



Extirpated? Don't You Mean Extinct?

Focus/Overview:

Students will create vocabulary flash cards and collect data from classroom discussions, handouts regarding paddlefish status in the United States, their habitat needs and the wildlife management practices being used to save them and to expand the population. Students will become familiar with terms common to the understanding of the species' status and examine possible causes of species loss.

Background Information:

The North American paddlefish is a large species of fish that has historically inhabited the rivers and streams of the Mississippi River drainage basin and some lower areas of Canada. Once a plentiful species, it has been overharvested by fishermen for its highly prized roe (unfertilized eggs). Fishermen have not been the only obstacles for these fish. They have been cut off from traditional breeding areas by dams, control structures and levees. Industrial pollution has destroyed their habitat in some areas, causing complete loss of the population in some states. Today, many states have programs in place to help the population recover and laws that govern the harvesting of eggs and the fishing of the species. Despite these measures, the paddlefish may never recover completely.

Learning Objectives:

Students will:

- Define the terms endangered, extirpated, protected, threatened and extinct as they relate to an animal or plant species.
- Identify the historical and present range of the American paddlefish (*Polyodon spathula*).
- Identify possible environmental causes for the decline in paddlefish population numbers in the United States.

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Grade Level
Middle School (6-8)

Duration
One to two 45-minute
class periods

Subject Area
Inquiry
Reading
Environmental Science

Materials List

- United States maps
- Colors/color pencils
- Note cards or construction paper
- Handouts (BM #1-3)
- Assessment (BM #4-6)
- Picture of paddlefish

Grade/ Benchmark/GLE Science

6-8/SI-M-A1/3
6-8/SI-M-A4/11
SE-M-A3
7/SE-M-A4/39
SE-M-A5

Language Arts

6/ELA-1-M1/1,3
7,8/ELA-1-M1/1
6/ELA-1-M3/6
7,8/ELA-1-M3/4
9-12/ELA-1-H3/4

BM = Blackline Master



Procedure:

Introduce the topic

Draw students to a discussion by asking questions. Ask, "What does the term extinct mean? Can you name an extinct animal? Why is this animal extinct? Where did this animal live? What did this animal eat?" These questions will facilitate a lengthy discussion. Explain to students that, yes, some species are extinct, and some other species are declining in numbers, but are not completely missing from our world yet. Explain that we all need to understand what extinct means, but we also need to know some other very important terms used to describe the present status of species populations.

Create vocabulary flashcards

Pass out note cards or colored construction paper squares. Students print one term on the front of each card, then flip the card over and print the term's meaning on the opposite side (See BM #1). Repeat the process for each term. These will be study tools for the students. Discuss each term as the card is created.

Introduce paddlefish and its status

Show students a picture of a paddlefish and explain that the status of this fish varies from state to state. It is a fish commonly found in the Mississippi River drainage basin, but not in the numbers of the past. It has been extirpated from some states, is endangered in some states, protected in many states and is generally a fish of concern. Pass out background information (BM #2). Ask students to read them silently.

Map paddlefish status

Pass out maps of the United States (BM #3). Using the background information, students shade the states in red that list the paddlefish as extirpated, blue for stable populations with fishing, yellow for endangered/threatened/critically imperiled, green for states that have paddlefish populations that are protected, and no color for states that are not a documented natural habitat of the paddlefish. (See answer sheet, BM #4.)

Using the completed maps, return to a discussion that focuses on possible reasons for the different status these states assign the paddlefish. Have students flip their maps and list some possible reasons for the decline of the paddlefish population. Discuss measures some states, including Louisiana, are taking to help restore the population.



Important Points in Lesson:

1. What is the status of the paddlefish in Louisiana?
The paddlefish is a protected species in Louisiana and may not be legally fished for any reason.
 2. What does the term extirpated mean?
Extirpated means that a species has disappeared from a specific area, but still exists in other areas.
 3. What does extinct mean?
Extinct means that a species no longer exists anywhere in the world and has no chance of ever returning; it is lost forever.
 4. What are some reasons for the changes in the paddlefish status?
 - Loss of or alteration of spawning areas
 - Construction of dams, control structures or other obstruction of natural waterways
 - Reduction of water levels and or reduced flow rate in streams
 - Pollution
 - Overharvesting and egg collection for roe
- **Analyze the impact of these changes on the paddlefish population.

Assessment:

- Vocabulary test (BM #5)
- Essay or journal entry in which students clearly distinguish between extirpated and extinct in relation to the paddlefish, identify reasons for extirpation, and describe restoration measures (BM #6).

Extensions:

- Build a Web search guiding students to sites that provide answers to paddlefish status, state by state.
- Enlarge the focus of the lesson to include all countries of the world and all paddlefish species, so that students will realize the limits of their existence.
- Have students research local waterways to find out if paddlefish are indigenous to their area.



TEACHER REFERENCES:

Publications

Aquatic Education Program. (Teacher's Manual). Booker Fowler Hatchery, Forest Hill, Louisiana 71430.

Booker-Fowler Fish Hatchery Aquatic Education Program, "Wildlife Laws and What They Mean." U.S. Fish and Wildlife Services Office of Endangered Species: Washington, D.C. Available from Angela Capello, Louisiana Department of Wildlife and Fisheries.

Booker-Fowler Fish Hatchery Aquatic Education Program, "Learn the Terms". Western Regional Environmental Education Council, (Project WILD), U.S. Fish and Wildlife Service Office of Endangered Species: Washington, D.C. Available from Angela Capello, Louisiana Department of Wildlife and Fisheries.

Capello, Angela. *Booker Fowler Fish Hatchery and the Story of Finnie the Fingerling*. Louisiana Department of Wildlife and Fisheries Aquatic Education Program: Baton Rouge. A coloring/storybook depicting the hatchery's role in the development of specific species of fish, including the paddlefish.

Williamson, D.F. 2003. *Caviar and Conservation: Status, Management and Trade of North American Sturgeon and Paddlefish*. TRAFFIC North America: Washington D.C. Electronic edition available at <http://www.traffic.org>.

Multimedia

Wills, Betty. *The Paddlefish: An American Treasure* (video). Earthwave Society: Fort Worth, Texas. This video addresses all facets of the life of paddlefish in the United States. It includes information on ongoing conservation efforts and methods, as well as the reasons for the decline of the population and current laws. Summary and ordering information at <http://www.earthwave.org/paddlefish.htm>. Cost \$24.95 plus shipping and handling.

Internet sources

Quarry Commando.com. *Paddlefish Facts*. <http://www.quarrycommando.com/paddlefish.html>. Accessed July 22, 2003. Overview of all aspects of paddlefish: range, adaptations and life cycle. Includes many pictures.

Species at Risk. *Paddlefish*. <http://www.speciesatrisk.gc.ca>. Accessed July 22, 2003. Lists all known species that are designated at risk or endangered in North America and Canada. Specific threats to habitat are listed.

Upper Midwest Environmental Sciences Center. *Paddlefish Study Project*. <http://www.umesc.usgs.gov/aquatic/fish/paddlefish/main.html>. Accessed June 14, 2004. Excellent source of information. Contains an animated map of the distribution of paddlefish.



Vocabulary List

SPECIES	A group of organisms that can interbreed and produce more of their own kind.
HABITAT	A place where an animal or plant lives and obtains food, water, shelter and living space.
POPULATION	Two or more individuals of the same kind, occupying a specific area.
EXTINCT	No longer existing or living anywhere on the earth.
ENDANGERED	In great danger or at risk of ceasing to exist.
PROTECTED	Limited in number, and protected by state laws from being disturbed.
THREATENED	An animal or plant that is likely to become endangered in the future throughout a significant part of its range.
EXTIRPATED	A species that no longer exists in one geographic area, but still survives in others.
OCCURRENCE	To exist or be present.
RANGE	A geographical area in which a species of organisms lives.
LIMITING FACTOR	Anything that interferes with or prevents a species from living.
STATUS	Current state of a species' existence.
RESTORATION	To return to a former state of healthy existence.
CONSERVATION	Actions to improve or sustain the health of a species in order for it not to be listed as endangered or threatened.
NATIVE SPECIES	A species that occurs naturally in an area.
POACH	To kill, collect or hunt an animal or a plant illegally.
RESTRICTED	Laws and regulations to govern or limit the use or harm of something.
SPECIES OF CONCERN	Informal term indicating that USFWS has some concern for the future well-being of the species but does not grant it Endangered Species Act protection.
CRITICALLY IMPERILED	Informal term for a very small or rapidly declining population that is at a risk for extinction.



Student – Paddlefish Background

Paddlefish (*Polyodon spathula*) are an ancient species of fish. Fossils of this odd-looking fish date back 400 million years. This means paddlefish lived before dinosaurs. They have a unique, paddle-shaped rostrum or nose and bodies that resemble a shark. Like the shark, a paddlefish's skeleton (including its forked, heterocercal tail) is made entirely of cartilage, except for the dentary or jawbone. A paddlefish has very few scales, similar to its close relative, the sturgeon. The paddlefish's few scales are located near the base of its tail fin.

There are only two species of paddlefish in the world, one in China and the other in the United States. Today, these river-dwelling fish are found in large, free-flowing rivers of the Mississippi River basin. They prefer the deep water and slow currents of pools, backwaters and impoundments, and tail waters below dams. Historically, paddlefish were found beyond the Mississippi River basin and throughout the Great Lakes and Canada. The fish is now extirpated. In other words, the species is no longer found in Canada and some areas of the United States where it once lived.

Although extirpated and threatened in some areas, paddlefish from stable populations are harvested commercially and as a game fish in some states. The meat is considered flavorful. Even more desirable than the meat are its eggs or roe. Paddlefish roe, similar to caviar, is considered to be a delicacy. It is an expensive dish made of unfertilized fish eggs from specific fish species. Since paddlefish mature slowly, taking the fish for only its roe has harmed some populations.

The most unique feature of the paddlefish is its rostrum, which is about one-third of its total body length. Scientists once believed that the rostrum was used to dig out food from stream bottoms. They now know that paddlefish are primarily filter feeders, and the rostrum has a sensory function. The rostrum is used to find food, and possibly to balance the fish's body in deep, swift-moving water. A paddlefish feeds by swimming with its large mouth open, using gillrakers to strain plankton from the water.

Although it is fast growing, a paddlefish matures slowly. Both males and females reach sexual maturity relatively late. Males mature at about 7 to 9 years, and females at 10 to 12 years. Though they like to live in deep water with slow currents, paddlefish leave these areas to spawn in cold, swiftly moving water when the water temperature reaches about 13°C (60°F). Since timing for spawning is dependent upon temperature, spawning occurs at different times in different places, depending upon latitude. For example, spawning usually occurs in February in Louisiana and June in Montana — whenever the water temperature is right. Once fertilized, the eggs become sticky and settle to the bottom.

Paddlefish prefer gravel bars for spawning so that their eggs will attach to the gravel surface. In Louisiana, there are few gravel bars, therefore, the fish spawn over hard surfaces. Paddlefish sometimes travel 100 to 200 miles to find an ideal habitat for spawning.



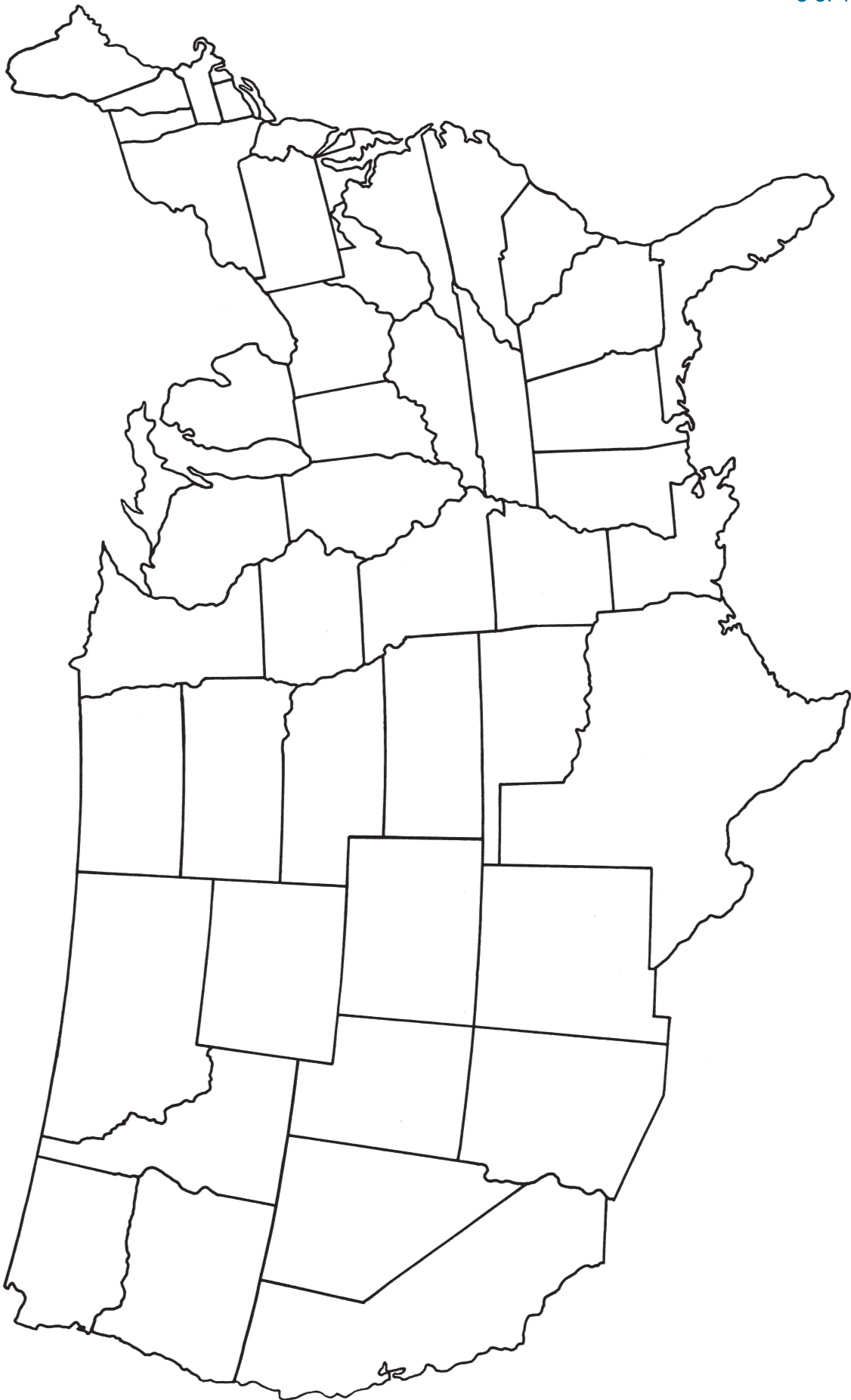
Blackline Master #2 (page 2)

The 2 to 3 mm (0.08 to 0.12 in) eggs hatch about a week after the spawn. When first hatched, the young do not swim well, do not have a rostrum and have few defenses against predators. Perhaps the key to their survival is that the fish grow very quickly. Young paddlefish grow up to 2.5 cm (1 in) per week under ideal conditions. Within a few weeks, fingerlings reach lengths of 10 to 13 cm (5 in) and develop a rostrum. Adult paddlefish can weigh up to 291 kg (200 lbs) reach lengths of up to 7 feet and live to be 30 years old, although the average lifespan is about 15 years.

For more than 100 years, many factors related to changes and destruction of habitat and overharvesting led to serious population declines of paddlefish. Human activities to improve flood control and navigation included dredging of rivers and the construction of levees, locks and dams. These actions helped industry and enabled people to live in flood-prone areas. However, these activities altered flow patterns and reduced the water flow (volume) of the Mississippi River and its tributaries, blocking movement of the fish and preventing them from reaching their spawning grounds. Pollution from industry and agriculture further degraded water quality and the remaining paddlefish habitat. Overharvesting for roe provided additional stress on the declining population.

Paddlefish have been extirpated in Canada, New York, Pennsylvania, Maryland and Virginia. In many other states, strict laws protect the population. In Minnesota, Nebraska, North Carolina, Ohio, Texas, West Virginia and Wisconsin, paddlefish populations are threatened, endangered or considered species of critical imperil, so laws were established to protect them. In Louisiana and Alabama, paddlefish are protected, and their population is stable. Several states, including Arkansas, Illinois, Indiana, Iowa, Kansas, Kentucky, Mississippi, Missouri, Montana, North Dakota, Oklahoma, South Dakota and Tennessee, have stable paddlefish populations that can continue to support commercial and/or game fishing industries.

Many programs have been developed in the United States to restore the paddlefish population throughout its natural range. State fish hatcheries, including Louisiana's, are playing a very important role to re-establish wild paddlefish populations. Tagging programs monitor populations and determine how well the fish are doing. Stocking programs aim to collect adult fish to artificially fertilize eggs, raise young paddlefish from eggs to fingerlings, and return hundreds of thousands of fingerlings to natural habitat. Programs are also working to educate the public on the impaired status of this species. Teachers and students are learning about paddlefish, too. With our help, populations might be stabilized or re-established in states where they are threatened or extirpated.



Name _____

Blackline Master #3



Name _____

Vocabulary Test

Match terms with the correct definition.

___ 1. Species	A. Actions to improve the health of a species in order for it not to be listed as endangered or threatened.
___ 2. Habitat	B. Laws and regulations to govern or limit the use or harm of something.
___ 3. Population	C. Two or more individuals of the same kind, occupying a specific area.
___ 4. Extinct	D. Limited in number and protected by state laws from being disturbed.
___ 5. Endangered	E. Informal term for a very small or rapidly declining population at risk of extinction.
___ 6. Protected	F. To return to a former state of health existence.
___ 7. Threatened	G. Informal term indicating that USFWS has some concern for the future well-being of the species but does not grant it Endangered Species Act protection.
___ 8. Extirpated	H. To kill, collect or hunt an animal or plant illegally.
___ 9. Occurrence	I. A place where an animal or plant lives and obtains food, water and shelter.
___ 10. Range	J. A species that no longer exists in one geographic area but still survives in other areas.
___ 11. Limiting Factor	K. No longer living anywhere on the earth.
___ 12. Status	L. A geographical area in which a species of organisms lives.
___ 13. Restoration	M. Anything that interferes with or prevents a population from thriving.
___ 14. Conservation	N. Current state of a species' existence.
___ 15. Native Species	O. A group of organisms that can interbreed and produce more of their own.
___ 16. Poach	P. A naturally occurring species in an area.
___ 17. Restricted	Q. To exist or be present.
___ 18. Species of Concern	R. In great danger or at risk of ceasing to exist.
___ 19. Critically Impaired	S. An animal or plant that is likely to become endangered in the future throughout a significant part of its range.



Blackline Master #5

Extirpated? Don't You Mean Extinct? Vocabulary Tests and Map Answer Key

Vocabulary Test

1. O 2. I 3. C 4. K 5. R 6. D 7. S 8. J 9. Q
10. L 11. M 12. N 13. F 14. A 15. P 16. H 17. B 18. G 19. E

Answers to Mapping Activity:

Extirpated -

(RED)
Maryland
New York
Pennsylvania
Virginia

Threatened/Endangered/Critically Impaired

(YELLOW)
Minnesota
Nebraska
North Carolina
Ohio
Texas
West Virginia
Wisconsin

Stable with Fishing

(BLUE)
Arkansas
Illinois
Indiana
Iowa
Kansas
Kentucky
Mississippi
Missouri
Montana
North Dakota
Oklahoma
South Dakota
Tennessee

Protected/Stable

(GREEN)
Louisiana
Alabama

Blank - all other states (paddlefish apparently not present)



Journal Rubric – Extirpated? Don't You Mean Extinct?

Entry Topic: Explain what you know about the status of the paddlefish in the United States.

- _____ 0 pts. No effort – Nothing written.
- _____ 1pt. Student distinguishes between extirpated and extinct.
- _____ 2 pts. Student distinguishes among terms of existence and identifies the paddlefish as extirpated, protected and endangered in different states throughout the United States.
- _____ 3pts. Student distinguishes among different terms of existence, gives examples of states of each status and gives at least two possible causes of those status rankings.
- _____ 4pts. Student distinguishes among different terms of existence, gives examples of states of each status and gives at least two possible causes of those status rankings. Student describes restorative efforts of states.

Point Assignment _____

Date _____

Student Name _____