Tracy Armand
Grolee Elementary
Opelousas, La.

Grade Level
Middle School (6-8)

Duration
Two 45-minute class periods

Subject Area
Inquiry
Life Science
Environmental Science

Materials List
- Colored paper 8.5 x 11" (five colors: 13 sheets of each)
- Rope or masking tape
- 4 hula hoops, yarn or masking tape
- Fish cards (BM #1)
- Season cards (BM #2)
- Water level/movement cards (BM #3)
- Water temperature cards (BM #4)
- Gravel cards (BM #5)
- Game layout (BM #6)
- Student recording sheet (BM #7)
- 5 plastic or paper bags

Grade/Benchmark/GLE Science
6,7,8/SI-M-A4/12,13
6,7,8/SI-M-A7/19,22
7/SE-M-A4/39
6,7,8/LS-M-C4
HS/LS-H-D3/26 (biology)
HS/LS-H-D4/27 (biology)
HS/LS-H-F3/35 (biology)

BM = Blackline Master

Critical Conditions for Paddlefish Spawning

Focus/Overview:

Through an active simulation, students learn about several critical environmental factors necessary for paddlefish spawning. They will examine some risks and consequences to the environment created by human actions.

Background Information:

Despite their ability to grow fast, paddlefish become sexually mature late in life. Males become sexually mature between the ages of 7 and 9 years and females between the ages of 10 and 12. Males may spawn every year, but females require two or more years to produce eggs. The female produces approximately 4.5 to 5.4 kg (10 to 12 lbs) of eggs.

Environmental conditions must be just right in order for the female to spawn. Paddlefish spawn in the early spring (February or early March for Louisiana fish) when the water temperature is approximately 13°C (60°F.)

Besides the right temperature, fast-flowing, high, rising water and clean gravel bars are necessary. If gravel bars are not available (as in the case of Louisiana) a hard substrate makes a great substitute. During spawning, the female paddlefish is accompanied by several males. As she releases eggs, the pursuing males release sperm (milt), fertilizing the eggs.

As fertilization occurs, the eggs become sticky and adhere to rocks. The eggs are kept free from silt and debris and remain oxygenated by the fast-moving flow of the water. Eggs hatch in seven days or less at temperatures of 15°C to 18°C (60°F to 65°F).

Learning Objectives:

Students will:
- Identify critical environmental factors necessary for successful spawning.
- Describe human and natural inhibitors to paddlefish spawning.

Procedure:

Advance Preparation:

Hint: Laminate cards if possible and adjust the number of cards to reflect class size.

1. For a class of 30
   Note**:** Use a different color paper for each card type
   Make:
   - 13 copies of "Fish Cards" (BM #1)
   - 13 copies of "Season Cards" (BM #2)
   - 13 copies of "Water Level/Movement Cards" (BM #3)
   - 13 copies of "Water Temperature Cards" (BM #4)
   - 13 copies of "Gravel Bars Cards" (BM #5)

   Cut out cards.

2. Set up a playing field as shown (BM #6) on the school playground or gymnasium floor. Use a rope (outdoor location) or masking tape (indoor location) to indicate the boundaries of the field. Within the playing field, mark four areas with yarn, masking tape or hula hoops.

3. Place "Season Cards" in one marked area, "Water Level/Movement Cards" in another, "Water Temperature Cards" in another and "Gravel Bars Cards" in the last. In each marked area, place the cards face down in a random order. These are known as protected areas.

4. At the end of the playing field, in the "spawning grounds," place three bags/boxes labeled: "Spawn," "Death" and "No Spawn."

5. At the start line, place a bag filled with "Fish Cards." Players will take a card before starting a round.

Activity:

1. Object of the game:
   Each player's goal is to reach the spawning grounds with all four condition cards. In the spawning grounds, players will determine if their fish was able to spawn.

2. Death cards:
   Some condition cards have a death circumstance. If a player picks a death card, he/she must go directly to the death bag/box at the end of the field, place one fish card and any condition cards collected in it, and sit out for the rest of the round.

3. Rules:
   - No running.
   - Players may only stay in the marked, protected card areas for 10 seconds.
   - Collect only one card from each card area.

4. Teacher directions:
   - Give each player two "Student Recording Sheets" (BM #7). Player will place and leave the "Student Recording Sheet" in the spawning grounds.

• Choose two students – one to be a predator and one to be a poacher. Provide each with a bag to collect cards. As the paddlefish students move between the card areas, these two students ***may only walk*** to tag them. Switch poacher and predator with each round.
*If your class has fewer than 20 students, assign only one poacher or predator.

5. Playing the Game:
• Players start out at the end of the playing field opposite the spawning grounds.

• Players will use one "Fish Card" per round. Each card represents a live paddlefish. Players take a card out of the fish card bag before starting the round.

• During each round, players will move to each card area, collecting one card at each area. Once all players have taken four cards, they will go to the end boundary, the spawning grounds.

• Players should watch out for the poacher and predator. If a player is tagged by a poacher or predator outside a protected card area, the player must give them a fish card and sit out the rest of the round. The poacher or predator will take the prey to the death bag; then he/she will return to the playing field.

• Players are safe as long as they are in a card area or beyond the lines that mark the boundaries at each end of the playing field. Time limit for fish to stay in a safe area is 10 seconds.

• At the end of each round players will look at their cards and record their results on the "Student Recording Sheet" (BM #7). Then students will determine which bag ("Spawn," "No Spawn" or "Death") in which to place their cards.
    • If a "Death Card" is drawn, the player must stop playing the round and go directly to the bag at the end boundary. There they will place the "Death Card" and one "Fish Card" in the "Death" bag along with the other situation cards collected. One the recording sheet, the player would indicate a death situation was drawn.
    • If all critical conditions are met for spawning (season, gravel bars, water temperature and water level/movement cards), each of these cards and a "Fish Card" will be place in the "Spawn" bag.
    • If all critical conditions are not met, players must place their cards and a "Fish Card" in the "No Spawn" bag.

• Discuss with students their experience at this point. Ask "How many fish were able to spawn? How many died?" Have students describe some of the cards they drew. Ask "What were some of the conditions that prevented paddlefish from spawning?"

• Play the game twice more. Move the outer boundaries in by 2 or 3 feet at some point in the field to represent a river narrowed by a dam or other means. Give students time to complete their recording sheets.

- Replay the game again. This time, split the group of players in half to represent a smaller population of fish. Each of the smaller groups will play two rounds for a total of four rounds. Record the results (BM #7). Compare the results of the two sizes of groups of paddlefish after playing three rounds with different numbers of "Fish Cards." Ask students to list and discuss the advantages and disadvantages of population size.

- Back in the classroom or the next day, review with students some of the situations they encountered throughout the simulation. Have them again describe some of the cards they drew from each area. What were some of the critical factors necessary to make it to the spawning grounds? Record students' observations, leading them, as needed, to infer specifics of each critical environmental factor.

Assessment:

- Students will draw or describe an ideal paddlefish habitat. Be sure they explain why they included each item or condition. How did these features provide for the needs of the paddlefish? What are ways that competition could alter the ideal habitat?
- Students will draw a concept map of critical conditions for spawning.

Extension:

As a class, combine all student data sheets to determine the spawning success of the population. Graph the results. What portion of the population was able to spawn? Failed? Died?

TEACHER REFERENCES:

Publications

Reed, Bobby C., W.E. Kelso and D.A. Rutherford. 1992. Louisiana Department of Wildlife and Fisheries. *Growth, Fecundity, and Mortality of Paddlefish in Louisiana*. Transactions of the American Fisheries Society.
A comprehensive study of paddlefish in Louisiana.

Internet sources

Corsentino, Pattyanne. 1995. *Ecosystem Matters: Activity and Resource Guide for Environmental Educators.* U.S. Department of Agriculture.
http://www.na.fs.fed.us/spfo/pubs/misc/eco/. Accessed June 14, 2004.

Iowa Department of Natural Resources. *Paddlefish*.
http://www.iowadnr.com/education/files/pddlfsh.pdf. Accessed Jan. 21, 2004.

Texas Parks and Wildlife. *Texas Freshwater Fishing: Paddlefish.*
http://www.tpwd.state.tx.us/fish/infish/species/pad/pad.htm. Accessed Jan. 21, 2004.
Biology of paddlefish life cycle, habitat and threats to paddlefish in Texas.

Blackline Master #1

Fish Cards

Blackline Master #2

Season Cards

Spring is for spawning! **Season**	**Spring is for spawning!** **Season**
Spring is for spawning! **Season**	**Spring is for spawning!** **Season**
Spring is for spawning! **Season**	**Spring is for spawning!** **Season**
Spring is for spawning! **Season**	**Spring is for spawning!** **Season**
Spring is for spawning! **Season**	**Spring is for spawning!** **Season**
Spring is for spawning! **Season**	**Spring is for spawning!** **Season**
Summer is too late. **Season**	**Summer is too late.** **Season**
Winter isn't the right time. **Season**	**Winter isn't the right time.** **Season**
Fall doesn't have the right conditions. **Season**	**Fall doesn't have the right conditions.** **Season**

Blackline Master #3

Water Level/Movement

Spring flooding brings fast-moving water. **Water level/movement**	**Whoa ... this water's deep! Perfect for spawning.** **Water level/movement**
The water level is too low to support spawning. **Water level/movement**	**Whoa ... this water's deep! Perfect for spawning.** **Water level/movement**
Beavers in your area erect a super dam that has slowed the flow of water and lowered the level upstream. Too bad – no spawning. **Water level/movement**	**The weatherman forecasts days and days of rain – enough for spawning.** **Water level/movement**
There are no obstructions to slow the flow of the rising water. **Water level/movement**	**The weatherman forecasts days and days of rain – enough for spawning.** **Water level/movement**
A dam is built along the river. Your pathway is cut off and you cannot travel upriver for spawning. **Water level/movement**	**Spring flooding brings fast-moving water.** **Water level/movement**
Drought strikes. The water level drops to record lows. You can't spawn this year. **Water level/movement**	**The water level is too low to support spawning.** **Water level/movement**
Spring flooding brings fast-moving water. **Water level/movement**	**There are no obstructions to slow the flow of the rising water.** **Water level/movement**
The weatherman forecasts days and days of rain – enough for spawning. **Water level/movement**	**Spring flooding brings fast-moving water.** **Water level/movement**
The water level is too low to support spawning. **Water level/movement**	**Whoa...this water's deep! Perfect for spawning.** **Water level/movement**

Blackline Master #4

Water Temperature

Warm water means phytoplankton blooms and lower dissolved oxygen levels. Dead paddlefish don't spawn. GO TO DEATH BAG. 	**It's been too cold to find much food. Not enough energy to spawn.** **Water temperature**
The water is 14°C (58°F) – great for spawning! **Water temperature**	**It's too warm to spawn. Not today.** **Water temperature**
The water is 16°C (61°F) – great for spawning! **Water temperature**	**The water is 16°C (61°F) – great for spawning!** **Water temperature**
The water is near 16°C (60°F) – great for spawning! **Water temperature**	**The water is 14°C (58°F) – great for spawning!** **Water temperature**
The water is 15°C (59°F) – great for spawning! **Water temperature**	**The water is 16°C (61°F) – great for spawning!** **Water temperature**
The water is 16°C (60°F) – great for spawning! **Water temperature**	**The water is 15°C (59°F) – great for spawning!** **Water temperature**
It's been too cold to find much food. Not enough energy to spawn. **Water temperature**	**The water is near 16°C (60°F) – great for spawning!** **Water temperature**
Brrr … -5°C (23°F) - too cold. **Water temperature**	**The water is 15°C (59°F) – great for spawning!** **Water temperature**
It's too warm to spawn. Not today. **Water temperature**	**The water is near 16°C (60°F) – great for spawning!** **Water temperature**

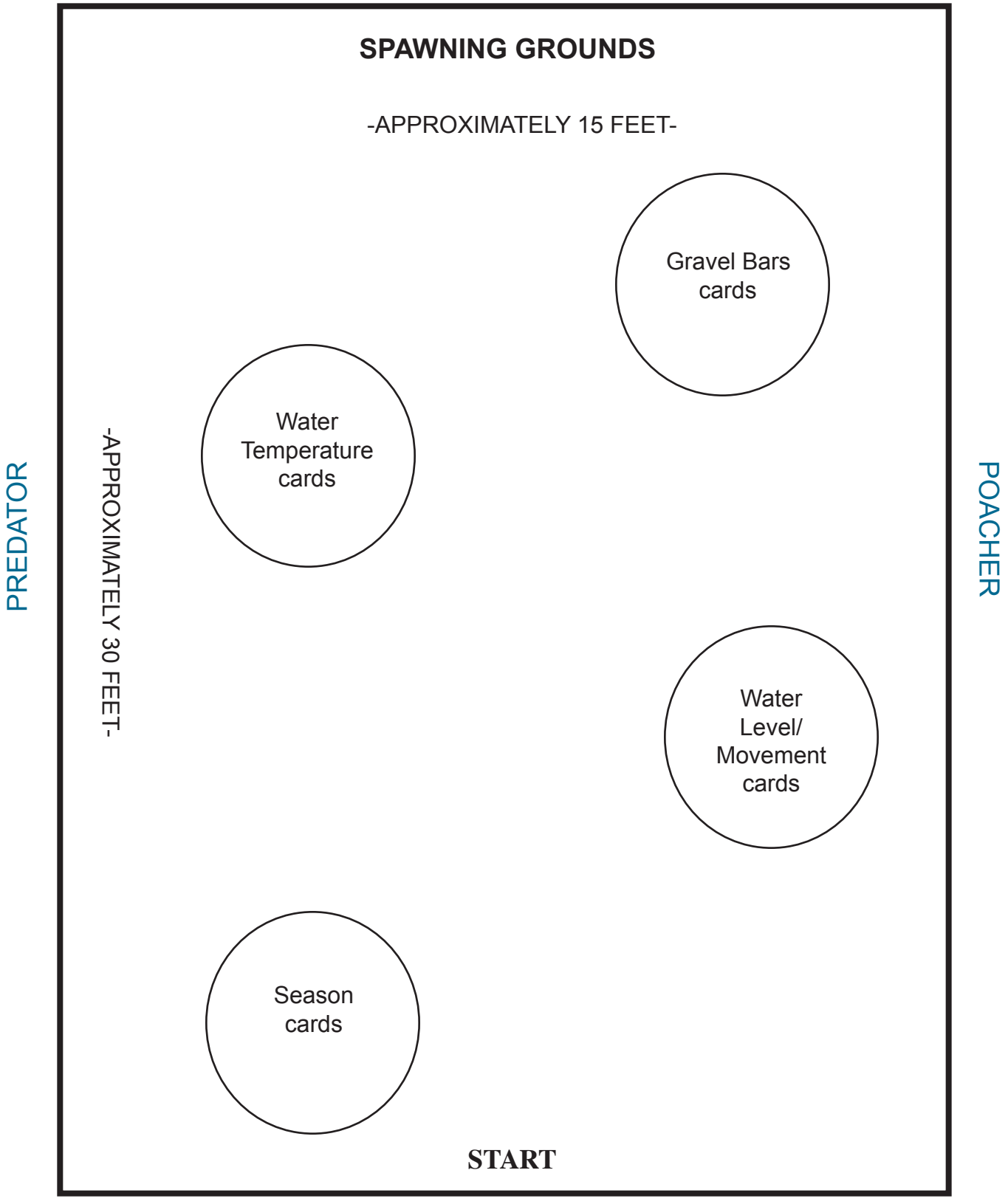
Blackline Master #5

Gravel Bars

Spring flooding brings fast-moving water and clean gravel bars. **Gravel Bars**	**Spring flooding brings fast-moving water and clean gravel bars.** **Gravel Bars**
The river bottom has been dredged. There is no gravel to be found, and spawning will not be successful. **Gravel bars**	**Stagnant water means dirty gravel bars. Not good for spawning.** **Gravel bars**
Concerned citizens clean away obstructions in the river. Gravel bars are clean. **Gravel bars**	**Spring flooding brings fast-moving water and clean gravel bars.** **Gravel Bars**
Stagnant water means dirty gravel bars. Not good for spawning. **Gravel bars**	**Spring flooding brings fast-moving water and clean gravel bars.** **Gravel Bars**
The river bottom has been dredged. There is no gravel to be found, and spawning will not be successful. **Gravel bars**	**Stagnant water means dirty gravel bars. Not good for spawning.** **Gravel bars**
Spring flooding brings fast-moving water and clean gravel bars. **Gravel bars**	**Concerned citizens clean away obstructions in the river. Gravel bars are clean.** **Gravel bars**
Concerned citizens clean away obstructions in the river. Gravel beds are clean. **Gravel bars**	**Concerned citizens clean away obstructions in the river. Gravel bars are clean.** **Gravel bars**
Spring flooding brings fast-moving water and clean gravel beds. **Gravel bars**	**Spring flooding brings fast-moving water and clean gravel bars.** **Gravel Bars**
Concerned citizens clean away obstructions in the river. Gravel bars are clean. **Gravel bars**	**Stagnant water means dirty gravel bars. Not good for spawning.** **Gravel bars**

Blackline Master #6

LAYOUT FOR PLAYING GAME



Blackline Master #7 (page 1)

Name_____

Student Recording Sheet

Round 1

Situation cards	Describe Condition	Enables Spawning
Season		Y N
Water Level/Movement		Y N
Water Temperature		Y N
Gravel Bars		Y N

Round 2

Situation cards	Describe Condition	Enables Spawning
Season		Y N
Water Level/Movement		Y N
Water Temperature		Y N
Gravel Bars		Y N

Round 3

Situation cards	Describe Condition	Enables Spawning
Season		Y N
Water Level/Movement		Y N
Water Temperature		Y N
Gravel Bars		Y N

Round 4

Situation cards	Describe Condition	Enables Spawning
Season		Y N
Water Level/Movement		Y N
Water Temperature		Y N
Gravel Bars		Y N

Blackline Master #7 (page 2)

Round 5

Situation cards	Describe Condition	Enables Spawning
Season		Y N
Water Level/Movement		Y N
Water Temperature		Y N
Gravel Bars		Y N

Round 6

Situation cards	Describe Condition	Enables Spawning
Season		Y N
Water Level/Movement		Y N
Water Temperature		Y N
Gravel Bars		Y N

What situations prevented paddlefish from spawning? _____
_____
_____
_____
_____

What critical conditions allowed spawning to occur?
_____
_____
_____
_____

How many of your fish were you able to spawn? _____ of total _____ = _____ percent

How many died? _____ of total _____ = _____ percent

How many were unable to spawn? _____ of total _____ = _____ percent