

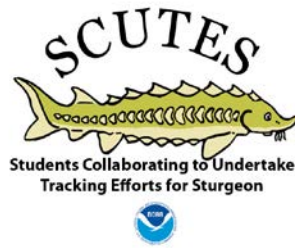
Topic/Lesson:	Atlantic sturgeon review – ABC Book
Objectives:	<p>Students will be able to:</p> <ul style="list-style-type: none"> • Demonstrate their knowledge of Atlantic sturgeon. • Create a page for an ABC book about Atlantic sturgeon for the third grade students to read. • Fill their letter specific page with accurate information about Atlantic sturgeon. • Revise and edit their rough draft.
Materials:	<ul style="list-style-type: none"> • Plain white computer/copy paper • Pencils, erasers • Crayons, markers, colored pencils • Computers with internet • Sturgeon informational booklet • Directions page • Dictionary • Basket/box • Slips of paper with one letter on them • Rubric
Vocabulary:	<ul style="list-style-type: none"> • Atlantic sturgeon • Rough draft/Edit/Revise/Final Copy • Educational • Accurate • Age appropriate • Estuaries • Foraging • Natal homing • Bycatch
Procedures:	<ol style="list-style-type: none"> 1) Begin class by asking students if anyone has ever seen an ABC book. Discuss what they are and their characteristics. 2) Read any ABC book to the class to demonstrate what they look like for any students who may be unfamiliar. 3) Explain to students that they will be assigned a letter in the alphabet and be responsible for creating that page for the ABC book (some students might be paired up or peer partnered). 4) Recall/brainstorm information students may already know about Atlantic sturgeon and start listing on board to activate background knowledge.

	<ol style="list-style-type: none"> 5) Distribute directions page and read out loud together, answering any questions or concerns as you go. 6) Explain the resources students may use as they create their page. 7) Have students pick their letter from the basket or box. 8) Students/pairs begin working on their ABC page. 9) Teacher walks around and assists students as necessary. 10) Students must have their pages approved by the teacher before they can create their final copy. 11) Teacher creates ABC book by putting all of the pages in order and binding. 12) Teacher can send book to a lower class grade for reading, or can arrange to have their own class read to them.
<p>Accommodations/ Modifications:</p>	<ul style="list-style-type: none"> • Peer partnering • Scaffolding • Written multiple step instructions • Preferential seating • Repetition, oral cueing



 Students Collaborating to Undertake
 Tracking Efforts for Sturgeon





Atlantic sturgeon ABC Book Directions

Your assignment is to create a letter specific page based on Atlantic sturgeon to be part of an ABC book that third graders will read. Each student(s) will be assigned a letter from the alphabet. Your page must only contain things that begin with your specific letter. The information and illustrations on your page must be accurate and factual information about Atlantic sturgeon. You may use internet search engines, your prior knowledge of Atlantic sturgeon, as well as the background information packet to assist you in locating your facts.

It is important to remember who your audience will be. Third grade students will be reading this ABC book to help them learn about Atlantic sturgeon, so try to keep your vocabulary and language appropriate for third graders. Do not use extremely complicated words that a typical third grader would not understand. Remember, it's not fun to read a book that is much too difficult for your reading level.

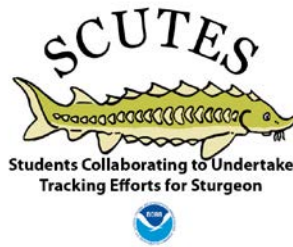
First you must complete a rough draft of your page. Before creating your final copy that will be placed in the book, you must edit and revise your page. Your rough draft will be collected as well to show evidence of your writing process and the improvements you have made. There should be no spelling or grammatical mistakes on your page. Your page must contain at least one illustration, although it may contain more. Remember to refer to the rubric throughout the working process so you know what you will be graded on and what your page should include. Do not start your final page until it has been checked by an adult and approved. Your page should be neat, organized, and attractive. You may use markers, colored pencils, or crayons on your final page.

If you are confused about what an ABC page should or could look like, please refer to the example we read together earlier or think back to other ABC books you have read.

The first thing you should do is to collect enough letter specific information about Atlantic sturgeon to fill your page. Next plan the set up of your page and how you want to organize and present your information, as well as illustration(s).

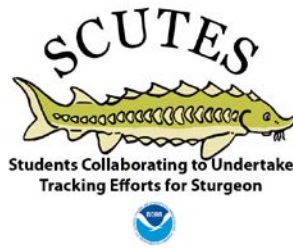
You will present your page to the class when the final copy is completely finished. This will count towards part of your grade.

Have fun and remember the point of the assignment, as well as your audience.



ABC Book Rubric

Task	Criteria	Possible Points
Letter specific	Your ABC page only contains information and illustrations that start with the specific letter you were assigned.	20 points
Revised and Edited	The final page has been revised and edited. There are no spelling or grammatical mistakes.	15 points
Information	The information on the page is accurate information that is age appropriate for a third grade audience.	25 points
Page setup	Your page must have at least 5 letter specific, accurate facts and at least one letter related illustration. It must be neat and organized as well as colorful and attractive.	25 points
Presentation	You must present the final version of your ABC page to the class. Your volume and rate of speech must be appropriate and clear.	15 points



Atlantic Sturgeon

The sturgeon family is the most primitive of all bony fishes, dating back to the Cretaceous period more than 120 million years ago. It is believed that the ancestors of sturgeon lived with the dinosaurs. This makes the sturgeon that you see today almost like living fossils!

There are seventeen species with many more subspecies of sturgeon worldwide from the genus *Acipenser*, and they are found only in the northern hemisphere. Two species can be found on the East Coast of the United States in coastal waters, estuaries and rivers. The two species on the East Coast are the Atlantic sturgeon (*Acipenser oxyrinchus*) and the smaller shortnose sturgeon (*Acipenser brevirostrum*). Atlantic sturgeon are found in several rivers along the Northeast and Mid-Atlantic coast including the Penobscot, Kennebec Complex, Saco, Merrimack, Connecticut, Hudson, Delaware and James Rivers.

Atlantic sturgeon are anadromous fish, which means that they spend part of their life cycle in salt water and part in freshwater. They spend most of their time in coastal ocean waters, but migrate and travel through estuaries to rivers and freshwater for spawning. They are slow growing and late maturing fish. Atlantic sturgeon have been recorded to reach lengths of 14 feet long, weighing almost 800 pounds! The oldest sturgeon that was recorded was estimated to be around 60 years old. Atlantic sturgeon are late maturing, with some not reaching reproductive maturity until they are over 20 years old.

Sturgeon have five rows of bony scutes along the length of their body. Scutes are a modified ganoid scale. Ganoid scales are diamond shaped and found on primitive bony fishes like sturgeon. They can help serve as protection for the fish like armor, and also make sturgeon distinct from other fish. Atlantic sturgeon have mostly a cartilaginous skeleton not bone, so most of a sturgeon would not show up on an X-Ray. Atlantic sturgeon are benthic or bottom feeders which means that they feed and forage on creatures on the bottom of the rivers, estuaries and coastal waters. They feed primarily on polychaetes (worms), mollusks, crustaceans, and insect larvae. Their mouth is located on the underside of their body making them ideal benthic feeders. Between the mouth and tip of their snout, sturgeon have four barbels. These barbels are sensors which they use to locate food. Sturgeon mouths are protrusible which means that they can be thrust out toward food on the ocean floor. They suck up food off the floor like a vacuum, and after swallowing it whole, they spit out any pebbles, sand and gravel that were also vacuumed up. Sturgeon do not have teeth! When they swallow their food whole, it goes into their muscular stomach which is strong enough to crush and break up food for digestion.

Fins

Sturgeon, like most fish, use their fins for swimming. The dorsal and anal fins are used to stabilize the fish. Pectoral and pelvic fins are on the sides of the body, and are used for turning, backing up, stopping and also balancing. The caudal or tail fin is like a boat propeller; it pushes them through the water by moving back and forth. The caudal fin on sturgeon is heterocercal, just like sharks!

Scutes

Sturgeon have five rows of bony scutes along the length of their body. Scutes are a modified scale. They can help serve as protection for the fish like armor and make sturgeon distinct from other fish.

Gills

Fish breathe oxygen from the water, similar to how humans breathe oxygen from the air. The gills on sturgeon are found just behind the head and under a gill flap. As water flows into their mouth, it flows over their gills which absorb oxygen from the water, like human lungs absorb oxygen from the air.

Eating

Foraging is looking for food. Atlantic sturgeon use estuaries and bays as foraging or feeding grounds. Sturgeon do not have teeth! They suck up food like a vacuum with their protrusible mouth. After swallowing food whole, their muscular stomach crushes it into smaller pieces for digestion. Some prey that sturgeon eat are polychaetes (worms), mollusks, and crustaceans.

There are four barbels between the tip of their snout and their mouth which they use as sensors to locate food.

Sturgeon in History

Sturgeon were used for many different purposes, not just food. The meat was high in protein and was prepared by a smoking or pickling process. This process allowed for the meat to be shipped and travel great distances without spoiling. The oil of the sturgeon was used as a substitute for

sperm whale oil as it was less smoky flavored and did not spoil as quickly. Isinglass, made from the swim bladder of the sturgeon, was used as a binding agent for paint as well as an adhesive.

The thick skin of the sturgeon was made into leather by a tanning process. The roe or eggs of the sturgeon were prepared through a salting process to become caviar.

During the late 1800's, the great "Caviar Rush" began. News of the abundance of sturgeon with caviar or "black gold" on the East Coast spread quickly. Many flocked to the coast in search of riches and this became known as the great "Caviar or Black Gold Rush." By the end of the 1800's and beginning of the 1900's, sturgeon stocks had declined drastically. Due to overfishing, close to seven million pounds of sturgeon were reportedly caught in 1887, and by 1905, it had dropped to only 20,000 and to a mere 400 pounds of sturgeon were recorded by 1989. In a time span of only 100 years, sturgeon landings went from tens of thousands of fish down to only a handful.

Atlantic sturgeon sometimes jump right out of the water! No one knows for sure why they do it. Some think that it is a form of communication or that they may be trying to get rid of parasites, and some even think that it may be just for fun.

Migration

Most Atlantic sturgeon spend their winters in deep coastal waters. When winter ends, they begin migrating up and down the coast to foraging and spawning grounds in the coastal estuaries and rivers. Atlantic sturgeon use estuaries for foraging grounds and also rearing grounds for

juveniles. When spawning, they usually travel to their natal river which is a process called natal homing. A natal river is the river where they were originally born.

Spawning grounds are found above the salt wedge in rivers, and are usually places with flowing water and a bottom consisting of gravel, pebbles, and cobble. When they arrive at the spawning grounds, females release eggs which are very sticky and attach to the pebbles and gravel. Males then swim over the eggs spreading milt which fertilizes the eggs and creates embryos.

The embryos will hatch into larvae within 3-6 days. At first, larvae have the yolk sac from the egg still attached to them that provides food and nourishment. This stage is called the yolk sac larval stage and lasts about 8-12 days. When the larvae or fry are finished with the yolk sac and are more mobile, they begin migrating downstream to the rearing grounds in the estuary, and use rocks and aquatic plants for hiding. As the fry continue to grow they are called fingerlings and continue to become more mobile. They feed on zooplankton, aquatic plants, and insect larvae. As juveniles, they move further downstream to the estuaries and brackish waters which are a mixture of salt and fresh water. Juveniles then stay in the estuaries for months or even years.

They are considered to be sub-adults by the time they leave the estuary and begin migrations. Sub-adults look the same as adults, but have not yet reached reproductive maturity. Adults and sub-adults migrate along the coast to their wintering habitats and then begin the whole migration all over again in the spring.

Protection

In 1990, the Atlantic States Marine Fisheries Commission (ASMFC) recognized the need to put protections in place for Atlantic sturgeon. Due to continued declines, in 1998 they imposed a 20-40 year moratorium on all Atlantic sturgeon fisheries. A moratorium is a ban on fishing and possession until the population's numbers can increase. This stopped fishing for Atlantic sturgeon for 20 to 40 years, or until the populations could be restored to a level where 20 subsequent years of adult females were protected.

The National Marine Fisheries Service (NMFS) then listed Atlantic sturgeon as a "Species of Concern (SOC)" in 2004. A Species of Concern listing does not provide protections like a listing under the Endangered Species Act (ESA). Listing a species as an SOC is meant to promote efforts to conserve the species that NMFS has particular concerns about their status and threats. It is also meant for the species that have little information available to determine whether listing under the Endangered Species Act is necessary.

In 2012, all Atlantic sturgeon that are hatched in U.S. rivers were listed under the ESA. Atlantic sturgeon that hatch in rivers from Rhode Island through Florida are endangered. Atlantic sturgeon that hatch in rivers from Maine through Massachusetts are threatened.

Threats

Although it is no longer legal to fish for or keep Atlantic sturgeon due to the moratorium, they are still caught as bycatch in some fisheries. Atlantic sturgeon are particularly vulnerable to fisheries that fish with gill nets. The fishery practices commonly used with gill netting involves setting and leaving nets for long periods of time, anywhere from several hours to days. Atlantic sturgeon swim into these nets and can get stuck. If their gills get closed shut by the nets, they can suffocate and die. Another threat posed by nets is what happens when nets are lost. Due to weather, storms, and rough waters, nets can break free and get lost. These are called “ghost nets” and can float around the ocean and rivers entangling sturgeon as well as marine mammals and sea turtles.

Dams on rivers pose another threat to Atlantic sturgeon. Dams were constructed on many rivers along the East Coast. They were made for many reasons including production of electricity through hydropower and for diversion of water for agriculture. Dams can be harmful to Atlantic sturgeon by blocking the way to their spawning grounds. If they are unable to reach their spawning grounds, they may choose to not spawn at all, or end up spawning in an area that is not suitable for the development of embryos. Many dams have special fish ladders or fish ways that are designed to allow for the passage of fish upstream of the dam. Sturgeon, however, do not use the fish ways to pass the dam, and even if they did, there has not yet been suitable methods designed for passage downstream.

Sturgeon are also harmed by tidal turbines, another form of hydropower. Tidal turbines look like fans under the water. The power of the tide makes the fan spin, and this motion creates energy.

If sturgeon swim near these turbines, they can be struck by the blades of the fan. Similar to the dangers that tidal turbines pose, vessel strikes pose a threat to sturgeon as they can be struck by the blades of a propeller as a boat is passing.

Pollution and dredging can also be detrimental to Atlantic sturgeon survival. Pollution can be caused by many different actions, and can include run-off from agricultural sites, roadways, construction sites, and pesticide applications. All of these things can affect water quality. A couple factors that affect water quality are dissolved oxygen and temperature. Run-off from agricultural sites can include fertilizer which can cause harmful algal blooms. When algae blooms, it can take oxygen out of the water which can kill fish and other aquatic life.

Temperature is another factor that can affect the migration spawning cues for sturgeon. The spawning migration is tied-in with the rise in temperature in the spring. Hatching time and egg development are also dependent on temperature. Dredging is when the river bottom is dug up to either make the river deeper or wider. Sturgeon can be caught in the dredge and killed. Dredging can affect spawning habitat as well by suspending fine particles and pollution which can cover over the gravel and cobble substrate that is needed for spawning.

Research

Scientists and researchers have been studying sturgeon for many years. Even though much research has been conducted, there is still a lot of information that we do not know. Where exactly are the spawning grounds? Where do they go in the winter? Why do they jump?... and much more. In an attempt to try to answer some of these questions, researchers have been using

tagging techniques to track and follow sturgeon throughout their migrations and coastal movements. A few types of tags that researchers have been using are satellite tags, acoustic telemetry tags, and PIT (passive integrated transponder) tags. Each tag aids researchers in getting different information that they are searching for.

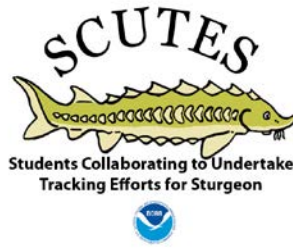
PIT tags are tiny little microchips that are placed under the skin of the sturgeon.

The tag is inserted with a small needle which pierces the skin and allows the tag to be placed just under the skin. When researchers catch sturgeon through their sampling efforts, they scan them with a PIT tag reader. PIT tag readers are small handheld devices that activate the tag when being scanned and record the unique and individual tag number. They can then take that tag number and find out in what river or where on the coast that fish was originally tagged.

Acoustic telemetry tags serve to give a broader picture of the migrations of sturgeon. Acoustic tags are inserted by researchers through a surgical approach. Using a scalpel, the researcher will make an incision into the body cavity large enough to fit the tag just under the fatty skin layer. This incision is then closed with stitches. These tags are larger than the typical PIT tag, and are programmed to “ping” or send out signals at specific intervals. Each of these tags has a unique identifying number. When a tagged fish swims near one of the acoustic telemetry receivers, the receiver records the number, date, and time. These acoustic receivers, which are about the size of a 1L bottle of soda, and are deployed up and down the coast in coastal waters as well as in rivers and estuaries. Researchers go to their receivers periodically and download all of the data that was collected. Each time a tag is identified by the receiver, it is called a “hit”. The researcher can then see where and when certain fish “hit” the receiver. With this information, and through

cooperation with other researchers, they can begin to see exactly where the fish has been traveling.

Satellite tags are a more in depth and comprehensive collection system. Once the satellite tags are attached to the fish, they begin collecting information immediately. This information is either stored in the tag, or sent directly up to satellites. If the data is being stored, there is usually a designated date where the tag will release from the fish. When the tag releases, it floats up to the surface and begins downloading to satellites all the data that it had collected in its time on the fish. This information is then given to the researcher. More expensive and larger satellite tags are capable of providing “real time” data where the information is constantly being downloaded and updated to the satellites and researchers. This information can show direct paths, and near exact locations of everywhere the fish went while it was tagged. With all of the data that can be collected from various kinds of tags, they are able to create maps that will helpfully illustrate the travels of Atlantic sturgeon.



Atlantic Sturgeon (with highlighted terms)

The **sturgeon** family is the most **primitive** of all **bony** fishes, dating back to the **Cretaceous** period more than 120 million years ago. It is believed that the ancestors of sturgeon lived with the **dinosaurs**. This makes the sturgeon that you see today almost like living **fossils**!

There are seventeen **species** with many more subspecies of sturgeon worldwide from the genus **Acipenser**, and they are found only in the northern hemisphere. Two species can be found on the East Coast of the United States in coastal waters, **estuaries** and rivers. The two species on the East Coast are the **Atlantic** sturgeon (*Acipenser oxyrinchus*) and the smaller **shortnose** sturgeon (*Acipenser brevirostrum*). Atlantic sturgeon are found in several rivers along the Northeast and Mid-Atlantic coast including the **Penobscot**, **Kennebec Complex**, **Saco**, **Merrimack**, **Connecticut**, **Hudson**, **Delaware** and **James** Rivers.

Atlantic sturgeon are **anadromous** fish, which means that they spend part of their life cycle in salt water and part in freshwater. They spend most of their time in coastal ocean waters, but **migrate** and travel through estuaries to **rivers** and freshwater for **spawning**. They are slow growing and late maturing fish. Atlantic sturgeon have been recorded to reach lengths of 14 feet long, weighing almost 800 pounds! The oldest sturgeon that was recorded was estimated to be around 60 years old. Atlantic sturgeon are late maturing, with some not reaching reproductive maturity until they are over 20 years old.

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Fins

Sturgeon, like most fish, use their fins for swimming. The **dorsal** and **anal** fins are used to stabilize the fish. **Pectoral** and **pelvic** fins are on the sides of the body, and are used for turning, backing up, stopping and also balancing. The **caudal** or tail fin is like a boat propeller; it pushes them through the water by moving back and forth. The caudal fin on sturgeon is **heterocercal**, just like sharks!

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Gills

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Sturgeon in History

Sturgeon were used for many different purposes, not just food. The meat was high in protein and was prepared by a smoking or pickling process. This process allowed for the meat to be shipped and travel great distances without spoiling. The oil of the sturgeon was used as a substitute for

sperm whale oil as it was less smoky flavored and did not spoil as quickly. **Isinglass**, made from the swim bladder of the sturgeon, was used as a binding agent for paint as well as an adhesive. The thick skin of the sturgeon was made into **leather** by a tanning process. And the **roe** or eggs of the sturgeon was prepared through a salting process to become **caviar**.

During the late 1800's, the great "Caviar Rush" began. News of the abundance of sturgeon with caviar or "black gold" on the East Coast spread quickly. Many flocked to the coast in search of riches and this became known as the great "Caviar or Black Gold Rush." By the end of the 1800's and beginning of the 1900's, sturgeon stocks had declined drastically. Due to **overfishing**, close to seven million pounds of sturgeon were reportedly caught in 1887, and by 1905, it had dropped to only 20,000 and to a mere 400 pounds of sturgeon were recorded by 1989. In a time span of only 100 years, sturgeon landings went from tens of thousands of fish down to only a handful.

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Migration

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juveniles. When spawning, they usually travel to their natal river which is a process called **natal homing**. A natal river is the river where they were originally born.

Spawning grounds are found above the **salt wedge** in rivers, and are usually places with flowing water and a bottom consisting of gravel, pebbles, and cobble. When they arrive at the spawning grounds, females release eggs which are very sticky and attach to the pebbles and gravel. Males then swim over the eggs spreading milt which fertilizes the eggs and creates embryos.

The **embryos** will hatch into **larvae** within 3-6 days. At first, larvae have the yolk sac from the egg still attached to them that provides food and **nourishment**. This stage is called the **yolk sac larval stage** and lasts about 8-12 days. When the larvae or **fry** are finished with the yolk sac and are more mobile, they begin migrating downstream to the rearing grounds in the estuary, and use rocks and aquatic plants for hiding. As the fry continue to grow they are called **fingerlings** and continue to become more mobile. They feed on **zooplankton**, aquatic plants, and insect larvae. As juveniles, they move further downstream to the estuaries and brackish waters which are a mixture of salt and fresh water. Juveniles then stay in the estuaries for months or even years.

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In 2012, all Atlantic sturgeon that are hatched in U.S. rivers were listed under the ESA. Atlantic sturgeon that hatch in rivers from Rhode Island through Florida are **endangered**. Atlantic sturgeon that hatch in rivers from Maine through Massachusetts are **threatened**.

Threats

Although it is no longer legal to fish for or keep Atlantic sturgeon due to the moratorium, they are still caught as **bycatch** in some fisheries. Atlantic sturgeon are particularly vulnerable to fisheries that fish with gill nets. The fishery practices commonly used with gill netting involves setting and leaving nets for long periods of time, anywhere from several hours to days. Atlantic sturgeon swim into these nets and can get stuck. If their gills get closed shut by the nets, they can suffocate and die. Another threat posed by nets is what happens when nets are lost. Due to weather, storms, and rough waters, nets can break free and get lost. These are called “**ghost nets**” and can float around the ocean and rivers entangling sturgeon as well as marine mammals and sea turtles.

Dams on rivers pose another threat to Atlantic sturgeon. Dams were constructed on many rivers along the East Coast. They were made for many reasons including production of electricity through **hydropower** and for diversion of water for agriculture. Dams can be harmful to Atlantic sturgeon by blocking the way to their spawning grounds. If they are unable to reach their spawning grounds, they may choose to not spawn at all, or end up spawning in an area that is not suitable for the development of embryos. Many dams have special fish ladders or fish ways that are designed to allow for the passage of fish **upstream** of the dam. Sturgeon, however, do not use the fish ways to pass the dam, and even if they did, there has not yet been suitable methods designed for passage downstream.

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tagging techniques to track and follow sturgeon throughout their migrations and coastal movements. A few types of tags that researchers have been using are satellite tags, acoustic telemetry tags, and PIT (passive integrated transponder) tags. Each tag aids researchers in getting different information that they are searching for.

PIT tags are tiny little microchips that are placed under the skin of the sturgeon.

The tag is inserted with a small needle which pierces the skin and allows the tag to be placed just under the skin. When researchers catch sturgeon through their sampling efforts, they scan them with a PIT tag reader. PIT tag readers are small handheld devices that activate the tag when being scanned and record the unique and individual tag number. They can then take that tag number and find out in what river or where on the coast that fish was originally tagged.

Acoustic telemetry tags serve to give a broader picture of the migrations of sturgeon. Acoustic tags are inserted by researchers through a surgical approach. Using a scalpel, the researcher will make an incision into the body cavity large enough to fit the tag just under the fatty skin layer. This incision is then closed with stitches. These tags are larger than the typical PIT tag, and are programmed to “ping” or send out signals at specific intervals. Each of these tags has a unique identifying number. When a tagged fish swims near one of the acoustic telemetry receivers, the receiver records the number, date, and time. These acoustic receivers, which are about the size of a 1L bottle of soda, and are deployed up and down the coast in coastal waters as well as in rivers and estuaries. Researchers go to their receivers periodically and download all of the data that was collected. Each time a tag is identified by the receiver, it is called a “hit.” The researcher can then see where and when certain fish “hit” the receiver. With this information, and through

cooperation with other researchers, they can begin to see exactly where the fish has been traveling.

Satellite tags are a more in depth and comprehensive collection system. Once the satellite tags are attached to the fish, they begin collecting information immediately. This information is either stored in the tag, or sent directly up to satellites. If the data is being stored, there is usually a designated date where the tag will release from the fish. When the tag releases, it floats up to the surface and begins downloading to satellites all the data that it had collected in its time on the fish. This information is then given to the researcher. More expensive and larger satellite tags are capable of providing “real time” data where the information is constantly being downloaded and updated to the satellites and researchers. This information can show direct paths, and near exact locations of everywhere the fish went while it was tagged. With all of the data that can be collected from various kinds of tags, they are able to create maps that will helpfully illustrate the travels of Atlantic sturgeon.