Overview:
The crawfish industry is an important part of Louisiana’s economy. The red swamp crawfish is one of the crawfish species used for widespread sale and consumption. In this lesson, students will learn how Louisiana’s native red swamp crawfish have been transplanted to other countries around the world and have thrived. Chinese crawfish even have become a competitor in the state.

Learning Objectives:
The students will:
- Understand how the red swamp crawfish traveled from Louisiana to Central America to Europe to Africa and to Asia.
- Explain how the red swamp crawfish became a part of China’s export business.
- Determine the positive and negative consequences for Louisiana’s red swamp crawfish industry because of other countries’ red swamp crawfish industries.

Materials List:
- Globe (teacher provides)
- Crayons
- Scissors

Grade Level Expectations:
Third Grade
16. Identify and compare customs, celebrations and traditions of various cultural groups in Louisiana. (G-1C-E4)
21. Identify natural resources in Louisiana and describe their uses and importance. (G-1D-E4)
37. Identify the concepts of specialization (i.e., being an expert in one job, product, or service) and interdependence (i.e., depending on others) in the production of goods and services. (E-1A-E7)
39. Identify goods that are produced within the local community and Louisiana and describe how they are shipped elsewhere for sale. (E-1A-E9)
42. Describe the basic principles of supply and demand and how competition can affect prices of goods. (E-1B-E1)
43. Explain the effect of increase/decrease in price upon the consumer and producer. (E-1B-E2)
Fourth Grade
3. Locate and label places on a map or globe: the seven continents, the United States and its major land forms, major bodies of water and waterways, referring to the poles, the equator, latitude, longitude and meridians. (G-1A-E2)
14. Locate economic activities that use natural resources in the local region, state and nation and describe the importance of the activities to these areas. (G-1C-E5)
19. Describe the use, distribution and importance of natural resources in different regions of the United States using geographic tools such as maps. (G-1D-E4)
46. Describe how supply and demand affect the price of a good or service in a given situation. (E-1B-E1)
47. Explain how a rise or fall in prices affects personal, family and government budgets. (E-1B-E2)

Fifth Grade
3. Interpret a map, using a map key/legend and symbols, distance scale, compass rose, cardinal or intermediate directions and latitude and longitude. (G-1A-M2)
16. Identify the natural resources used by people in the United States. (G-1D-M3)

Common Core State Standards:
Third Grade
3.4.7 Describe the importance of natural resources in Louisiana using maps.
3.8.3 Describe the basic concepts of supply and demand and explain how competition affects the prices of goods and services.

Fourth Grade
4.5.2 Analyze how physical characteristics of a region shape its economic development.

Fifth Grade
5.4.2 Analyze a map using a variety of tools.

Vocabulary Definitions:
Circumnavigate – To go completely around something (usually the Earth).

Consumers – People who buy and use goods and services.

Crop Rotation – Growing a series of different crops in the same area during sequential seasons.

Crustacean – Type of animal (an arthropod) with a hard shell and segmented body that usually lives in the water.

Demand – The quantity of goods buyers will take at a particular price.

Economy – How a region uses and takes care of resources and distributes products.

Native species – A species that came to exist in an area through natural processes and no human intervention.
**Introduced species** – A species that does not naturally occur in an area. Also called alien, exotic or non-native species.

**Producer** – A person who makes a good (or goods) for consumers.

**Renewable natural resource** – A resource that can replenish with the passage of time, either through biological reproduction or other naturally recurring processes

**Supply** – The quantity of a commodity that is in the market and available for purchase or that is available for purchase at a particular price.

**Background Information:**

The red swamp crawfish, *Procambarus clarkii*, is one of 36 species of crawfish native to Louisiana and is mostly found in the southern United States and northeastern Mexico.

Red swamp crawfish thrive in swamps and ditches with still water and tend to stay away from water sources with a strong current. The red swamp crawfish is mostly active at night – when it can feed on its prey undisturbed. The diet includes insects, snails, tadpoles, larvae, worms and even deceased animals.

The red swamp crawfish, in particular, is an important part of Louisiana’s culture. Native Americans enjoyed them even before the beginning of colonization of America. Eating crawfish has continued as a popular pastime among residents of Louisiana and is a large part of our culture, particularly when families gather to enjoy each other’s company. Crawfish are the heart of many Louisiana specialty cuisines and boost our tourism economy as people travel to our state to enjoy our food.

**Louisiana Crawfish Industry Growth**

<table>
<thead>
<tr>
<th>Approximate Date</th>
<th>Amount Harvested</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1880</td>
<td>23,400 pounds</td>
<td>$2,140</td>
</tr>
<tr>
<td>1908</td>
<td>88,000 pounds</td>
<td>$3,600</td>
</tr>
<tr>
<td>1960 to present</td>
<td>110 million pounds per year (90 percent of U.S. domestic crawfish crop)</td>
<td>$120-150 million $300 million annually</td>
</tr>
</tbody>
</table>

The benefits of the crawfish industry in Louisiana are numerous. Louisiana accounts for about 90 percent of all crawfish harvested in the United States!

Red swamp crawfish are a **renewable natural resource** from our wetland ecosystems. Crawfish can be farmed in **crop rotation** with rice, providing Louisiana farmers with a dual source of income. Growing, harvesting, selling and cooking crawfish provide many jobs for our residents (fishers, trappers, sales people, chefs, waiters, manufacturers) and boost our state’s economy. Crawfish production and consumption remain a major part of our culture (festivals, recipes, songs, etc.), which, in turn, draw tourists to our state. The crawfish is such an integral part of Louisiana culture that in 1983 Louisiana adopted the crawfish as our state crustacean, becoming the first state to adopt an official crustacean.

In more recent years, however, crawfish sales have declined in Louisiana due to an increase in imported crawfish from China. Since the red swamp crawfish has been introduced (on accident or purpose) to other countries, such as China, other nations have established crawfish industries. China, in particular, is providing frozen crawfish tails in Louisiana stores for cheaper prices than Louisiana products. Purchasing crawfish from a competitor like China could hurt our economy.
One reason why Louisiana is not able to compete with China in frozen crawfish sales is that Louisiana processing plants have not been able to keep up with those of China. LSU AgCenter research scientist Dr. Greg Lutz says that some of the reasons Louisiana is unable to keep up with China in frozen crawfish sales stem from the limitations of our processing (peeling) plants. Lutz says:

Over the past decade, a number of fundamental changes have overtaken the industry and the full impacts of some of these changes are only now being realized. Perhaps the greatest change in Louisiana’s crawfish farming industry involves the processing (peeling) sector. Historically, whenever crawfish harvests exceeded what could be moved through market channels to restaurants and retail consumers, product found its way to processing plants to be peeled and sold as fresh or frozen tail meat. During the mid-1990s, these enterprises came under assault from low-priced, imported crawfish meat.

The economics of trying to compete with imported product from China, coupled with difficulties obtaining suitable labor during a period of economic prosperity, began to take their toll on one processor after another. Processors already were hard pressed to obtain raw product at prices that would allow them to compete at the seafood counter. In 1996, there were an estimated 90 to 100 crawfish processors in Louisiana; today there are approximately 15. (Crawfish Profile. 2011)

Advance Preparation:
1. Familiarize yourself with Louisiana’s red swamp crawfish by reading the background information before conducting this lesson.
2. On your world map, draw a red line that connects Louisiana to the following areas separately: Central America (Costa Rica), Europe (France, Spain, Scandinavia), Africa (Kenya, Nigeria) and Asia (China, Japan).
3. Make copies of the blackline masters:
   a. World Map (one per student)
   b. Exit Ticket (one per student pair)
   c. Podcast script (one per student pair)

Procedure:
Guiding Questions
- How did Louisiana’s indigenous red swamp crawfish travel to Europe and China and then eventually become an economic competitor for Louisiana’s import/export business?
- How do Louisiana’s and other countries’ red swamp crawfish industries positively and negatively affect Louisiana?

1. Show the Crawfish Clip Art to students. Hold a brainstorming discussion with the students. Refer to the background to guide the discussion. Ask the following guided questions to help students think deeply:
   a. What is this that I am holding in my hand? Where does it come from?
   b. Is it a native species (refer to vocabulary section for definition) or a non-native species (refer to vocabulary section for definition) to Louisiana?
c. How is it important to Louisiana? Talk about economic importance using background information.

2. Tell students this crawfish clip art is a representation of the red swamp crawfish. It is a **native species** to Louisiana.

3. As a class, show the world map where you plotted a red line connecting Louisiana to the following points. (separately): Central America (Costa Rica), Europe (France, Spain, Scandinavia), Africa (Kenya, Nigeria) and Asia (China, Japan).

4. Use the crawfish clip art cutout to demonstrate how crawfish have traveled or **circumnavigated** the world. Explain circumnavigation using vocabulary definition and the globe model. (The podcast and script will give you insight as to how this happened. Also, review the background for more information.)

5. Explain that this lesson will show how a species of crawfish that was native to Louisiana traveled around the world and ended up in China.

6. Also, explain that students will learn how China now competes with our major businesses by producing red swamp crawfish, too.

7. Divide students into pairs.

8. Pass out one World Map sheet and one crayon to each pair of students.

9. Pass out a copy of the podcast script to each pair of students.

10. Have students skim the **podcast script** and highlight any unknown terms. Discuss these words with the class before you begin the podcast.

11. Watch and/or listen to the podcast. National Geographic Web Site: podcast “Tiny Travelers.” (See the resources section for URL.) Students should follow along with their scripts.

12. As students are listening to the podcast, they will draw an “X” on all of the places the podcast indicates our native red swamp crawfish have traveled.
   a. Tell them not to connect the points with lines.
   b. If they can’t find the place right away, they may write down the name of the place on the back of the world map.
   c. Another option would be to stop the podcast each time a place is mentioned to allow the pairs ample time to find the places mentioned.

13. Have students share the many different places that were discussed in the podcast. (Answers: France, Spain, Costa Rica, Kenya, Nigeria, Japan, China, Scandinavia)

14. Using a ruler and crayons, have each pair of students draw a line from Louisiana to each place (separately) on their maps, so that Louisiana is the starting point (epicenter).

15. Discuss how crawfish started in Louisiana but traveled to all of these places in the world and have adapted to and even flourished in their new habitats. 

16. Using the Background Information for this lesson and other knowledge of economics, review economic vocabulary with the students: supply, demand, specialization, etc.
   a. How does this competing industry affect Louisiana? (Students will answer this on the **Exit Ticket**. See the key for answers.)

17. Pass out **Exit Ticket** for informal assessment. Review the directions for the **Exit Ticket**. Students may use jots to answer the questions. This may be completed in pairs or individually, and they may use the script to help.

18. Use the students’ answers on the exit ticket to determine if they understood the positive and negative consequences of the crawfish industry in Louisiana and the world. (Informal assessment)
Extension Ideas

- Have pairs of students make podcasts summarizing what they learned from the podcast. (assessment option)
- Have students make podcasts to show their research of another food item that has made its way to a foreign country.
- Have students use Monterey Bay Aquarium Seafood Watch’s website on red swamp crawfish to explore how U.S.-farmed crawfish are the best choice because they are native to the region where they are farmed and the farming methods used are ecologically responsible. (See the link in the resources section.)

Blackline Masters:

- World Map
- Exit Ticket
- Exit Ticket KEY
- Podcast Script

Resources:

Crawfish Clip Art: http://www.clker.com/clipart-13342.html


Louisiana Crawfish Research and Promotion Board: http://www.crawfish.org/history.html


National Geographic MapMaker Kit for Wall Display: http://education.nationalgeographic.com/education/program/nat-geo-mapmaker-kits/?ar_a=1

National Geographic World Map Handouts: http://education.nationalgeographic.com/education/mapping/outline-map/?map=The_World&ar_a=1

University of Michigan’s Animal Diversity Web: Red Swamp Crawfish Information http://animaldiversity.ummz.umich.edu/accounts/Procambarus_clarkii/
Crawfish Clip Art
Crawfish Podcast from the Encyclopedia of Life

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Red swamp crawfish
Procamburus clarkii

Ari: From the Encyclopedia of Life, this is One Species at a Time. I’m Ari Daniel Shapiro.

Sometimes it’s the smallest travelers who end up on the biggest journeys. And in this story, that journey is nothing less than a circumnavigation powered by biology, and by business.

We start with Procamburus clarkii – the red swamp crawfish.

<crawfish bag cutting>

Michael Robertson scissors off the top of a mesh bag stuffed with crawfish...

<crawfish bag dump>

...and pours them onto a sorting table. There are hundreds of them.

Robertson: A nice sack here – all very lively crawfish.

Ari: Robertson works here, at Big Fisherman Seafood – a well-known crawfish shop in New Orleans. He acts quickly to separate the live, crawling crawfish from the occasional dead ones. Then he boils them in a large pot, along with some garlic. Robertson fishes out a couple of the cooked ones.

Robertson: You just peel ’em and eat ’em there. These are done, ready to come out.

Ari: Rusty Gaude, with Louisiana Sea Grant, looks on. He’s been studying and selling crawfish – in one form or another – for the last 30 years. He says that Louisianans have their French ancestors to thank for crawfish cuisine.

Gaude: In France, they had a long tradition of eating crawfish. And so when those French people came over here, they saw an animal – not quite the same, it’s actually a different genus. But it’s still a crawfish and they knew exactly what to do with it. And they said, “You’re gonna look good in a pot.”
Ari: Over time, the Louisiana crawfish industry grew. And out of the 37 species of native crawfish here, only two – the red swamp crawfish and the white river crawfish, or Procambarus zonangulus – were able to be scaled up for widespread production and consumption.

Now, our journey gets set in motion when in the 1800s, a couple hundred years after France first stepped foot in Louisiana, the French needed help – with their crawfish.

Gaude: The population of the native French crawfish has been decimated.

Ari: And it wasn’t just France. From Spain to Scandinavia, native European crawfish populations were on the decline. Rusty Gaude says the reason behind that decline – was yet another kind of crawfish – a North American variety of the genus Orconectes. Orconectes was brought to Europe, uninvited. And it carried a North American fungal disease across the Atlantic.

Gaude: The European crawfish – once they got exposed to these North American diseases, it pulled the population down, and virtually stopped the possibility of them developing a commercial industry.

Ari: The solution was to introduce Louisiana’s red swamp crawfish into Europe. And by the way, this is just the first stop in this business-driven journey for these animals. I should say that the last leg of this trip and the most surprising one is happening right now. But at this point we’re in the 1900’s, and it took Spain years to implement the introduction – to verify and then re-verify this was the right course of action. And people are still divided, decades after the introduction.

Gaude: To the families that are involved in the industry, it has been a godsend.

Ari: It helped bring back a crawfish festival. And it’s become food not just for people in Europe, but also for a number of birds and mammals. But then there are the problems. Like when the crawfish burrow into dikes, riddling them with holes so that the water held inside just flows out. In addition –

Gaude: They will go into a partially vegetated area and they will strip it clean. It’ll look like the asphalt street that’s next to us.

Ari: So it’s not a simple...

Gaude: It’s not black and white. It’s a full spectrum of gray.

Ari: Louisiana’s red swamp crawfish has also been introduced into Costa Rica, Kenya, and Nigeria – with business motivating the move every time.

But perhaps its most troublesome introduction – the irony of which I'll get to in a minute – has been in Asia.
Gaude: In the case of Japan, they actually brought the Louisiana crawfish not to eat, but to feed to bullfrogs.

Ari: Sidenote – the bullfrogs also came from Louisiana. But anyway... the point is that the red swamp crawfish escaped.

Gaude: When that happened, nobody will say – nobody really knows. But those crawfish found their way over to China.

Ari: They spread through the Chinese rice fields in a flash. And it wasn’t long before China turned this new invasive pest into an export. And here’s where the loop closes. Rusty Gaude walks me across the street from the seafood shop, into Breaux Mart – a New Orleans grocery store. He opens a freezer, and holds up two packages of crawfish – one from Louisiana and one from China.

Ari: They look identical.

Gaude: Identical – it’s from the same animal.

Ari: The China’s $8.69.

Gaude: And the American is $17.99.

Ari: It’s the same amount of crawfish, but that cost is to get the crawfish...

Gaude: Process it, peel it out, freeze it, transport it, go through distribution over here, and it still comes in at half the price of ours. It has literally changed the industry. Because now, the only thing that we have a unique handle on is the live animal.

Ari: And so... the Louisiana red swamp crawfish has taken up residence across 4 continents – a move fueled by the demands of crawfish eaters the world over. And it remains a vital part of culinary and cultural life, right here in New Orleans... where its global journey began.

Ari: Check out some pictures of those fresh Louisiana crawfish at eol.org.

Our series, One Species at a Time, is produced by Atlantic Public Media in Woods Hole, Massachusetts. I’m Ari Daniel Shapiro.
Crawfish Economics

student activity sheet

Name ___________________________________________ Date ___________________

Question 1:
What have been some positive consequences of the red swamp crawfish industry in Louisiana?

Exit Ticket
Remember: Red swamp crawfish are indigenous to the freshwater bayous of Louisiana. They are an introduced species elsewhere in the United States, as well as Europe, Central America, Africa and Asia.

Question 2:
What are some negative consequences of the red swamp crawfish industry in Louisiana that result from China also having a crawfish industry?
Hatcheries and Habitats: The Alligator Snapping Turtle
Teacher Instructions

Overview:
In this lesson, students will learn about aquatic and terrestrial turtles. Students will focus on a wetland turtle, the alligator snapping turtle, and efforts to protect this close-to endangered species.

Learning Objectives:
The students will:
- Compare and contrast the differences between aquatic and terrestrial turtles.
- Study the alligator snapping turtle, its habitat and its need for protection and conservation in our local wetlands.
- Understand the role of a hatchery in the conservation process.

Materials:
- Aluminum foil
- Computer (optional)
- Construction paper
- Egg cartons (teacher provides)
- Glue
- Manila folder (teacher provides)
- Markers
- Pipe cleaners
- Popsicle sticks
- Scissors
- Shoe boxes (teacher provides)
- Yarn
- Other materials: toilet paper rolls, leaves, rocks, sticks, etc. (teacher provides)

Grade Level Expectations:
Third Grade
Science
62. Identify animals in Louisiana that have recovered and that are no longer considered endangered. (SE-E-A5)
English
ELA.3.10. Demonstrate understanding by summarizing stories and information, including the main events or ideas and selected details from the text in oral or written responses. RL.3.4
ELA.3.17. Demonstrate understanding of information in grade-appropriate texts using a variety of strategies.

Fourth Grade
Science
41. Describe how parts of animals’ bodies are related to their functions and survival. (LS-E-A3)

English
ELA.4.14. Demonstrate understanding of information in grade-appropriate texts using a variety of strategies.
ELA.4.42. Locate information using a broad variety of reference sources, including almanacs, atlases, newspapers, magazines and brochures.

Fifth Grade
Science
28. Explain and give examples of predator/prey relationships. (LS-M-C4)

English
ELA.5.12. Demonstrate understanding of information in grade-appropriate texts using a variety of strategies.
ELA.5.42. Locate and select information using a variety of organizational features in grade-appropriate resources.

Common Core State Standards:

Third Grade
Science
3-LS4-4. Make a claim about the merit of a solution to a problem caused when the environment changes and the types of plants and animals that live there may change.

English
RI.3.2. Determine the main idea of a text, recount the key details and explain how they support the main idea.
RI.3.9. Compare and contrast the most important points and key details presented in two texts on the same topic.
RL.3.1. Ask and answer questions to demonstrate understanding of a text, referring explicitly to the text as the basis for the answers.
SL.3.1. Engage effectively in a range of collaborative discussions with diverse partners on grade three topics and texts, building on others’ ideas and expressing their own clearly.

Fourth Grade
RI.4.9. Integrate information from two texts on the same topic in order to write about or speak about the subject knowledgeably.
SL.4.1. Engage effectively in a range of collaborative discussions with diverse partners on grade four topics and texts, building on others’ ideas and expressing their own clearly.
Fifth Grade

SL.5.1. Engage effectively in a range of collaborative discussions with diverse partners on grade five topics and texts, building on others’ ideas and expressing their own clearly.

**Vocabulary Definitions:**

**Anatomy** – The body structure of an organism.

**Aquatic (animals)** – Animals that live predominantly in water.

**Ectotherm** – Animal that uses the environment around it to regulate its body temperature.

**Endangered species** – A species that is at risk of going extinct in all or part of its range.

**Hatchery** – A place where the eggs or young fish, turtles or birds are artificially controlled for commercial production or conservation practices.

**Hatchling** – A young animal that recently hatched from an egg.

**Terrestrial (animals)** – Animals that live predominantly on land.

**Background Information:**

**Turtle Biology**

Turtles are a group of diverse reptiles with an external shell. With a fossil history dating back 220 million years, more than 285 species of modern turtles exist in a variety of habitats; from oceans to deserts. Turtles are “cold-blooded,” or **ectotherms** – animals that use the environment around them, most notably the sun, to regulate their body temperatures. Turtles have no teeth but have hard beaklike jaws for slicing and crushing food. Turtles usually don't drink water but instead get their water from the variety of foods they eat. All turtles lay eggs, often in nests dug in soil or sand. They are characterized by slow growth, late maturity and long life expectancy, often making them vulnerable to human effects, such as habitat destruction and hunting.

Turtle **anatomy** has played an important role in their success from prehistoric eras to present. Turtles are most well known for their bony shells, although some species like the leatherback sea turtle and other soft-shelled turtles have lost or minimized the bone in their shells. Despite having a shell, turtles are vertebrates, whose shells serve as protection in addition to skeletal support. The shell has openings for the legs, tail and head, most of which can be pulled inside or tucked under the edge of the shell for protection. Most turtle shells are made of three layers: bone, tissue and blood vessels, and keratin. Keratin is the hard, outermost layer of the shell, which is the same material that makes up animal hair, nails, beaks, hooves and horns. This keratin makes up the scutes of the shell – the hard scalelike shapes that create the pattern of turtles' shells. The middle layer of the shell is tissue and blood vessels, which allow the shell to grow as a turtle ages and to heal if it is damaged. The bottom layer is bone, the supportive structure to which a turtle's backbone is connected. The shell itself is comprised of two parts: the upper shell, or carapace, and the lower shell, called the plastron. A turtle’s shell can give provide clues to many things including its age, life events or where it lives.

Turtles usually are adapted to either aquatic or terrestrial habitats. **Terrestrial** turtles are those adapted specifically for life on land, such as box turtles. These turtles usually have hard, protective domelike shells that reduce predators’ ability to crush the shells. **Aquatic** turtles, or turtles that live in
water, usually have webbed feet and flattened shells that make them hydrodynamic. Some species have lost their bony shells and have leathery or soft shells. Aquatic turtles live in either freshwater environments or the ocean (salt water). Sea turtles usually are much larger than their freshwater cousins, traveling thousands of miles on ocean currents spanning the globe. Sea turtles have a special adaptation for dealing the salt water: glands beneath their eyes to help with excreting salt buildup in their bodies.

### About the Alligator Snapping Turtle

The alligator snapping turtle (*Macrochelys temminickii*) is a well-known inhabitant of Louisiana's wetlands and is the largest freshwater turtle in North America. Alligator snapping turtles are aquatic turtles that are found in lakes, rivers, canals and wetlands of Texas, Louisiana, Arkansas and other southeastern states. This prehistoric-looking turtle is easily recognizable by three ridges of peaked scutes on its carapace (upper shell); its star-shaped eyes; long, alligatorlike tail; and hooked, hawklike beak.

Alligator snapping turtles are mainly carnivorous, feeding on other turtles, fish, crustaceans and invertebrates, as well as dead animals, acorns, tupelo fruit and some aquatic plants. An alligator snapping turtle uses a wormlike appendage on its tongue to attract prey towards its mouth before catching the prey. In addition, these predators can use chemical cues in the water to find prey.

Although alligator snapping turtles are mainly aquatic, they lay their eggs in nests made of soil on land. During the spring, each turtle lays about 16 to 38 eggs – only producing one clutch, or set of eggs, a year or every other year. Eggs hatch in 100 to 140 days into baby turtles, or hatchlings, which head to the water after escaping their eggs. Hatchlings and eggs are vulnerable to predators such as red ants, wild hogs, large fish, birds and raccoons. The turtles have fewer problems with predators, however, if they manage to become adults.

Alligator snapping turtles once were common in Louisiana, but due to their popularity in the commercial fishing industry, habitat alterations and nest disturbances, their population has dropped significantly throughout their native range. Until 2004, alligator snapping turtles were harvested commercially for use in soups and other foods. Recreational fishers still are allowed to harvest one turtle per day. In addition to those issues, dredging of sediment in waterways and water pollution have affected alligator snapping turtle habitats, compounding the issues of population decline. Because of those problems, the alligator snapping turtle may become an endangered species.

### Saving the Snapping Turtle

Many tactics are being used to restore alligator snapping turtle populations. Most notably, scientific research provides the information needed to determine the status of the alligator snapping turtle, and such research leads to the creation of regulations, protective listings and management practices. Over the past 50 years, many studies have been conducted by scientists from state and federal agencies, universities and private institutions concerning the alligator snapping turtle. In addition, insights from local residents, fishers and other groups help researchers identify problems and gain firsthand observations.

Protective listings, laws and regulations concerning harvest are crucial to preserving many species. In Louisiana, the alligator snapping turtle has been designated as a rare species, leading to a ban on commercial harvest in 2004 and limits on recreational harvest to one turtle per day. Surrounding states have instituted similar regulations to protect the alligator snapping turtle. On an international level, the alligator snapping turtle is listed as vulnerable on the IUCN Red List and was included in CITES Appendix III in 2006. (See General Wetlands Information for more on...
Protection and Conservation of Natural Resources.) The alligator snapping turtle is scheduled to be reviewed in 2017 for potential listing as threatened under the Endangered Species Act.

Habitat is another key to maintaining alligator snapping turtle populations. Dredging, the scooping of sediment from the bottoms of waterways, changes the habitat of the alligator snapping turtle and its prey. Changing dredging practices may increase habitat suitability and turtle survival. Water pollution also contributes to the degradation of turtle habitat, leading to toxicity and disease. Nest predation by raccoons, other small mammals, wild hogs and red ants also is an issue, because these animals destroy the nests and eat the eggs in them. Red ants even have been known to prey upon young turtles, as well as eggs.

The U.S. Fish and Wildlife Service began a “head start” program for alligator snapping turtles at the Tishomingo National Fish Hatchery in Oklahoma in 2000. In 2011, the Louisiana Department of Wildlife and Fisheries’ Monroe Hatchery also began a head start program for the alligator snapping turtle. A hatchery is a place where the eggs of young of fish, turtles or birds are artificially controlled for commercial production or conservation practices. Hatchlings at the Monroe Hatchery will be raised in captivity for three years. This tactic increases survival of young turtles by limiting exposure to weather and predators. For the first year at the hatchery, turtles will be raised indoors in heated tanks to maximize growth. Each indoor tank has natural substrate (mud), small logs and aquatic vegetation to emulate the turtle's natural habitat. Ultraviolet lights with timers hang above the tanks to provide the turtles with a normal day length, called a photoperiod. The UV light is important for growth and bone development. For the remaining two years, turtles will be kept in outdoor ponds before being released into areas with low numbers of alligator snapping turtles, as determined by statewide trapping surveys currently being conducted by Louisiana Department of Wildlife and Fisheries.

Advance Preparation:
1. Make copies of the following blackline masters for each student:
   - All About Turtles
   - Venn Diagram
   - Alligator Snapping Turtle Fact Sheet
   - Louisiana Department of Wildlife and Fisheries Head Start Project
   - Create a Turtle Habitat
   - Exit Ticket (notice that there are multiple tickets per page to save paper)
2. Have one shoe box ready for each student.
3. Have materials ready for creating habitats (in assembly line fashion).
4. Students can collect or bring items for the activity on Day 2, including toilet paper rolls, twigs, leaves and rocks.
5. Cut egg cartons into individual cups.

Procedure:
Guiding Questions:
- What are the differences between terrestrial and aquatic turtles?
- What is a hatchery and how can it help Louisiana’s alligator snapping turtle’s population so it remains off the endangered species list?
- Why are hatcheries and habitats important?
Day 1: All About Turtles

1. Pass out a manila folder to each student.
2. Have each student write “Turtle Information Packet” on the outside of the folder, with each student’s name at the bottom of his or her folder.
3. Explain that the students will receive and collect several pieces of information on turtles during today’s lesson. All materials will be kept inside this folder so they can refer to these materials easily, if needed.
4. As a whole class, discuss the following questions. Allow students to record their thoughts on the back of their Turtle Information Packet. Encourage students to write whatever they think. During this brainstorming stage, there are no wrong answers.
   a. What is a turtle? (*Reptile with a shell, cold-blooded, lives in water or on land, sometimes kept as pets, etc.*)
   b. Have you ever seen a turtle outside?
   c. Where did you see it?
   d. What did it look like?
   e. How do the students think turtles get the food they need? (*hunting, swimming, etc.*)
   f. What do the students think the purpose of the shell is? (*Structural support, protection, etc.*)
5. Have each student sketch a turtle and write what they think the differences are between water turtles and land turtles, labeling body parts to show their functions.
6. Define the terms aquatic and terrestrial. Make sure students understand that water turtles are aquatic and that land turtles are terrestrial. (*Aquatic animals live predominantly in water; terrestrial animals live predominantly on land.*)
7. Pass out All About Turtles to the students. (See blackline masters.)
8. Give students five to 10 minutes to read and take notes on the inside flaps of their manila folders.
9. After the students have read and taken notes, return to the questions in Step 4. What were students correct about? What new information did they learn?
10. Divide the class into pairs of students and pass out the *Venn Diagram Work Sheet* (See blackline masters.) to each student.
11. Give the students 10 minutes to complete the *Venn Diagram Work Sheet* comparing the details of aquatic and terrestrial turtles.
12. Discuss findings and use the *Venn Diagram Work Sheet Key* (See blackline masters.) to make sure students have the corrected information.
13. Have students put their copies of All About Turtles and the *Venn Diagram Work Sheet* in their Turtle Information Packets.
14. Now that students have an idea of the difference between aquatic and terrestrial turtles, let’s focus on a particular Louisiana wetland turtle, the alligator snapping turtle.
15. Pass out the Alligator Snapping Turtle Fact Sheet. (*Optional: Go to http://www.arkive.org/alligator-snapping-turtle/macrochelys-temminckii/ and share a variety of images and short video clips of this turtle.*)
16. Read through this sheet as a class to learn more about the alligator snapping turtle.
17. Explain to students that this turtle is close to becoming listed as endangered. (*Refer to background information for details on threats to the turtle.*)
18. Ask the students what they think we can do to stop this from happening. (Answers: scientific research, habitat protection, raising turtles in hatcheries and releasing them, harvest regulations, etc. Refer to background information for more details.)

19. Explain that alligator snapping turtles have begun being raised in hatcheries. Define a hatchery and its importance, using the background information. (Definition: A place where the eggs or young of fish, turtles or birds are artificially controlled for commercial production or conservation practices.)

20. Define hatchling (a young animal that recently hatched from an egg).

21. Pass out the Louisiana Department of Wildlife and Fisheries Head Start Project information to each student. Give the students five minutes to read through the material.

22. Discuss the Louisiana Department of Wildlife and Fisheries Head Start Project article with students and how the Monroe Hatchery is working to provide these alligator snapping turtle hatchlings with the best possible outcome for their species’ survival. (See background for more information.)

23. Have students put this article in their Turtle Information Packets. They may put the Turtle Information Packet away, and we will return to it next class period.

Day 2: Create a Turtle Habitat

1. Have students take out their Turtle Information Packets.

2. Tell students that a healthy habitat is crucial to the progress and survival of turtles and that today they will focus on threats to alligator snapping turtles and their habitat.

3. Based on what students learned during Day 1, ask them what might threaten the alligator snapping turtles and their habitat. (wetland development, dredging of sediment, water pollution, nest predators, fishers, etc.)

4. Tell students they will create models of what they think a healthy, balanced turtle habitat would be including the threats that could be present.

5. As a class, have each student build a “turtle” using the egg carton cups, popsicle sticks and construction paper.

6. Pass out one Create a Turtle Habitat instruction sheet to each student. (See blackline masters.)

7. Lay all materials out in assembly line fashion for students to build the habitats.

8. Allow 30 minutes for students to create their habitats. Students can work in pairs if there are not enough materials, but no more than three students per shoe box.

9. Ask volunteers to share their answers out loud to make sure they are on the right track. Allow students to discuss with classmates what they thought about while they were creating their habitats.

10. Have several students share their answers about the threats they included in their habitats. What threats did they include? What did they do to protect turtles from this threat?

11. Once all of the sharing is complete, return to the original guiding questions from the beginning of the lesson. Ask what we can do to save turtles in our wetlands and stop/prevent threats that were discussed today (scientific research, habitat protection, raising in hatcheries and releasing, harvest regulations, etc.).

12. Discuss any questions still remaining on these topics.

13. Assessment: Pass out Exit Ticket work sheet to each student. Have students complete the work sheets and turn them in. Use the Exit Ticket Key to grade the work sheet.

14. Have students tape their task card to shoe box and display for other classes to see and learn.
Blackline Masters:
- All About Turtles
- Alligator Snapping Turtle Fact Sheet
- Venn Diagram Work Sheet
- Venn Diagram Work Sheet Key
- Louisiana Department of Wildlife and Fishers Head Start Project
- Create a Turtle Habitat
- Exit Ticket
- Exit Ticket Key

References:


Question 1:
What have been some positive consequences of the red swamp crawfish industry in Louisiana?

Answers will vary!
The red swamp crawfish industry has had positive consequences for the health, culture and economy of many regions, as well as the environment. The red swamp crawfish is part of a healthful diet for many people in Louisiana and throughout the world. Cooking with crawfish is an important part of the cultural heritage of Louisiana's Cajun community, inspiring festivals, cookbooks and even songs. Cajun culture helps drive a powerful tourism industry in Louisiana. The introduction of the red swamp crawfish also established or re-established the crawfish industry in many areas. Crawfish are harvested not just as food for people but for animals, as well. Crawfish industries employ thousands of people—such as fishers, manufacturers of infrastructure such as boats and traps, sales representatives, chefs and other restaurant personnel. Red swamp crawfish also are an important part of the food web. According to Rusty Gaude, who works with Louisiana Sea Grant and is the central expert interviewed in the podcast provided with this lesson, native birds and mammals have come to rely on native and non-native crawfish for food.

Exit Ticket
Remember: Red swamp crawfish are indigenous to the freshwater bayous of Louisiana. They are an introduced species elsewhere in the United States, as well as Europe, Central America, Africa and Asia.

Question 2:
What are some negative consequences to the red swamp crawfish industry in Louisiana that result from China also having a crawfish industry?

Answers will vary!
The introduction of red swamp crawfish into China has had negative economic consequences on the red swamp crawfish industry in Louisiana. China exports red swamp crawfish at half the price of Louisiana red swamp crawfish. “It has literally changed the industry,” says Rusty Gaude, who works with Louisiana Sea Grant.