Atlantic & Shortnose Sturgeons

Coloring, Activities, and Education Booklet

Atlantic Sturgeon

Shortnose Sturgeon

SCUTES
Students Collaborating to Undertake Tracking Efforts for Sturgeon
Hey Kids!
My name is Scooter, and I’m an Atlantic sturgeon. I’m hanging out with my cousin, Barb. She is a shortnose sturgeon. She’s shorter than me and has a short, broad snout. I got my name from these cool scales that we have called SCUTES. Barb is named after the neat whiskers we have called barbels. I will tell you all about those later. Would you like to learn about Atlantic and shortnose sturgeon? I can tell you all sorts of things about us like our life cycles, how we travel from the ocean to rivers, how even George Washington used to fish for us, and about how we were around when the dinosaurs were still alive! We are a pretty interesting fish if you ask me! I even have some games for you to play and all sorts of things for you to color too. If there is a word in **bold** that you don’t understand, have no fear! The definition is in the back of this book. Come on! Let’s have some fun learning about Atlantic and shortnose sturgeons!

Hi there! I’m Barb, Scooter’s cousin, and I’m a shortnose sturgeon.
ATLANTIC & SHORTNOSE STURGEONS

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 the Atlantic Ocean. They are normally found in coastal waters, bays, estuaries, and rivers. The two species on the East coast are the Atlantic sturgeon (Acipenser oxyrinchus oxyrinchus) and the smaller shortnose sturgeon (Acipenser brevirostrum).

Atlantic and shortnose sturgeons are anadromous fish, which means that they spend part of their life cycle in salt water and part in freshwater. They are able to do this by osmoregulating, or leveling their body salts. They spend most of their time in coastal ocean waters, but migrate and travel through estuaries to rivers and freshwater for spawning, but shortnose sturgeon spend more time in rivers and farther upstream than Atlantic sturgeon. They are slow growing and late maturing fish. While shortnose sturgeon have been known to reach no more than 5 feet and weigh up to 50 pounds, Atlantic sturgeon have been recorded to reach lengths over 14 feet long, weighing almost 800 pounds! The oldest Atlantic and shortnose sturgeons recorded were estimated to be around 60 years old. Some shortnose sturgeon do not
reach reproductive maturity until they are 13 years old while some Atlantic sturgeon do not reach maturity until they are 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 and shortnose sturgeons 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 (clams), crustaceans (crabs), and insect larvae. Their mouths are located on the underside of their body making them ideal bottom feeders. Between the mouth and tip of their snout, sturgeon have four barbels that are similar to whiskers. These barbels are sensors which they use to locate food. Sturgeon mouths are protrusible which means that it can be pushed 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 most of the 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.

Summary of Atlantic & Shortnose Sturgeons

- The sturgeon family is the most primitive of all bony fishes, dating back 120 million years. They lived with the dinosaurs!
- Atlantic and shortnose sturgeons are anadromous, migrating between the ocean in saltwater, estuaries in brackish waters, and rivers in fresh-water, though shortnose sturgeon spend more time in freshwater than Atlantic sturgeon.
- They have 5 rows of bony scutes which are modified ganoid scales.
- Shortnose sturgeon grow up to 5 feet and weigh 50 pounds. Atlantic sturgeon can grow over 14 feet long, and weigh up to 800 pounds. They can live to be over 60 years old!
- They are bottom feeders that use their barbels to sense and locate food, and they use their protrusible mouths to vacuum up the food.
Sturgeon

**Fins**

Sturgeons, like most fish, use their fins for swimming, steering, and for balance. 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, 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 bigger on the top than the bottom which is called **heterocercal**, just like a shark’s tail!

**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**

Like humans, fish need oxygen to live, but fish do not have lungs inside their body and do not breathe like humans do. Instead, fish have **gills**, which 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 water.

**Eating**

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. Sturgeon eat various **prey** including 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.
Connect the Dots

Connect the dots from 1 all the way up to 25 to reveal a new friend!

When you have reached the finish, help Scooter by drawing in the scutes on his back. Follow the line from number 22 to 25. Then you can color him!

Thanks for your help!!
STURGEON THROUGH HISTORY

The Native Americans of North America fished for *sturgeon* using spears, lassos, clubs, and *weirs*. *Sturgeon* are known to leap out of the water on occasion and would even sometimes jump right into their boats! They were known to be curious fish, so one fishing method used by the Housatonic Native Americans to catch *sturgeon* was fishing at night while holding a torch above the water. The *sturgeon* were so curious and attracted to the light that they would come right up to the surface of the water to check out the strange sight. When they came close enough, they would get hit on the head with a club or an axe by the fisherman who would then drag the stunned fish into the boat. In addition, North American Native tribes named the full moon in August “*Sturgeon Moon*” because the fish were plentiful at that time.

*Sturgeon* were found in great numbers when European settlers first arrived in North America. Some accounts noted that there were so many *sturgeon* in the James River that you could walk across the river on their backs. In the late 1700’s, George Washington started a *recreational* fishery for *sturgeon* on the Potomac River. They were very strong, large fish, so when fishermen would catch a *sturgeon* with a lasso, they would brace themselves in the boat for the *sturgeon* equivalent to a “*Nantucket sleigh ride*.” However, it was not always fun and games with *sturgeon* on the Potomac. A *sturgeon* actually killed a Continental Army officer when he was crossing the Potomac as it jumped into his boat, landing on him and breaking his legs.

*Sturgeon* were considered to be a delicacy and a “royal” fish back in England. To be a “royal” fish meant that the king had first rights to any *sturgeon*.
that were caught. The colonists were suspicious of the Native Americans who consumed these scute-armored fish, and regardless of their “royal” status in Europe, continued to refuse to eat the sturgeon. However, after harsh winters with little food, and so many of these large fish in great abundance, Captain John Smith convinced them to make good use of sturgeon.

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 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. Close to seven million pounds of sturgeon were reportedly caught in 1887, but due to overfishing, it had dropped to only 20,000 by 1905, and by 1989, a mere 400 pounds of sturgeon were recorded. In a time span of only 100 years, catches of sturgeon went from tens of thousands of fish down to only a handful.

**Summary of Sturgeon in History**

- **Sturgeon** used to be greatly abundant in rivers and coastal waters along the eastern seaboard of the United States.
- The Native Americans used spears, lassos, weirs, clubs, and even fire to catch sturgeon.
- Sturgeon are known to jump clear out of the water and even sometimes land in boats. People have been injured by jumping sturgeon.
- Sturgeon were used for meat, oil, leather, isinglass, and caviar.
- Stocks of sturgeon became greatly depleted after the great “Caviar” or “Black Gold Rush” when fishermen flocked to the coast in search of riches from caviar.
Sturgeon were used for many purposes: The meat was eaten after it was smoked or pickled; the skin was tanned and turned into leather; sturgeon oil was used instead of sperm whale oil; isinglass from the swim bladder was used as a binding agent in paint as well as an adhesive, and a clarification agent for wine; and the eggs or roe were salted and prepared into caviar. Caviar became known as the other “black gold.”
Can you find these words in the puzzle above?

Words may be horizontal, vertical, or diagonal.
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.

What do you think?
What’s Missing From These Sturgeon?

Can you find what parts are missing from sturgeon 1, 2, and 3?

Use the sturgeon on the top of the page as a guide. (Hint: Fish #1 and #2 are missing two parts each, and fish #3 is missing three parts.) After you find the missing parts, you can draw them back into the picture.
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. Shortnose sturgeon migrate down to the estuaries and sometimes to nearby rivers, but mostly stay within the river, not making big migrations down the coast like Atlantic sturgeon. Atlantic and shortnose sturgeons 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 hatched. 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, or nursery, 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 better swimmers. They feed on zooplankton (tiny animals), aquatic plants, and insect larvae. When they become 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 are not yet able to reproduce. Adults and sub-adults migrate along the coast to their wintering habitats and then begin the whole migration all over again in the spring.

**Summary of Migration**

- Atlantic and shortnose sturgeons migrate from the ocean and brackish water to freshwater rivers for spawning, and to brackish estuaries for foraging and rearing habitat.
- They exhibit natal homing which means they spawn in the river in which they were hatched.
- Spawning occurs in freshwater. As the embryo grows up to be a juvenile and finally a sub-adult and adult, they move farther downstream to brackish waters and eventually out to the ocean.
When larvae first emerge from the eggs, they still have the yolk sac attached. This provides food and nourishment while they are growing. They hide out in the spaces between rocks and under aquatic plants for protection.
Migratory Sturgeon

Words may be vertical, horizontal, or diagonal.

Can you find these words in the puzzle above?

- ATLANTIC
- STURGEON
- ANADROMOUS
- SPAWNING
- MIGRATE
- HABITAT
- OCEAN
- RIVER

- ESTUARY
- PEBBLES
- GRAVEL
- SUBSTRATE
- SUBSTRATE
- SALT WEDGE
- COASTAL
- TEMPERATURE
- FLOW
Atlantic and shortnose sturgeons use estuaries and bays as foraging/feeding grounds. They eat various **prey** including **crustaceans**, polychaetes, and **mollusks**. Their protrusible mouth sucks up food along with sand and pebbles like a vacuum. After they swallow the food whole, they spit out the pebbles and sand.

How many **prey** items can you find?
Migration Maze: Foraging

Help the sturgeon find his way to the foraging grounds...be careful, there are many obstacles along the way such as boat propellers, fishing nets, and fishing lures.
Migration Maze: Spawning

Can you help my friends, Spike and Sandy, find their way to the spawning grounds?

START

FINISH
Life Stages

Embryo

Yolk sac larvae

Larvae

Fingerling

Juvenile

Adult

Stages
Life Cycle and Physiology

• FIN
• BARBELS
• CAUDAL
• DORSAL
• PECTORAL
• PELVIC
• PROTRUSIBLE
• GILLS
• SCUTES
• EGGS
• YOLKSAC
• LARVAE
• FRY
• JUVENILES
• SUBADULTS

Can you find these words in the puzzle above?

Words may be horizontal, vertical, or diagonal.
PROTECTION

Shortnose sturgeon were listed as endangered throughout their range in 1967 under the Endangered Species Preservation Act and later under the Endangered Species Act (ESA) when it was started in 1973. They are still listed as endangered under the ESA, which means that they are protected by law from fishing and other threats.

In 1998, the Atlantic States Marine Fisheries Commission (ASMFC) recognized the need to put protections in place for Atlantic sturgeon. They started a ban which stopped fishing for Atlantic sturgeon for 20 to 40 years or until the populations could be restored to a level where 20 years of age classes were protected. Also, no one is allowed to keep any Atlantic sturgeon that are accidentally caught.

NOAA Fisheries (NMFS) then listed Atlantic sturgeon as a “Species of Concern (SOC)” in 2004. A SOC listing does not provide protections like a listing under the ESA. Listing a species as a SOC is meant to promote efforts to conserve the species about which NMFS is concerned. It is also meant for the species that have little information available to determine whether listing under the ESA is necessary.

Atlantic sturgeon were listed as a “Candidate Species” as well, because NMFS was reviewing the status of the species to determine if listing under the ESA was necessary. In 2007, the status review of Atlantic sturgeon was completed. Based upon the best available scientific and commercial information, NMFS determined that listing all of the Atlantic sturgeon populations off the East coast of the United States as either endangered or threatened under the ESA is warranted. In 2012, four of the five populations (sturgeon born in rivers which flow into southern Massachusetts to Florida) have been listed as endangered while Atlantic sturgeon who were born in rivers that flow into the Gulf of Maine have been listed as threatened.

Summary of Protection

- Shortnose sturgeon have been listed as endangered throughout their range since 1967.
- There is a ban on fishing for and keeping Atlantic sturgeon for up to 40 years.
- Atlantic sturgeon were previously a NMFS Species of Concern and Candidate Species.
- In 2012, NMFS listed the Gulf of Maine population of Atlantic sturgeon as threatened and the other four populations as endangered throughout the rest of the U.S. range.
All Stirred Up!

These words and definitions have gotten all stirred up! Unscramble the words and then draw a line to match them to the correct definition.

A. The first mobile life stage of **sturgeon** after hatching from an **egg**
B. This occurs when the number of fish taken from an ecosystem and population is greater than the population’s ability to grow and reproduce
C. Referring to a mouth/jaw which is capable of being extended outward in order to suck up **prey** items
D. Searching for food or **prey**
E. Made from the **swim bladder** of **sturgeon**; used as a binding agent for paint, an adhesive, and also a clarifying agent for **wine**
F. Fish that spend some of their life cycle in salt water and **migrate** to fresh water rivers and streams to spawn
G. Whisker-like sensors near the mouth used to find **prey**
H. A fish that feeds on the benthos or bottom of the water column
I. Processed **roe** or **eggs** of **sturgeon**
J. Near the mouth of a river where the ocean saltwater meets and mixes with the freshwater of the river
K. A sac attached to the **embryo** that provides nourishment
L. An animal that has not matured to an age where it can reproduce, but exhibits ALL external traits of the adult

Now take the letters in the circles and unscramble them below to find out the bonus word.
THREATS

Although it is no longer legal to fish for or keep Atlantic and shortnose sturgeons, they are still caught accidentally as incidental catch in some fisheries. They are caught by recreational fishermen on lures and hooks, often accidentally snagging the sturgeon on the side or tail. Sturgeon are vulnerable to commercial fisheries that fish with gill nets. The way fishermen fish with gill nets usually is by setting and leaving nets for long periods of time, anywhere from several hours to days. 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 in the ocean. These are called “ghost nets” and can float around the ocean and rivers entangling sturgeon as well as other fish species, marine mammals, and sea turtles.

Dams on rivers pose another threat to Atlantic and shortnose sturgeons. Dams were constructed on many rivers along the East Coast. They were made for many reasons including production of electricity through hydropower (using flowing water to make electricity) and for sending water where it needs to go for growing plants for food. Dams can be harmful to 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 fishways that are made to allow fish to swim upstream of the dam. Other dams install fish lifts or elevators to move fish up and over a dam. However, sturgeon do not use these.
fishways to pass the **dams**, and even if they did, engineers have not yet developed ways to pass the large fish back downstream of the dam.

**Sturgeon** can also be harmed by tidal **turbines**, another form of hydropower. Some 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, boat strikes pose a threat to **sturgeon** as they can be struck by the blades of a propeller and the boat itself as the boat is passing.

**Pollution** and **dredging** can also cause problems for the survival of Atlantic and shortnose **sturgeons**. **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 of water quality factors that affect **sturgeon** 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 begins with the rise in temperature in the spring. Hatching time and egg development are also dependent on temperature.

**Dredging** is another potential threat to **sturgeon** and 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 filling the water with mud and **pollution** which can cover over the gravel and cobble **substrate** that is needed for **spawning**.

**Summary of Threats**

- **Incidental catch** of **sturgeon** in some **fisheries** still happens.
- **Dams** can block **sturgeon** from reaching their **spawning** grounds.
- **Sturgeon** do not use fish ladders to get upstream of a dam. Even if they did, there is still no good way to get them back downstream of the dam.
- **Tidal turbines** can harm **sturgeon** if they get struck by the blades.
- Ship strikes and boat propellers are also a threat to **sturgeon**.
- **Dredging**, **dam** construction, and **pollution** are all factors that can cause a **loss of habitat** for **sturgeon** and can affect **spawning**, rearing, and foraging.
Threats to Atlantic and Shortnose Sturgeons

DOWN

(2) This occurs when run-off with fertilizer causes tiny aquatic plants to reproduce quickly, removing oxygen from the water, which can be deadly to fish.

(3) This is used as a form of alternative energy, but sturgeon can be killed if they swim into it and get caught in the blades.

(6) A net is called this when it is lost by a fisherman and floats around in the water. Sturgeon and marine animals can become entangled in these nets.

(7) This is what it is called when human actions are causing harm to the environment through chemicals in exhaust and runoff, as well as litter and trash in rivers, oceans, and on land.

ACROSS

(1) Fish use this to climb over and pass a dam upstream; however, sturgeon do not use this.

(4) Although fishing for Atlantic and shortnose sturgeons is no longer legal, they are still caught as incidental _____.

(5) This is a form of pollution that flows from agricultural areas, construction sites, and roadways.

(7) This is attached to the motor on a boat and pushes it through the water. Sturgeon can be killed if they are hit by the blades on this.
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 as a way 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 it 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 more surgical approach. Using a scalpel, the researcher will make an incision (cut) 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 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 liter bottle of soda, 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 tag** is attached through a **dorsal** scute on the sturgeon’s back, they begin collecting information immediately. This information is either stored in the tag or sent directly up to the 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 uploaded 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 show where the sturgeon traveled.

**Summary of Research**

- Research has been focused on studying Atlantic and shortnose **sturgeons** for many years, but there is still much about these **sturgeon** that we do not know.
- Researchers use various tags to track **sturgeon**. These include **PIT tags**, **acoustic telemetry tags**, and **satellite tags**.
- **PIT tags** are small microchips inserted into the skin. **PIT tag** readers can read the unique identifier of the tag when waved over it.
- **Acoustic tags** “ping” and their signal is picked up by the receivers. The tag number, date, and time are recorded in the receiver.
- **Satellite tags** can either store location data that is recorded constantly once deployed and upload to satellites at the predetermined date, or provide **“real time” data** by uploading continuously to satellites orbiting the Earth.
Help map the travels of a **sturgeon** in the river. Pick your favorite colored crayon or marker and draw a dotted line or arrow for where the sturgeon traveled in the river from Monday morning to Saturday night. Each day has a morning, afternoon, and night. Follow the receiver data through the days of the week starting with Monday morning and ending with Saturday night.

**Receiver Data:**

#1 Monday morning, Monday afternoon, and Saturday afternoon.

#2 Monday evening, and Tuesday morning, Wednesday morning, Saturday morning, and Saturday night.

#3 Tuesday afternoon, Tuesday night, Friday night

#4 Wednesday afternoon, Wednesday night

#5 Thursday morning, Thursday afternoon, Thursday night

#6 Friday morning, Friday afternoon
Glossary

**Acoustic Telemetry Tags** - tags used for **tracking**; it sends out a “ping” which is picked up and recorded by an acoustic receiver

**Anadromous** - fish that live in the salt water oceans and **migrate** to fresh water rivers and streams to spawn

**Anal Fin** - fin located on the underside of a fish just behind the anus which is used for stabilization

**Atlantic Ocean** - the second largest ocean; located between the East **Coast** of North and South America and the West **Coast** of Europe and Africa; covers approximately one-fifth of the Earth’s surface

**Barbel** - whisker-like sensors found between the snout and mouth on **sturgeon** which are used to find **prey**

**Bay** - an area of water bordered by land on three sides; generally have calmer waters than the adjacent sea due to the protection of the surrounding land

**Bottom Feeder** - a fish that feeds on the bottom of the water column

**Brackish Water** - water that is more salty than fresh water, but not as salty as seawater; results from mixing of seawater with fresh water, as in **estuaries**

**Buoyancy** - the upward force that fluid exerts on things that are less dense than the water; upward force that keeps items afloat

**Caviar** - the processed **roe** or **eggs** of **sturgeon**

**Caudal Fin** - the tail fin; propels fish through the water by moving back and forth or side to side

**Coastal** - area where the land meets the sea or ocean; the seashore

**Commercial** - intended to be sold; Atlantic and shortnose sturgeon were once a **commercial** fishery for their meat and eggs (**caviar**)

**Crustacean** - a large group of arthropods, with almost 52,000 described **species**; includes various familiar marine animals such as crabs, lobsters, crayfish, shrimp, krill, and barnacles

**Dam** - a barrier constructed across a **waterway** to control the flow of water, usually for redirection of water in order to harness power of the water flow

**Diadromous** - referring to fish that make migrations between salty sea water and fresh river water

**Dorsal Fin** - the fin located on the back of the fish used for stabilization

**Dredging** - A method for deepening streams, lakes, or reservoirs by scraping and removing solids from the bottom

**Endangered Species** - a **species** that is in danger of extinction

**Estuary** - the mouth of a river where the tide or flow of marine water (salt water) meets and mixes with the freshwater of the river

**Eggs** - the reproductive body consisting of an **embryo** together with the nutritive and protective envelopes

**Embryo** - a fertilized **egg**

**Fingerling** - refers to an early life stage of a young fish when it generally measures to a size similar to a human finger

**Fishery** - industry involved in the catching, processing, and marketing of fish
Forage - searching for food or prey
Fry - life stage at which fish have identifiable body parts; follows the larval stage
Ganoid Scales - diamond shaped scales that are found on primitive bony fishes like sturgeon; scutes are a modified ganoid scale
Genus - a taxonomic rank used in classifying organisms
Gills - the respiratory organ of most aquatic animals that process or breathe water to obtain oxygen
Gill Net - specific net type used by fisherman; fish swim into the net and are caught by their gills or tangled up in the webbing
Habitat - the area or environment where where organisms like plants and animals live or occur
Heterocercal Fin - a tail or caudal fin with unequal lobes; in sturgeon, the top lobe is larger and points upward, like the tail of a shark
Incidental Catch - accidental catch of a non-target species while fishing for another species
Isinglass - made from the swim bladder of sturgeon; used as a binding agent for paint, adhesive, and also a clarifying agent for wine
Juvenile - the life stage at which fish exhibit most but not all traits of an adult fish
Larvae - the first mobile life stage of sturgeon after hatching from an egg
Loss of Habitat - when habitat, or areas where animals live or occur, is no longer available to them due to dam construction and pollution; habitat loss is thought to be a major factor in declining sturgeon populations
Migrate - to move from one area to another, usually for feeding or reproduction
Milt - combination of sperm cells of male fish with the fluid containing them; during spawning, the male releases milt as the female deposits her eggs
Mollusk - An invertebrate animal usually enclosed in a shell, such as an oyster, mussel, or clam
Natal - pertaining to birth
Nantucket Sleigh Ride - a phrase to describe when a whale was harpooned and would drag the whaling boat behind him; typically referring to whaling for sperm whales off of Nantucket, MA
Nursery - The part of a fish’s or animal’s habitat where the young grow up, also known as rearing grounds
Overfishing - occurs when the number of fish taken from an ecosystem and population is greater than the population’s ability to reproduce and replenish the number in the population
Pectoral Fin - fins on the side of the body used for turning, stopping, and balancing
Pelvic Fin - the paired fin behind the pectoral fin on the sides of the body also used for turning, stopping, and balancing
Pickling - the process of preserving food by anaerobic fermentation in brine, a solution of salt in water
PIT tag - PIT (passive integrated transponder) tags are an injectable, internal microchip that allows unique identification of a marked fish; the tag is passive, meaning that it does not put forth the unique number until it is requested by a scanner
Pollution - the introduction of contaminants into an environment that causes instability, disorder, harm, or discomfort to the ecosystem
Polychaete - A large and diverse group of segmented marine worms
Primitive - very old; having only slightly evolved from an earlier primeval or ancestral type
Prehistoric - belonging to or existing in times before recorded history
Prey - animal hunted or caught for food
Protrusible - capable of being thrust outward; sturgeon have a protrusible mouth which they use to suck up prey items like a vacuum
Rearing - the action or practice of bringing a person, animal, or plant to maturity or to a certain stage of growth; juvenile sturgeon spend most of their time in their rearing grounds, or nursery
Recreational - engaged in a pastime; fishermen who fish for a hobby and not to sell their catch are called recreational fishermen
“Realtime” Data - Data that is available to users as soon as it is received by the system
Roe - fish eggs; sturgeon eggs or roe are turned into caviar
Salting - the preservation of food with dry salt; related to pickling (preparing food with brine, i.e. salty water); one of the oldest methods of preserving food
Salt Wedge - the area in an estuary where there is minimal mixing of salt and fresh water; where the salt water forms a wedge thickest on the ocean side and tapered off toward the freshwater side
Satellite Tags - tags used for tracking that are capable of storing near exact location data as well as time and depth, which is then downloaded to satellites
Scales - small rigid plates that grow out of an animal’s skin for protection; sturgeon have ganoid scales
Scutes - modified boney ganoid scales on sturgeon; there are five rows on a sturgeon’s body that extend from the head to the base of the tail
Smoking (smoked) - the process of flavoring, cooking, or preserving food by exposing it to the smoke from burning or smoldering plant materials, most often wood
Spawning - the action of depositing or laying eggs or sperm (milt)
Species - a group or class of animals or plants having certain common and permanent characteristics which clearly distinguish it from other groups
Sturgeon - common name used for species of fish in the family Acipenseridae
Status Review - comprehensive assessments of a species’ biological status and its threats, and are the basis for making determinations as to whether a species warrants listing under the Endangered Species Act
Sub-adult - an animal that has not matured to an age where it can reproduce, but exhibits all external traits of the adult
Substrate - the sediment material found on the bottom of a body of water
Swim Bladder - an internal organ that enables fish to control buoyancy; this organ in sturgeon is used to make isinglass
Tracking - monitoring movements and activities
Tagging - a way to identify previously caught fish by marking them with wire or a flag; way to track fish when tagged with acoustic, PIT, or satellite tags
Tanning - the process of making leather from the skins of animals using tannin, an acidic chemical compound
Threatened Species - a species that is likely to become endangered in the future
Turbine - a machine that uses moving water to create energy by passing the water through a series of blades

Waterway - any navigable body of water

Weir - a kind of trap for fishing; fishing weirs were constructed out of sticks that were woven together like a basket and configured in different patterns like a maze, where water could flow through, but the fish could not leave them

Yolk Sac - a sac attached to an embryo that provides early nourishment; early stages of larva retain the yolk sac for nourishment

Zooplankton - tiny free floating organisms in aquatic systems that provide food for sturgeon in the larval stages

References


For SCUTES Computer Games Visit:

Dinosaurs of the Sea

Eat and run
http://www.greateratlantic.fisheries.noaa.gov/prot_res/scutes/games/SturgeonEatNRun.swf
Answer Key

Historic Sturgeon

Foraging
How many prey items can you find?
13

Life Cycle and Physiology

Forage: D Yolksac: K
Overfishing: B Barbels: G
Bonus word: Sturgeon

Threats to Atlantic and Shortnose Sturgeons

All Stirred Up!
Subadult: L Anadromous: F
Isinglass: E Bottom Feeder: H
Protrusible: C Caviar: I
Larvae: A Estuary: J
Overfishing: B Barbels: G
Forage: D Yolksac: K

What's Missing From These Sturgeon?
1. Dorsal fin, Anal fin
2. Barbels, Gills
3. Eye, Middle row of scutes, Caudal fin

Migratory Sturgeon

Answer Key

34
Draw yourself under the hat so you can become a SCUTES Tracker, just like me.