch, R.M., Miller, G., and Hansen, M. 2006. Fecundity of Lake Sturgeon (Acipenser fulvescens, Rafinesque) in Lake Winnebago, Wisconsin, USA. Journal of Applied Ichthyology. Suppl. 1. 116-118.

Student Worksheet

Learning More About Lake Sturgeon Biology

The figure you have created represents a mathematical model. We can use this model (a simplified version of a more complex process) to predict how many eggs a lake sturgeon of a particular weight might produce. This modeling projection can help managers know how many fish they need to capture to collect eggs to hatch and raise for stocking to help restore and maintain lake sturgeon populations.

Variation and Best-Fit Line

As you have learned, lake sturgeon produce a range (8,000-14,000) of eggs based on their weight. The differences in data caused by differences in the individual fish weights create a numerical value that is called variation. Variation, in turn, creates uncertainty in prediction (projection).

Fish	Weight (kilograms)	Number of Eggs	Eggs / Kilograms
1	31	342,000	11,113
2	24	227,000	9,311
3	22	291,000	13,359
4	31	460,000	14,803
5	21	154,000	7,236
6	29	384,000	13,437
7	33	379,000	11,600
8	28	279,000	9,937
9	24	255,000	10,417
10	32	452,000	14,247
11	29	322,000	10,930
12	38	438,000	11,643
13	28	298,000	10,605
14	29	250,000	8,756

The chart on this page represents the actual number of eggs collected from 14 lake sturgeon of various weights. Add the data from this chart to the figure you have made. How does the actual data from specific fish fit into your graph? Lake sturgeon grow considerably larger than the weights for the 14 fish in this chart. Use the information you have learned to determine a range of the number of eggs these 14 fish might produce. Add a best-fit line to help you make your prediction. A best-fit line runs straight through the points on a figure as close to as many of the points as possible.

Write a new label for your figure to reflect this new data representation.

Bruch, R.M., Miller, G., and Hansen, M. 2006. Fecundity of Lake Sturgeon (Acipenser fulvescens, Rafinesque) in Lake Winnebago, Wisconsin, USA. Journal of Applied Ichthyology. Suppl. 1. 116-118.
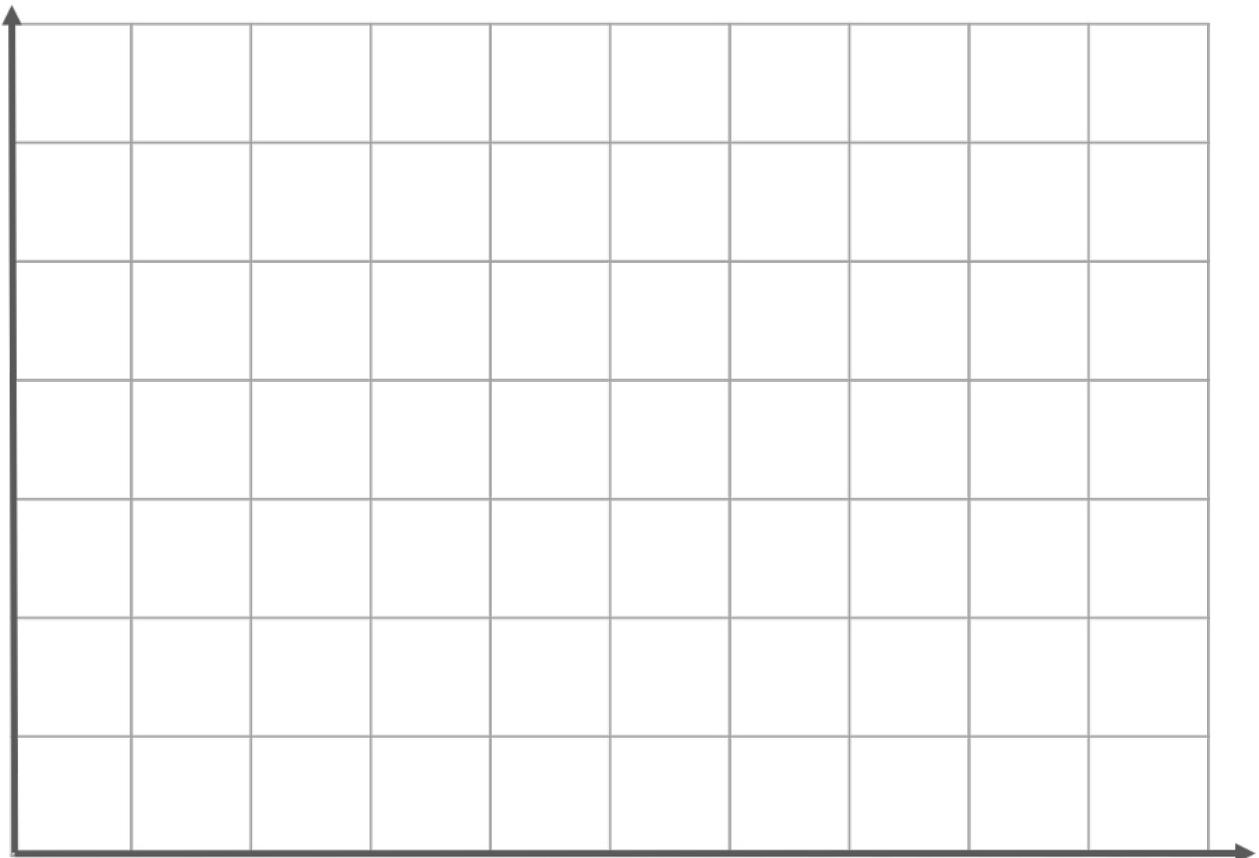
Student Worksheet

Learning More About Lake Sturgeon Biology

How many eggs might you expect a 25 kilogram lake sturgeon to produce? How about a 35 kilogram lake sturgeon? Use the area below to make your calculations and plot your data points.

_____

_____

_____

_____

Student Worksheet

Learning More About Lake Sturgeon Biology

If scientists found a lake sturgeon that weighed 50 kilograms, how many eggs do you think it might be able to produce? What is the least (minimum) number and the greatest (maximum) number of eggs you might expect that fish to produce?

_____

Explain how you determined your answers?

_____

If scientists found a lake sturgeon that weighed 100 kilograms, how many eggs do you think it might be able to produce?

_____

_____

Do you think you would get closer trying to predict the actual number of eggs in a small lake sturgeon, or a large lake sturgeon? Explain your answer

_____

_____

Lake Sturgeon Lesson 10: Who Is Who?

Grade Level
Intermediate
4th-6th

Duration
Two to three 45-minute class periods

Subject
Science
Art
English Language

Materials List
• Arts and crafts materials
• Student Worksheet

Sturgeon Sack
Plush sturgeon, vinyl sturgeon, tape measure

Learning Standards
NGSS MSLS5 (growth and development), NG Math - NY5 G (Geometry) - MSLS24, NGELA 5SL5 (visual presentation of knowledge and ideas)

Focus/Overview
The students will:

1. Learn about some of the other sturgeon in the world.

2. Create their own interpretation of a sturgeon artistically.

Image Credit: Jesse Lepak / NY Sea Grant

Background Information
This lesson is all about some of the other species of sturgeon found in the world and how they compare to the lake sturgeon you have been learning about, and the white sturgeon you read about.

Teacher Suggestions
We have included a plush sturgeon, vinyl lake sturgeon cutout, and tape measure for your students to examine. You might challenge students to make a costume, or other creative lake sturgeon artistic representations. Use the tape measure and different-sized models of sturgeons included with the curriculum to demonstrate how large and small (scale of size) the various sturgeon species can grow. Consider using skits/plays/dances or other interpretations of lake sturgeon to communicate their importance or consider linking this Lesson to the "Form and Function" Lesson in which students are asked to create their own interpretation of a fish.

Ask your students to develop an awareness campaign, for example, a short public service announcement (PSA), to encourage public interest in sturgeon conservation.

New York Sea Grant

Student Worksheet

Who is Who?

Image Credit: Jesse Lepak / NY Sea Grant

Background Information

This lesson is about some of the other species of sturgeon found in the world and how they compare to the lake sturgeon you have been learning about, and the white sturgeon you read about.

Sturgeon Around the World

There are many different species of sturgeon, some that live in only a few special places. You have been learning about the lake sturgeon (*Acipenser fulvescens*) found in the Great Lakes Basin. You also read *Tale of a Great White Fish* about the journey of a white sturgeon (*Acipenser transmontanus*), the largest sturgeon in North America, reported to reach almost 6.5 meters long. The beluga, or great, sturgeon (*Huso huso*) is the largest species of sturgeon, and among the world's largest fish. It can reach lengths of nearly 8 meters and weights of more than 3,000 kilograms.

Not all sturgeon are large; in fact, one species only reaches about 30 centimeters in length at its largest. The dwarf sturgeon (*Pseudoscaphirhynchus hermanni*) is critically endangered in Eurasia. This small species is rare, and relatively little is known about it.

From large to small, all sturgeon are unique. However, they have one unfortunate similarity. Nearly all sturgeon are threatened, and more than half are listed as Critically Endangered by the IUCN (International Union for Conservation of Nature). Sturgeon are special for many reasons. Many cultures have represented the sturgeon in artwork, artisanal crafts, or dance as well as making it the focus of scientific research and they have undertaken educational and conservation efforts to raise awareness about sturgeon as a unique fish and one worth saving.

Name:_____ Date: _____

Creating Your Own Sturgeon

Directions Create your own sturgeon using items that might otherwise end up in (pollute) the waters where sturgeon live.

Here are some ideas for materials you might consider using:

- Use scraps of newspaper or other paper to make papier-mâché sturgeon
- Old bottle caps can be great as scutes for your sturgeon
- Use cardboard from a delivered package or cereal boxes to help build your sturgeon
- Get together with your class and collect materials to share as a group

Can you top this? This is a picture of a Great White Shark at The Florida Aquarium built with trash.... it is life-size! Flip-flops, shoe soles, and other plastics were used around the mouth.
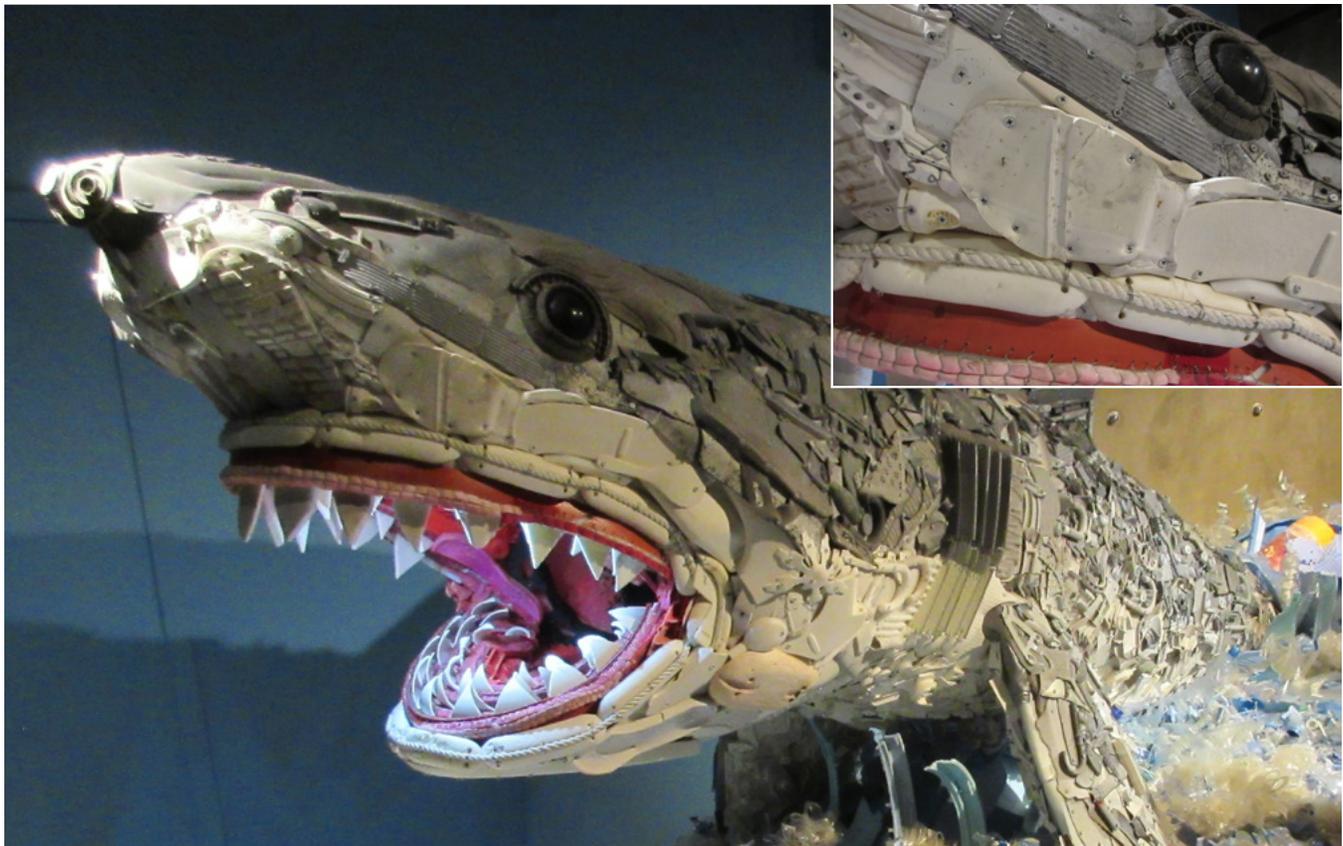
Image Credit: Jesse Lepak / NY Sea Grant

Image Credit: Erika Stoddard/NYSDEC