Topic/Lesson:	**Implications and Inferences in Sturgeon Studies**
Subject:	Analyzing a text for content
Author:	Tracy Bowen
Overview:	In drawing conclusions (making inferences), you are really getting at the ultimate meaning of things - what is important, why it is important, how one event influences another, and how one happening leads to another. Simply getting the facts in reading is not enough - you must think about what those facts mean.
Objectives:	Students will be able to: • Interpret a scholarly or newspaper article for implied content. • Cite textual content to support their interpretations.
Background Knowledge:	Students should have already learned about using context clues to define unfamiliar words (see "Fishing for a Meaning" curriculum).
Materials:	• "Analyzing a Text" description; • Copy of the DEC article for each student; • Copy of the Textual Analysis questions for each student; • Textual Analysis Answer Key • Copy of the "Atlantic Sturgeon" description for each student.
Vocabulary:	• Imply, implied, implying, implication; • Infer, inference, inferring.
Procedures:	Using the "Analyzing a Text" description explain to the students about "reading between the lines" and finding the information that is implied in a text. Explain the difference between imply and infer. Distribute a copy of the DEC article to each student. Explain that they will be reading about a type of fish called Atlantic sturgeon. Ask for volunteers to read aloud: • The title of the article. • Photo captions and describe the photos. • The first paragraph (you can have two students each read one sentence). Have the class brainstorm what they think the text is going to be about.

	Distribute the "Textual Analysis Questions" to each student.
	Having the students work alone, tell them to read the questions and then read the article.
	Tell them to:
	• Read the entire article.
	• As they read, have them underline or highlight any information that may help answer the questions.
	• Once they have read the article, they should fill out the question page.
	Review the questions and answers with the group. Have students use evidence from the text to explain their answers.
Conclusions:	Hand out the "Atlantic Sturgeon" description to each student to take home and read. Have them write a paragraph about their assumptions about sturgeon based on the DEC article and what surprised them in reading the description.
Massachusetts Frameworks:	Reading Standards 1. Cite textual evidence to support analysis of what the text says explicitly as well as inferences drawn from the text.
Resources:	http://www.readworks.org/lessons/grade5/bridge-terabithia/textual-analysis-lesson http://academic.cuesta.edu/acasupp/as/309.htm http://www.dec.ny.gov/environmentdec/44110.html
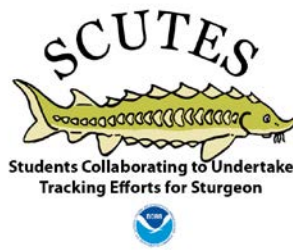
Analyzing a Text

"Drawing conclusions" refers to information that is implied or inferred. In other words, the information is not openly stated.

Writers often <u>tell</u> you more than they say directly. They provide hints or clues that help you to "read between the lines." Using these clues to gain a deeper understanding of your reading is called *inferring*. When you *infer*, you go beyond the surface details to see other meanings the details suggest or *imply* (not directly stated). When the meanings of words are not stated clearly in the context of the text, they may be *implied* - that is, suggested or hinted at. When meanings are implied, you may *infer* them.

Inference is just a big word that means a *conclusion* or *judgment*. If you infer that something has happened, you do not see, hear, feel, smell, or taste the actual event. But from what you know, it makes sense to think that it has happened. You make inferences every day. Most of the time you do so without thinking about it. Suppose you are sitting in your car stopped at a red light. You hear screeching tires, then a loud crash and breaking glass. You see <u>nothing</u>, but you *infer* that there has been a car accident. We all know the sounds of screeching tires and a crash. We know that these sounds <u>almost always</u> mean a car accident. But there could be some other reason, and therefore another explanation, for the sounds. Perhaps it was not an accident involving two moving vehicles. Maybe an angry driver rammed a parked car. Or maybe someone played the sound of a car crash from a recording. Making *inferences* means choosing the most likely explanation from the facts at hand. When you make an inference, be able to identify the clues you used.

Early Sturgeon Data Show Unexpected Results

1 It began as an ambitious project in the mid-Hudson River two years ago: Atlantic sturgeon were tagged with specialized satellite and sonic devices to track migration and spawning patterns, testing whether conventional wisdom on this ancient fish still applied. Though it is too early to reach conclusions, scientists at the New York Department of Environmental Conservation (DEC) have seen surprising results, thanks in part to a 7.5-foot-long fish called Minerva.

2 In the spring of 2006 and again in the spring of 2007, DEC marked 20 sturgeon with sonic tags that send a signal to remote receivers when the fish return to the Hudson to spawn. Over the same period, DEC attached satellite tags to 23 sturgeon to gather data about their travel once they leave the river. The first few fish spotted have produced unexpected data about their journeys.

Sonic Tag Tracking Results

3 It was thought, based on studies of sturgeon eggs, that sturgeon return to the Hudson River every three to five years, though no one had verified the spawning frequency. So it was curious when "Minerva McGonagall" was found in the river near Stony Point in April two years after she was equipped with a sonic tag. Then in May, along came "Arthur Weasley" and "R2D2," also much earlier than expected. (All the fish tagged in 2006 were given names from the "Harry Potter" series; 2007 fish were named after "Star Wars" characters.)

This small tag allows DEC to track the sturgeon's movement in the Hudson.

4 Minerva has shown other unexpected behavior. First, the female beat the males to the Hudson. Second, she didn't swim straight to the typical spawning grounds near Hyde Park. Rather, she lingered near Haverstraw Bay and just recently moved up to the Hudson Highlands, still farther south than she's expected to be. "Females are supposed to rush to the spawning grounds and then leave,'' explained Amanda Higgs, estuary biologist with DEC's Hudson River Fisheries Unit. "She's been here for a month and a half."

5 Sonic signals from Minerva and other tagged fish are picked up by a receiver anchored near Hastings-on-Hudson. Once the signal is recorded, DEC scientists proceed by boat to track and obtain more data about the fish. This year, DEC's mobile crew began tracking in April so as to not miss some of the earlier sturgeon arrivals that may have been missed in 2007.

6 The sonic tags will provide invaluable insight on the sturgeon's use of the Hudson and help DEC's Hudson River Estuary Program meet its goals for long-term management of Atlantic

sturgeon. These goals include: identifying spawning areas, determining bottom-type preferences, and estimating how long the fish stay in the river during their spawning run.

Satellite Tag Tracking Results

This sturgeon will get a tag that allows biologists to track its location throughout the season.

It's typical for other fish species to leave the Hudson and swim north. Here again, the sturgeon, so far, have gone against the grain. "We didn't expect them to go south," Higgs said. "They're doing the opposite of the other fish." In general, the satellite-tagged sturgeon left the river in the summer, lingered in New York and New Jersey waters for a while, then moved south to either the mouth of the Delaware River or to Chesapeake Bay.

The tags send a signal every 15 minutes, conveying information about latitude, water temperature, and depth. Externally attached to the fish, the tags are programmed to pop off after many months. Supported by a float, the tags drift to a beach where they can be found by their satellite signals. However, sometimes the journey (weather, other factors) corrupts the data.

A major goal of the study is to learn more about sturgeon seasonal migration along the Atlantic coast (i.e., where they are on the map, how close to shore, at what depths, etc.). The project is funded by DEC's Hudson River Estuary Program and Bureau of Marine Resources, along with the U.S. Fish and Wildlife Service, the Atlantic States Marine Fisheries Commission, the Pew Institute for Oceanic Studies, and the University of Miami.

Sturgeon Recovery by 2009 Sought

One of the goals of DEC's Hudson River Estuary Action Plan is for Atlantic sturgeon to show signs of recovery by 2009. "New York imposed a moratorium on sturgeon fishing in 1996 and convinced other Atlantic coast states to do the same in 1998," said Fran Dunwell, coordinator of DEC's Estuary Program. "Since then, we have aggressively pursued a program of study designed to promote recovery of the species in the Hudson and further protect its habitat."

Sturgeon belong to one of the most primitive groups of bony fish, having survived since the Cretaceous period more than 120 million years ago. While some characteristics have changed over time, sturgeon remain basically unchanged from their Cretaceous ancestors. More information about sturgeon and fish conservation plans is available on DEC web pages.

SCUTES

**Students Collaborating to Undertake
Tracking Efforts for Sturgeon**
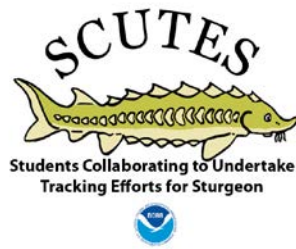
Name: _____

Date: _____

Questions about "Early Sturgeon Data Show Unexpected Results"

Paragraph 1

Scientists know everything there is to know about sturgeon.   True or False

Write the words or phrases in the paragraph that led you to your answer.

Paragraph 2

Where did the sturgeon (the ones that were included in this study) hatch?

Do they stay in the same place for their whole lives?

Paragraph 3

Through this study, scientists are learning new things about how often sturgeon may spawn. How did they get information about spawning before this study?

Write the words or phrases in the paragraph that led you to your answer.

Paragraph 4

Female sturgeon usually arrive at the spawning grounds before the males.   True or False

Write the words or phrases in the paragraph that led you to your answer.

Paragraph 5

The 2007 tracking program began in:

    a) March or earlier
    b) April
    c) May or later

Paragraph 6

Is river bottom-type important to spawning sturgeon?

Write the words or phrases in the paragraph that led you to your answer.

Paragraph 7

The scientists made assumptions about where the sturgeon would go. What were they?

What did they base their assumptions on?

Were they correct in their assumptions?

Paragraph 8

Data from this study are incomplete.   True or False

Write the words or phrases in the paragraph that led you to your answer.

Paragraph 9

A lot of organizations are interested in learning more about sturgeon.   True or False

Write the words or phrases in the paragraph that led you to your answer.

Paragraph 10

In your own words, what is DEC trying to accomplish with this study?

Write the words or phrases in the paragraph that led you to your answer.

Paragraph 11

In relation to other fish species, sturgeon are:

    a) An older species
    b) A newer species

Write the words or phrases in the paragraph that led you to your answer.

Students Collaborating to Undertake
Tracking Efforts for Sturgeon
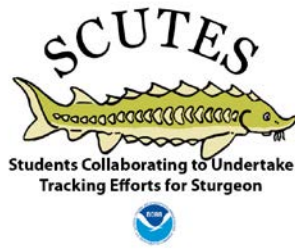
Questions about "Early Sturgeon Data Show Unexpected Results":
Teacher Answer Key

Paragraph 1

Scientists know everything there is to know about sturgeon.   *False*

Write the words or phrases in the paragraph that led you to your answer.
Testing conventional wisdom; too early to reach conclusions; surprising results

Paragraph 2

Where did the sturgeon (the ones that were included in this study) hatch?
Hudson River

Do they stay in the same place for their whole lives?
No (return to the Hudson to spawn; once they leave the river)

Paragraph 3

Through this study scientists are learning new things about how often sturgeon may spawn. How did they get information about spawning before this study*?*
By studying the eggs

Write the words or phrases in the paragraph that led you to your answer.
"It was thought, based on studies of sturgeon eggs…"

Paragraph 4

Female sturgeon usually arrive at the spawning grounds before the males.   *False*

Write the words or phrases in the paragraph that led you to your answer.
Other unexpected behavior; the female beat the males to the Hudson

Paragraph 5

The 2007 tracking program began in:

    c)   *May or later*

Paragraph 6

Is river bottom-type important to spawning sturgeon?   *Yes*

Write the words or phrases in the paragraph that led you to your answer.
Identifying spawning areas; determining bottom-type preferences

Paragraph 7

The scientists made assumptions about where the sturgeon would go. What were they?
Head north when they leave the river.

What did they base their assumptions on?
What other fish species do.

Were they correct in their assumptions? *No*

Paragraph 8

Data from this study are incomplete.   *True*

Write the words or phrases in the paragraph that led you to your answer.
Tags pop off after months; sometimes the journey corrupts the data

Paragraph 9

A lot of organizations are interested in learning more about sturgeon.   *True*

Write the words or phrases in the paragraph that led you to your answer.
Project funded by DEC's Hudson River Estuary Program and Bureau of Marine Resources, US Fish & Wildlife Resources, Atlantic States Marine Fisheries Commission, Pew Institute, and Univ. of Miami

Paragraph 10

In your own words, what is DEC trying to accomplish with this study? *Recovery of the species*

Write the words or phrases in the paragraph that led you to your answer.
One of the goals…is for Atlantic sturgeon to show signs of recovery. Aggressively pursued a program of study designed to promote recovery of the species.

Paragraph 11

In relation to other fish species, sturgeon are:

   a) *An older species*

Write the words or phrases in the paragraph that led you to your answer.
One of the most primitive groups of bony fish

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 oxyrinchus*) and the smaller shortnose sturgeon (*Acipenser brevirostrum*).

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. Some Atlantic sturgeon do not reach reproductive maturity until they are 20 years old.
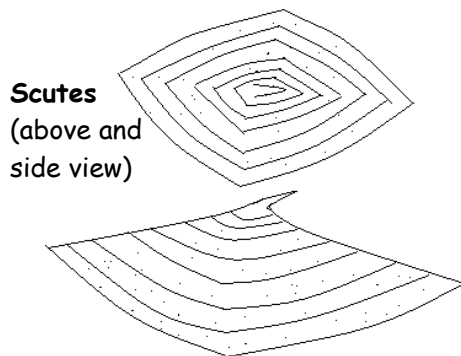
Scutes
(above and
side view)

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 help serve as protection for the fish, and also make sturgeon distinct from other fish.

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 mouths are 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 it 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 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.

Barbels

Protrusible
mouth