

Crawfish Educational Materials

For Grades K-8
& High School Biology

Based on GLEs
(Grade Level Expectations)

Louisiana
CRAWFISH PROMOTION
AND RESEARCH BOARD



Courtesy of the Louisiana Crawfish Promotion and Research Board and the Louisiana
Department of Agriculture & Forestry <http://www.crawfish.org>
April 2006

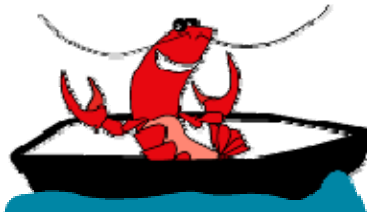
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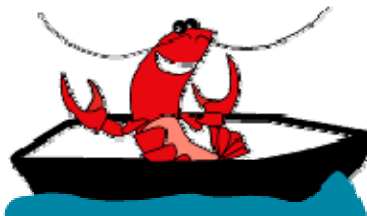


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Kindergarten
GLE
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Kindergarten: Grade Level Expectations for English Language Arts

Page 5

Reading and Responding: Standard 1

1. Demonstrate understanding of phonemic awareness by doing the following:

- Clapping/ tapping to match each syllable of a spoken word (ELA-1-E1)

Writing and Proofing: Standard 3

30. Print letters and words with proper figure grounding on a line and with appropriate spaces of words (ELA-3-1)

Pages 6-7

Reading and Responding: Standard 1

10. Answer questions about the important characters, setting, and events of a story (ELA-1-E5)

11. Describe the connections between life experiences and texts (ELA-1-E6)

Reading and Responding: Standard 6

13. Identify whether the type of text read aloud is a true story, a fictional story, a song, or a poem (ELA-6-E2)

Reading and Responding: Standard 7

14. Demonstrate understanding of information in texts read aloud using a variety of strategies, including:

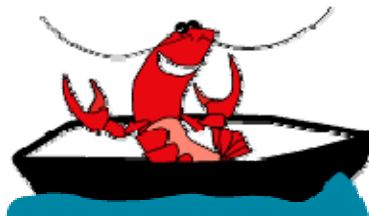
- making predictions using prior knowledge and pictures
- using pictures to resolve questions (ELA-7-E1)

Page 8

Reading and Responding: Standard 1

3. Demonstrate understanding of phonics by matching each consonant sound to the appropriate letter. (ELA-1-E1)

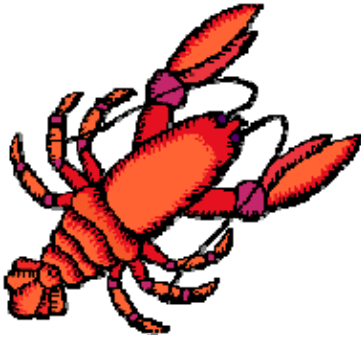
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Name _____

Date _____

Teachers: Read the following words aloud and have the students clap out the syllables and then write the number of syllables below the word.



These words all name the animal on the left.

Crawfish

2

Crawdaddy

Crayfish

Decapod

Mudbug

Ecrevisse

Crawdad

Name_____

Date_____

Teachers: Read the following story aloud and ask students to respond to the statements and questions below.



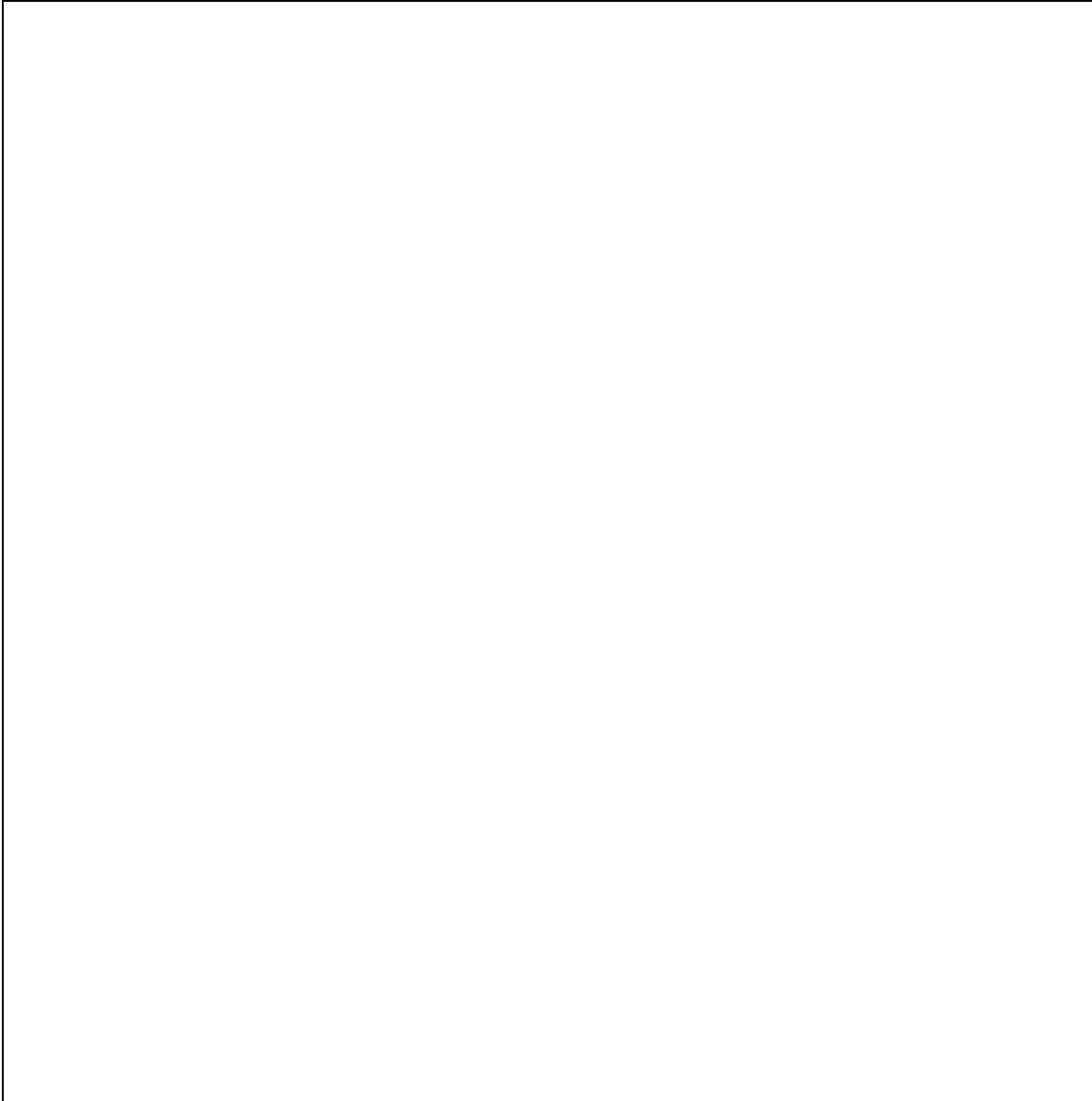
If the water dries out of a nearby ditch, a crawfish will dig a hole, also called a burrow, in the mud next to the ditch. He builds a mud tower on top of his burrow. He lives in the burrow under the tower until the next rain. When it rains, the tower will wash away but the crawfish is safe in the burrow. The crawfish can stay cool and wet in its new home.

True or False

- Crawfish build their own homes.
- Crawfish live near water.
- Crawfish enjoy hot, dry weather.
- Crawfish build their homes from grass and leaves.

1. Is the story above a true story?
2. Where do you think the crawfish goes after the next rain?
3. Will it come out of its hole during the rain?
4. What do you think might happen to its mud hole after a heavy rain?

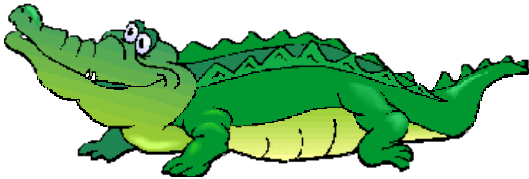
Draw a picture of a crawfish during the rain in the box below. Draw a picture of his mud hole next to the new water puddle.



Name _____

Date _____

The animals below eat crawfish. Draw a line connecting the animal to the letter it begins with.



Ff



Rr



Aa



Ss

Animals are alligator, fish, snake and raccoon.

Kindergarten: Grade Level Expectations for Math

Pages 10-11

Number and Number Relations

6. Identify pennies, nickels and dimes and their values using the cent sign. (N-1-E)(N-2-E)

Pages 12-13

Number and Number Relations

2. Count a set of 20 or fewer objects by establishing a 1- to- 1 correspondence between number names and objects (N-1- E) (N-3-E) (A-1-E)

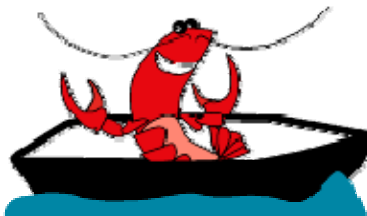
8. Compare sets containing 20 or fewer objects using the words *same/different* and *more/less/greater/fewer* (N-3-E) (N-1-E)

9. Use concrete objects to model simple real-life addition and subtraction problems (N-4-E)

Geometry

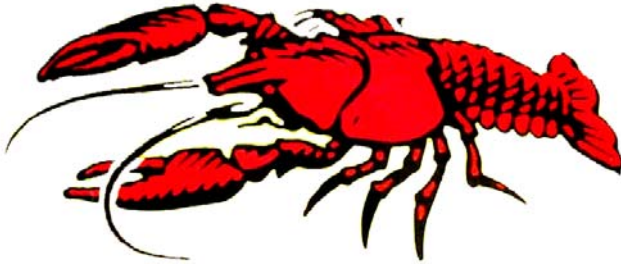
20. Draw circles, squares, rectangles, and triangles (G-4-E)

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Name _____

Date _____



A crawfish costs about 10 cents. Look at the coin sets below that equal 10 cents. Write the value of each coin below the coin. Use the symbol for cent.

¢

Example:



10 ¢

1.



2.





3.



Name _____

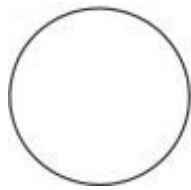
Date _____



The raccoon ate _____ crayfish.

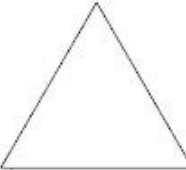


The otter ate _____ crayfish.



1. Draw a circle around the word that completes the sentence.

The  ate **(more/ less)**  than the .

2. Draw a triangle  around the word that completes the sentence.

The  ate a **(greater/ fewer)** number of  .

3.        7

minus -      -5

Draw the answer.

Write the number.

Kindergarten: Grade Level Expectations for Science

Page 15

Characteristics of Organisms

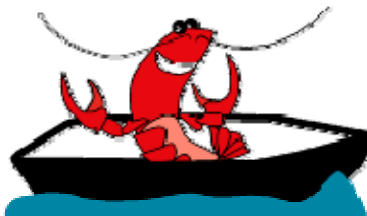
26. Classify various foods into the major groups (e.g., bread, meat, vegetable, fruit) (LS-E-A6)

Page 16

Characteristics of Organisms

25. Identify easily observable variations within types of plants and animals (e.g., features of class varieties of trees, breeds of dogs) (LS-E-A4)

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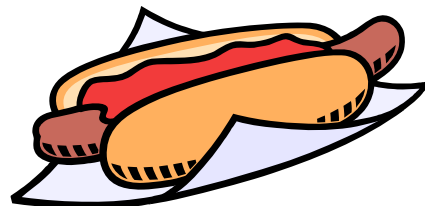
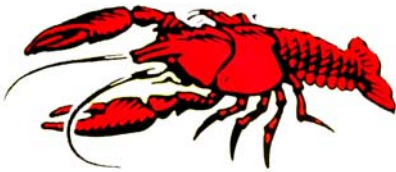
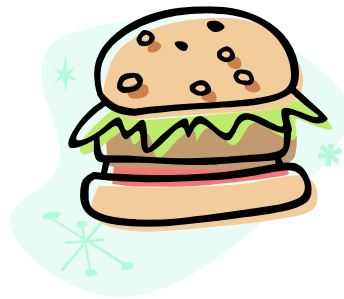
Name _____

Date _____

Four food groups make up a healthy diet.

1. Milk Products (milk, yogurt, cheese)
2. Grains (cereals, breads, pasta)
3. Meats
4. Vegetables/ Fruits

Draw a **red circle** around the meat products and a **green circle** around the fruits and vegetables.



Name_____

Date_____

Types of Crawfish

There are many types of crawfish. White River crawfish and Red Swamp crawfish are most commonly eaten by people. Because caves are so dark, color and sight are not very important to the animals that spend their whole lives in caves. Many cave animals are not colored and many have no eyes. Look at the pictures below and answer the questions.



White River Crawfish



Red Swamp Crawfish



Cave Crawfish

1. Which crawfish is lightest in color?

2. Which crawfish is darkest in color?

3. Is the White River crawfish or the Red Swamp crawfish thicker?

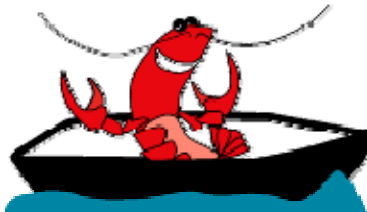
Kindergarten: Grade Level Expectations for Social Studies

Pages 18- 19

Geography: The World in Spatial Term

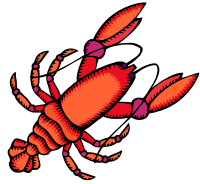
2. Recognize the shape of Louisiana and the United States on maps and globes (G-1A-E2)

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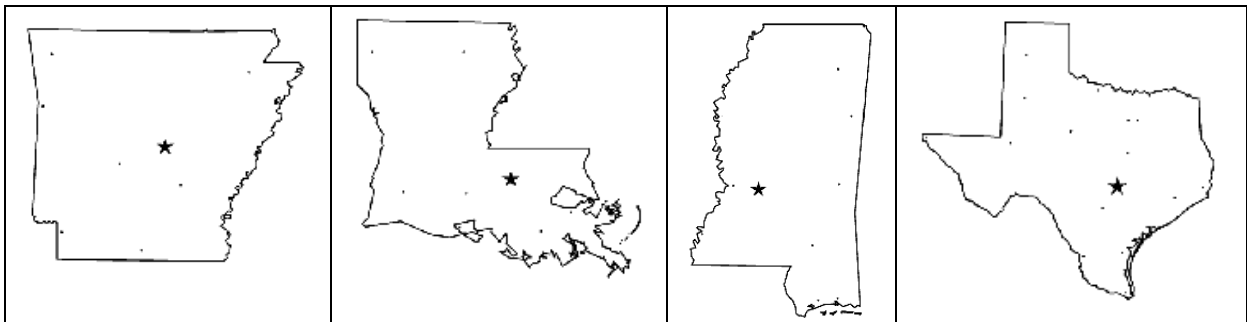
Name_____

Date_____



Crawfish live in many states. Louisiana has more crawfish than Arkansas, Texas and Mississippi all together.

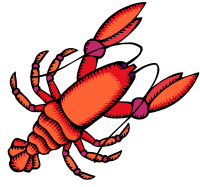
Circle the map of Louisiana.



Above maps are of Arkansas, Louisiana, Mississippi and Texas.

Name_____

Date_____



Crawfish live in many countries. The United States has more crawfish than Brazil and Japan.

Circle the map of the United States.



Above maps are of the United States, Brazil and Japan.

First Grade
GLE
(Grade Level Expectation)
Based
Worksheets
&
Activities

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First Grade: Grade Level Expectations for Language Arts

Pages 22-23

Standard 1

1. Demonstrate understanding of phonemic awareness by:

- Distinguishing which words have the same target sounds (i.e., beginning, medial, and end) in given sets of spoken words.
- Distinguishing long- and short-vowel sounds related to the same letter in one-syllable words. (ELA-1-E1)

Page 24

Writing, Standard 2

29. Independently write simple informational descriptions. (ELA-2-E4)

Page 25

Writing/ Proofreading, Standard 3

44. Alphabetize to the first letter. (ELA-3-E5)

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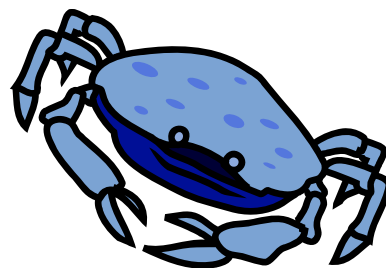
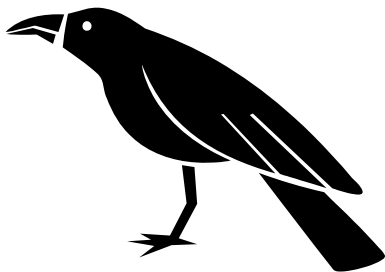
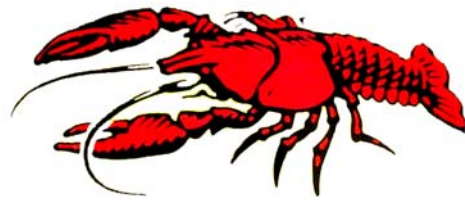


Name _____

Date _____

Teachers: Review each of the pictures. Name each of the animals (coon, crawfish, crab, crow). Then ask the students to:

Circle the Louisiana animals that begin with the same letter.



Name _____

Date _____

Teachers: Read the following sentences aloud. Then ask the students to:

Draw a **blue circle** around the words with a **short “a”** sound and a **red circle** around the words with a **long “a”** sound.

Crawfish



have ten walking legs.

Crawfish
tails.



carry their babies on their

Crawfish



taste good.

Name _____

Date _____



Write three (3) complete sentences describing the crawfish.

Name _____

Date _____

Go fishing! Pull out the words below in alphabetical order and copy them on the lines to the right.



pincher

First Grade: Grade Level Expectations for Math

Page 27

Data Analysis, Probability and Discrete Math

32. Given a set of data, construct and read information from bar graphs and charts.
(D-1-E, D-2-E)

Number and Number Relations

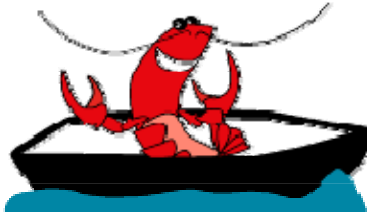
1. Count to 100s by 1s, 5s, 10s, and 25s (N-1-E, N-3-E, N-4-E)

Page 28

Geometry

28. Determine if a shape has a line of symmetry by folding. (G-2-E)

Louisiana CRAWFISH PROMOTION AND RESEARCH BOARD



Name _____

Date _____

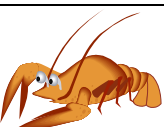
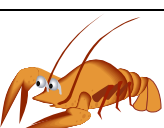
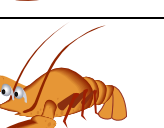


John used 15 crawfish  as bait while fishing.

Mary used 10 crawfish . Zach used 25 crawfish .

Beth fished with only 5 crawfish .

Color in the chart to represent the number of crawfish each child used as bait.

30 								
25 								
20 								
15 								
10 								
5 								

John

Mary

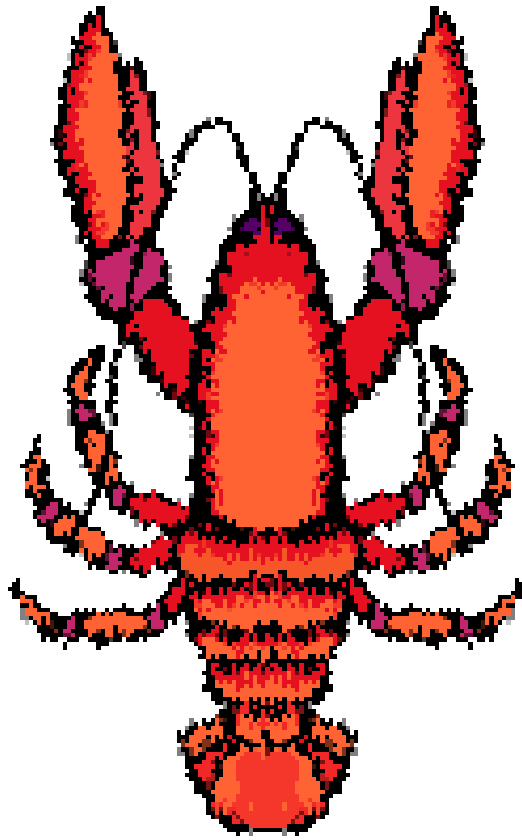
Zach

Beth

Name _____

Date _____

Symmetrical Crawfish



Cut the crawfish out and fold it in half, so that both halves line up. The folded line is called a ***line of symmetry***.

First Grade: Grade Level Expectations for Science

Page 30

Physical Science: Properties of Objects and Materials

15. Measure length and width of a variety of objects and materials by using nonstandard tools, such as paper clips, cubes, shoes, and hands (PS-E-A4)

Page 31

Organisms and Their Environments

32. Describe features of some animals that benefit them in their environments (LS-E-C1)

Page 32

Life Science: Characteristics of Organisms

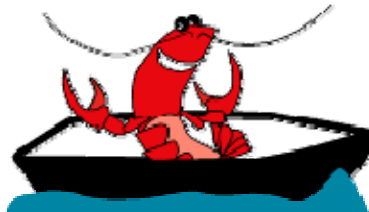
27. Identify what animals and plants need to grow and develop (LS-E-A1)

29. Describe basic functions of parts of the body (e.g., lungs, heart, bones, muscles) (LS-E-A3)

Organisms and Their Environments

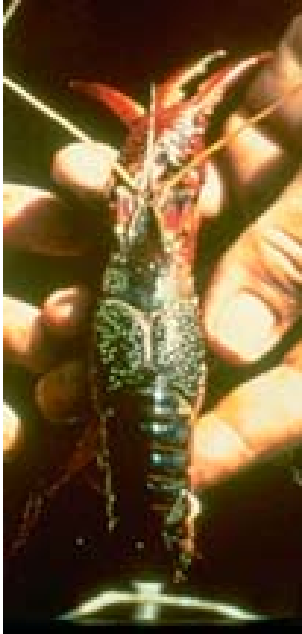
32. Describe features of some animals that benefit them in their environments (LS-E-C1)

Louisiana CRAWFISH PROMOTION AND RESEARCH BOARD



Name _____

Date _____



Crawfish

Crab

Use paperclips to measure the photos of the crawfish and crab above.

1. The crawfish is about _____ paperclip(s) long and _____ paperclip(s) wide.
2. The body of the crab is about _____ paperclip(s) long and _____ paperclip(s) wide.
3. The width of the crab from the tip of one leg to the tip of the leg on the other side is _____ paperclip(s) wide.

Teachers:

Show the students the photo below and discuss the antennae (plural) and eyes of the crawfish.



Why does the crawfish have good eyesight?

Crawfish have eyes on little stalks that stick out of their heads. They have excellent vision and can see in color. They can move their eyes around and see in all directions. They are slow and clumsy on land and can use their great vision to sense danger right away.

What does the crawfish use the antennae (plural) for and how many do they have?

When they are underwater they may not be able to see well. If it is dark or the water is cloudy, they can not depend on their eyes. They can use their antennae to sense things around them. They can both feel and smell with their antennae. They have two pairs of antennae (4 total antennae).

Bonus question:

What do you think it uses its claws for? It can grab food floating in the water with its claws. It also uses its claws to fight. They can pinch with their claws. Claws are used for defense, mating and aggressive display.

Name _____

Date _____

Circle the things animals need to live.

Air Food Tools Water Love Shelter Friends

Circle the correct answer.



A fish breathes through its _____ (gills, nose).



A fox breathes through its _____ (gills, nose).



A crawfish breathes through its _____ (gills, nose).

Crawfish live both in water and on land. It uses gills to breathe and therefore must stay damp or moist on land. A crawfish can live for months in mud by keeping its gills wet enough to breathe. Crawfish are sometimes called mudbugs.

First Grade: Grade Level Expectations for Social Studies

Page 34

Physical and Human Systems

11. Identify and compare basic elements of culture (e.g., food, music, celebrations)
(G-1C-E4)

Page 35

Geography: The World in Spatial Terms

2. Interpret a simple chart (G-1A-E1)

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Louisiana State Symbols

<http://www.sec.state.la.us/around/facts/facts-a.htm>



Flag

State Bird: Brown Pelican
State Flower: Magnolia
State Crustacean: Crawfish
State Reptile: Alligator

Crawfish

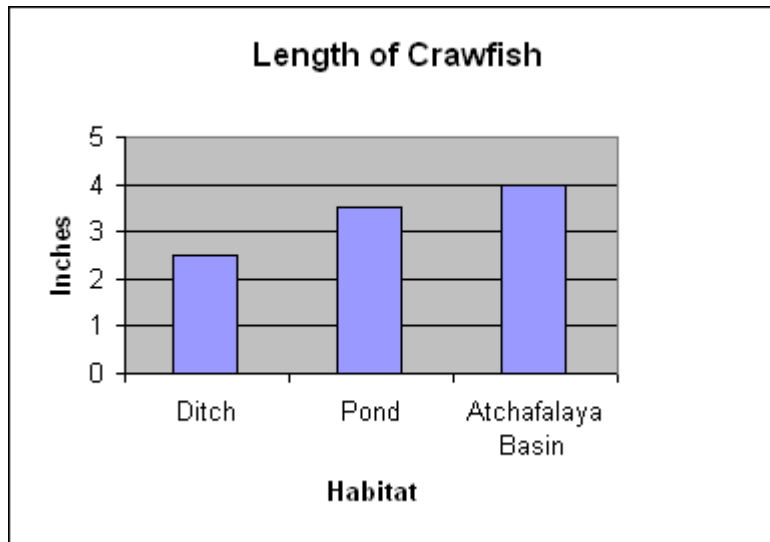
Eating crawfish has a long history in Louisiana. Native Americans ate crawfish even before the Cajuns came to Louisiana. They caught crawfish using deer meat as bait. By the 1930s nets were used to catch crawfish. About 70 million pounds of crawfish are caught in Louisiana each year, and the average size is around twenty crawfish per pound.

Crawfish boils with Cajun music and dancing are popular family gatherings.

Teachers: Talk to your students about their cultural experiences with crawfish boils or any other type of large family gathering. Ask them to write a story describing a fun party that they can remember.

Name _____

Date _____



1. About how big do crawfish grow in Atchafalaya Basin? _____ inches.
2. Do crawfish grow larger in ponds or ditches? _____
3. Do crawfish grow larger in ponds or lakes? _____
4. Why might crawfish grow larger in the ponds and lakes than in ditches? * _____

* they have more room to grow

Second Grade

GLE

(Grade Level Expectation)

Based

Worksheets

&

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Louisiana

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Second Grade: Grade Level Expectations for English Language Arts

Pages 38- 39

Reading and Responding: Standard 6:

14. Compare and contrast different versions of the same story from different cultures through oral, written, and visual responses (ELA-6-E1)

15. Identify a variety of types of literature, including biography, autobiography, and the folktale, in oral and written responses (ELA-6-E2)

Page 40

Writing/Proofreading: Standard 3

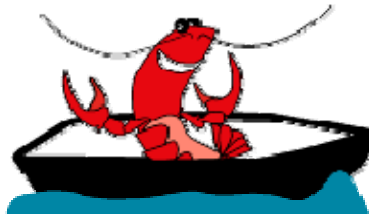
31. Distinguish between a sentence and a sentence fragment (ELA-3-E3)

Page 41

Writing/Proofreading: Standard 3

36. Alphabetize to the second letter and some third letters (ELA-4-E2)

Louisiana CRAWFISH PROMOTION AND RESEARCH BOARD



Name _____

Date _____

The Many Different Cinderella Stories

Is Cinderella a biography, an autobiography or a folktale?

Teachers: Read excerpts from the following book reviews taken from http://www.childrenslit.com/th_cinderella.html, or check the books out of the library and read the entire stories. Visit the webpage listed above for many more Cinderella reviews. Have the children identify the cultures of each story. Then have each child choose and illustrate two versions of the Cinderella stories. Let the children do show and tell with their drawings and have the rest of the class identify which story the pictures identify.

Bigfoot Cinderrrrrella

Tony Johnston

Illustrations by James Warhola

This Cinderella story with Bigfoot creatures is set in an old-growth forest. Rrrrrella (so-called because the sisters roar Ella, her real name) is strong, "with feet like log canoes," while the stepsisters are "puny little things with dinky feet." True to tradition, Rrrrrella is kind and befriends a hungry grizzly bear who later rescues her ("Me your beary godfather.") He magically mats and tangles her fur so she can go to the fun-fest thrown by the Bigfoot prince. For some reason all the characters speak truncated English... "No pick flowers!" and "Where my stinking beauty go?" The illustrations depict the Bigfoot creatures as brown-haired, except for Rrrrrella who is blond and the stepmother who is gray. All have big noses, and of course, big feet.

ISBN: 0-399-23021-1

Bubba the Cowboy Prince

Helen Ketteman

Illustrated by James Warhola

The premise isn't original, but the execution and artwork certainly are. Bubba is a ranch hand, with two dimwitted, lazy stepbrothers. When Miz Lurleen, a rich rancher from down the road, throws a ball, of course Bubba doesn't have the proper clothes. He is rescued by a fairy godcow, who turns one of the longhorns into a white stallion and Bubba's threads into a fabulous Stetson and crisp jeans. At midnight, Bubba loses his cowboy boot, but eventually Miz Lurleen finds Bubba and they ride off into the sunset. The text is full of outrageous Texas-size sayings, such as "darker than a black bull at midnight" and "another ten dollar Stetson on a five cent head."

ISBN: 0-590-25506-1



Cendrillon

Robert D. San Souci

Illustrations by Brian Pinkney

This Cinderella tale is told by the godmother, a Caribbean washerwoman, who loves a lonely little drudge and helps her prepare for a magical night at a rich man's party.

ISBN: 0-689-80668-X

Cendrillon: A Cajun Cinderella

Sheila Hebert Collins

Illustrated by Patrick Soper

No "bibbity-bobbity-boos" for the fairy *marraine* of this Cinderella tale: she turns crawfish into horses and a crab into a coachman, all the while invoking Cajun sausage and chanting "poosh, poosh, poosh." This is not one of the many folk versions that have evolved in the South; rather it is Collins' open attempt to marry Cajun culture and language to the popular vision of Cinderella. French phrases sprinkle the text, and although they are defined on the bottom of each page, the effect is still confusing and contrived. Soper's vivid blue and green toned illustrations convey an appealing mixture of fairy tale and down-home New Orleans flavor (for example, the ferryboat that carries Cendrillon's coach across the river), even if Cendrillon herself is barely recognizable from one page to the next.

ISBN: 1-56554-326-2

The Egyptian Cinderella

Shirley Climo

Illustrations by Ruth Heller

In this clever retelling of an ancient Egyptian tale, a Greek slave girl named Rhodopis receives a pair of rose-red slippers from her kindly old master. When a falcon swoops down and soars away with one of the beautiful shoes, she becomes heartbroken. Unbeknownst to her, the falcon delivers her slipper to the great Pharaoh himself, who sets out on a journey to find the slipper's owner. When he locates Rhodopis, he falls in love and makes her his wife and beloved queen.

ISBN: 0-690-04822-X

ISBN: 0-690-04824-6



The Golden Sandal

Rebecca Hickox

Illustrations by Will Hillenbrand

Maha's father is a fisherman and must be away for long periods. Maha wishes for a stepmother and stepsister to keep her company and to help her. When Maha's wish comes true, and her father marries again, Maha is delighted. Her delight ends when the stepmother becomes jealous of her and makes her do all the work, and feeds her only dried dates. Maha's unlikely rescuer is the red fish that she throws back into the water. This is another Cinderella tale but with differences that make it unique to the country of Iraq.

ISBN: 0-8234-1331-4

Name _____

Date _____

Write an S next to the complete sentences and an F next to the sentence fragments.

- ___1. Cave crawfish are called cave dwellers.
- ___2. While those found at the surface, no matter how briefly, are called surface dwellers.
- ___3. A crawfish sheds its hard shell regularly.
- ___4. Which is called molting.
- ___5. A very young crawfish can molt every 5 or 6 days.
- ___6. There are many different kinds of crawfish.
- ___7. Scientists can tell different types of crawfish apart.
- ___8. By examining the tips of their swimming legs.
- ___9. Mature male crawfish have bigger claws than females.
- ___10. Males also have hooks on their walking legs.

Name _____

Date _____

Go fishing! Pull out the words below in alphabetical order and copy them on the lines to the right.



claw

crawfish

antennae

eyestalk

crustacean

gills

legs

This image shows a full page of handwriting practice paper. It features ten identical sets of horizontal guidelines arranged vertically. Each set includes three lines: a solid top line, a dashed middle line, and a solid bottom line, providing a structured space for practicing letter formation and alignment.

Second Grade: Grade Level Expectations for Math

Page 43

Geometry

21. Identify a reduction or enlargement of a given shape (G-2-E)

Page 44

Patterns, Relations and Functions

31. Recognize, extend, create and explain patterns that involve simple rotations or size changes with geometric objects (P-1-E, P-2-E)

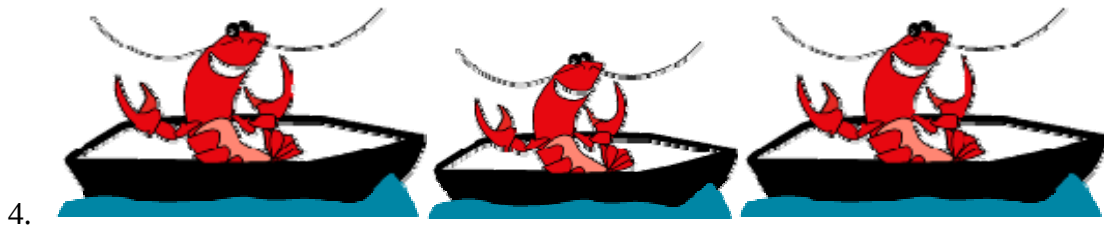
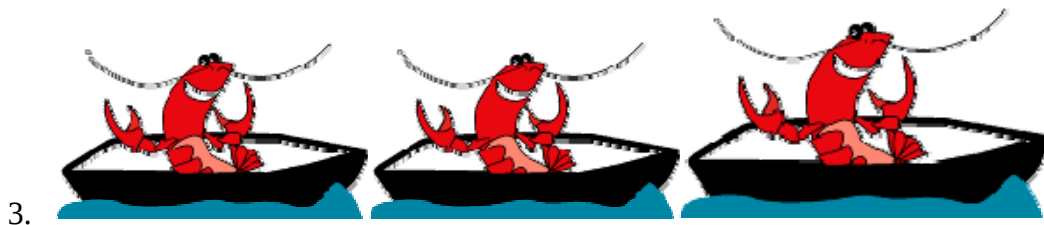
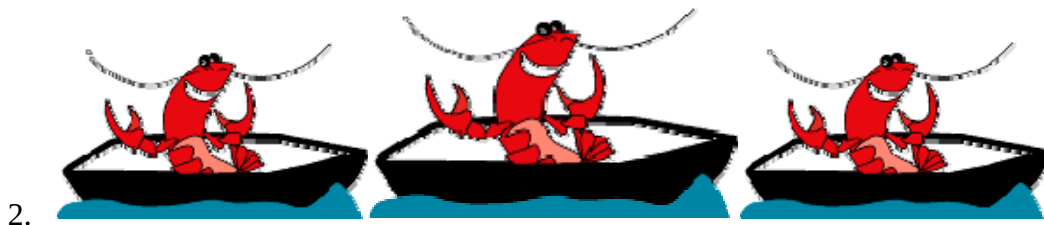
Louisiana CRAWFISH PROMOTION AND RESEARCH BOARD



Name _____

Date _____

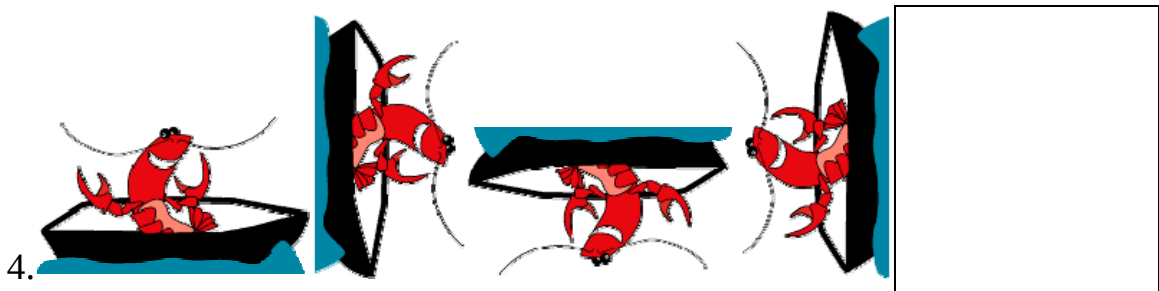
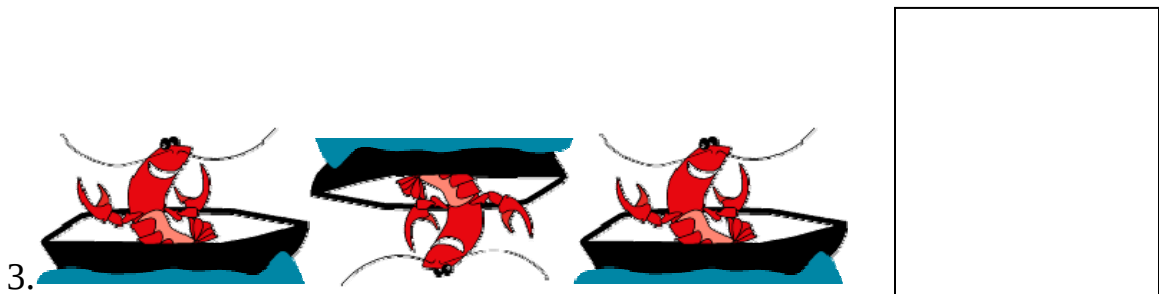
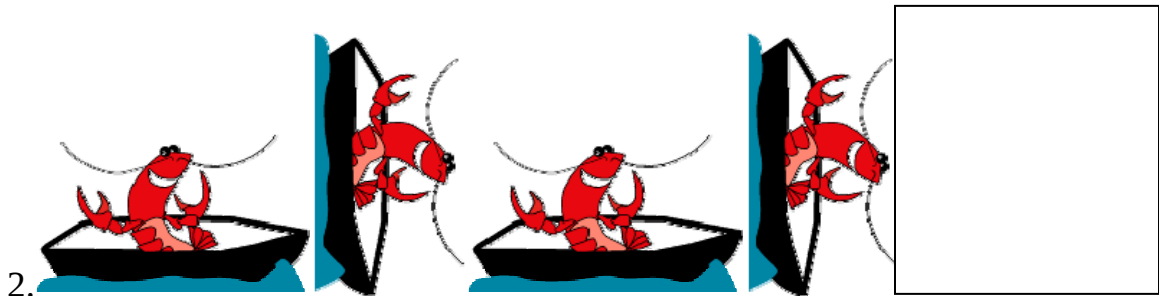
Circle the image that is different.



Name _____

Date _____

Draw the next crawfish in the pattern.



Second Grade: Grade Level Expectations for Science

Page 46

Life Science: Characteristics of Organisms

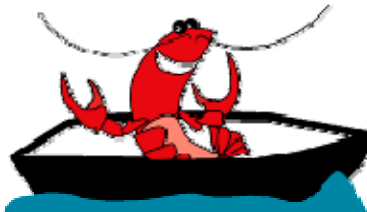
27. Match the appropriate food source and habitat for a variety of animals. (LS-E-A1)

Page 47

Science and the Environment

47. Illustrate and describe a simple food chain located within an ecosystem. (SE-E-A2)

Louisiana
CRAWFISH PROMOTION
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Name _____

Date _____

Circle the best choice for what the animals eat and where they live.

Animals	What They Eat		Where They Live	
Crawfish	Water fleas	Lobster	Lakes	Pasture
Shark	Squirrels	Fish	Lakes	Ocean
Water flea	Algae	Fish	Fields	Lakes
Fox	Lobster	Mice	Marsh	Woods
Fish	Crawfish	Squirrels	Lakes	Fields

Name _____

Date _____

A **food chain** shows how each living thing gets its food energy. Some animals eat plants and some animals eat other animals. For example, a simple food chain links the plants, the herbivores (animals that eat plants), and the carnivores (animals that eat the other animals). Each link in this chain is food for the next link. These food chains start with plant life and ends with an animal.

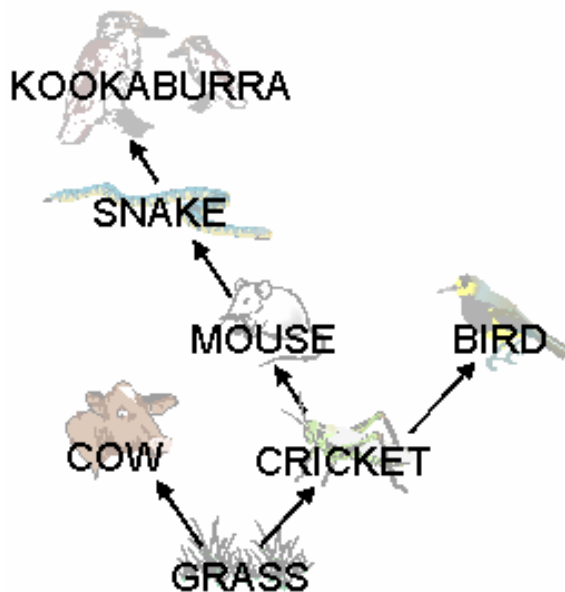
Put the following in the right order to make a food chain.

1. algae, crawfish, water flea: _____

2. crawfish, water flea, raccoon, alligator: _____

Note: Both crawfish and water fleas eat algae. Draw a simple food chain using algae, water fleas, crawfish, raccoons, and alligators.

Sample: Both cows and crickets eat grass. Both birds and mice eat crickets. Snakes eat mice. Kookaburra eat snakes.



More information: The kokkaburra is an Australian kingfisher! Kingfishers eat crawfish as well as snakes.

Second Grade: Grade Level Expectations for Social Studies

Pages 49- 50

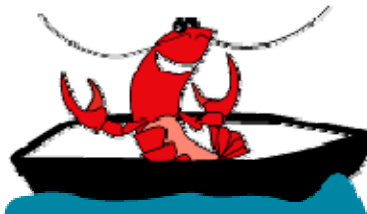
Physical and Human System

- 13. Identify simple demographics of a local region (e.g., mostly factory workers) (G-1C-E3)
- 14. Identify ways of making a living within the community (G-1C-E5)

Economics: Fundamental Economic Concepts

- 29. Explain how basic human needs of food, clothing, and shelter can be met (E-1A-E1)
- 34. Explain how people in the local community depend on each other for goods and services (E-1A-E5)
- 35. Identify various ways in which resources are used (e.g., use of trees to produce wood for building, wood products, heat) (E-1A-E6)
- 36. Describe the roles of farmers, processors, and distributors in food production and consumption (E-1A-E6)
- 37. Describe the role of weather, land, and water resources in food production over time (E-1A-E6)
- 38. Identify the specialized work that people do to manufacture, transport, and market goods and services (E-1A-E7)

Louisiana CRAWFISH PROMOTION AND RESEARCH BOARD



Name _____

Date _____

The Business of Crawfish

Many families in Louisiana enjoy eating crawfish and make a living by raising crawfish. There are many crawfish farmers in Louisiana.

Louisiana is a naturally wet state. The Mississippi River Basin is full of lakes and ponds. Louisiana supplies much of the world's crawfish. This environment is ideal for crawfish farming.

People in Louisiana eat crawfish, use crawfish as bait to catch fish, and sell crawfish to people in other states and in other countries. The crawfish industry supports farmers, seafood processors, wholesale dealers, truck drivers, store owners, and many other types of workers.

Answer the following questions by reading the paragraphs above.

1. Name two things mentioned in the reading above that people in Louisiana eat.
2. Name three ways that people use crawfish.

Name _____

Date _____

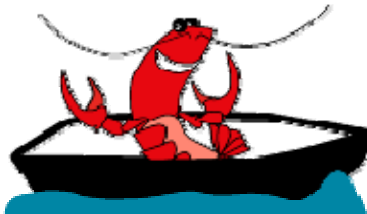
3. How do Louisiana's water resources help crawfish farmers?

4. Name three jobs listed above related to the crawfish industry?

5. Can you think of another job related to the crawfish industry not listed in the reading above?

Third Grade
GLE
(Grade Level Expectation)
Based
Worksheets
&
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CRAWFISH PROMOTION
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Third Grade: Grade Level Expectations for Language Arts

Pages 53- 54

Reading and Responding

Standard 7

- 19. Identify an author's purpose for writing, including persuading, entertaining and informing. (ELA-7-E3)
- 20. Explain the author's viewpoint using information from the text. (ELA-7-E3)
- 21. Identify differences between fact and opinion. (ELA-7-E4)

Page 55

Writing/ Proofreading

Standard 3

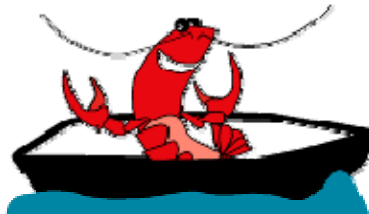
- 29. Use standard English punctuation, including commas to separate phrases in a series.
- 30. Capitalize the first word in direct quotations and proper adjectives (e.g., American flag, Mexican food) (ELA 3 E2) (ELA-3-E2)
- 31. Write using standard English structure and usage, including making subjects and verbs agree in sentences with simple and compound subjects and predicates. (ELA-3-E3)

Page 56

Writing/ Proofreading, Standard 3

- 35. Alphabetize to the second and third letters. (ELA-3-E5)

Louisiana CRAWFISH PROMOTION AND RESEARCH BOARD



Teachers:

Read the following passage, an excerpt from LSU AgCenter News, aloud to your students paragraph by paragraph and then discuss/ answer the questions as they follow. First, allow the students to use a dictionary to define **crustacean**.

New Rice Variety Developed For Crawfish Farmers

Crawfish farmers will have a way to improve the diets of their crustaceans, thanks to researchers at the LSU AgCenter's Rice Research Station at Crowley. Those researchers developed a new rice variety called "**Ecrevisse**," which is French for crawfish.

1. What is the name of the new type of rice researchers developed?
2. What does the name mean?
3. Does the meaning of the name explain the reason the researchers developed this rice?

That new variety from the LSU AgCenter provides more **biomass** – or vegetation – throughout the crawfish season than those currently grown, according to AgCenter regional director Dr. Steve Linscombe, who also is one of the developers of Ecrevisse. That, in turn, leads to more sources of food for the crawfish.

4. What does biomass mean?
5. What benefit does the crawfish gain from more biomass?

Linscombe explained that Ecrevisse is intended for crawfish farmers who raise crawfish in **monoculture** – where the ponds are used for raising crawfish only rather than **double-cropped** with rice that is first harvested for grain...

6. What does monoculture mean?
7. What does double-cropped mean?
8. What two crops does double-cropped refer to in the paragraph above?
9. Is the new type of rice good for monoculture or double-cropped crawfish farms?

While rice is an important part of the crawfish food chain, crawfish really don't feed on it, explained Dr. Ray McClain, an aquaculture researcher at the LSU AgCenter Rice Research Station. Decaying green plants, such as rice, provide the food for insects and small water organisms that make up the bulk of the crawfish diet, McClain said.

10. Why is rice important to crawfish if they don't eat it?
11. What do crawfish eat?

But one of the drawbacks of rice varieties grown for grain is their susceptibility to "**winterkill**" – which means they don't grow back in the spring.

12. What is the drawback of the type of rice grown for grain?

13. What does winterkill mean?

Ecrevisse, on the other hand, "has better cold tolerance and can have regrowth in the spring to produce good vegetation that provides the environment where crawfish thrive," McClain said.

14. Why does Ecrevisse produce better vegetation than rice grown as grain?

Linscombe said farmers who raise crawfish in monoculture often continue harvesting the mudbugs well into summer and, without good vegetation, the crawfish stop growing and remain stunted.

15. What happens to crawfish during the summer if they don't have good vegetation?

Field trials with Ecrevisse as part of the crawfish's food chain produced more large, high-value crawfish than did fields with common rice plants, McClain said.

16. What result did planting Ecrevisse in crawfish farms have?

The new rice variety should improve productivity of ponds devoted to raising crawfish exclusively, Linscombe said. "I think under commercial conditions, the use of this variety may actually produce higher yields of crawfish."

17. How can crawfish farmers expect to benefit from using this new type of rice?

18. What is the author's purpose for writing this article? To inform? To persuade? To entertain?

Name _____

Date _____

Correct the following sentences. Capitalize and add punctuation.

1. **crawfish eat insects algae and other water organisms**
2. **crawfish have gills which they use for breathing**
3. **to begin a mating ritual male and female crawfish clash claws**
4. **a lot of crawfish on the world market is louisiana crawfish**
5. **crawfish farmers flood their fields and stock them with crawfish in april or
may drain their ponds in june plant rice in august reflood the ponds in
october and harvest the crawfish from january to may**

Name _____

Date _____

Go fishing! Pull out the words in alphabetical order and copy them on the lines to the right.



bait cattail
 marsh

crawfish
 mudbug
chimneys

 boat
rice heron

bayou farm

 fish
ducks

1	8
2	9
3	10
4	11
5	12
6	13
7	

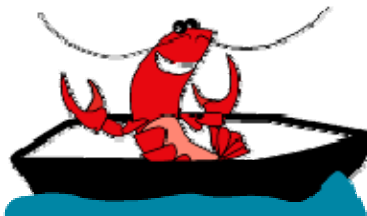
Third Grade: Grade Level Expectations for Math

Pages 58- 59

Data Analysis, Probability, and Discrete Math

- 40. Read, describe, and organize a two-circle Venn diagram (D-1-E, D-2-E)
- 42. Match a data set to a graph, table or chart and vice versa (D-2-E)
- 43. Represent and solve problems using data from a variety of sources (e.g., tables, graphs, maps, advertisements) (D-3-E)

Louisiana CRAWFISH PROMOTION AND RESEARCH BOARD



Name _____

Date _____

Arthropods are animals with **external skeletons** and **jointed legs**. An external skeleton is also called an exoskeleton. It protects the animal from the outside environment.

Look at the chart below to discover the four different types of arthropods.

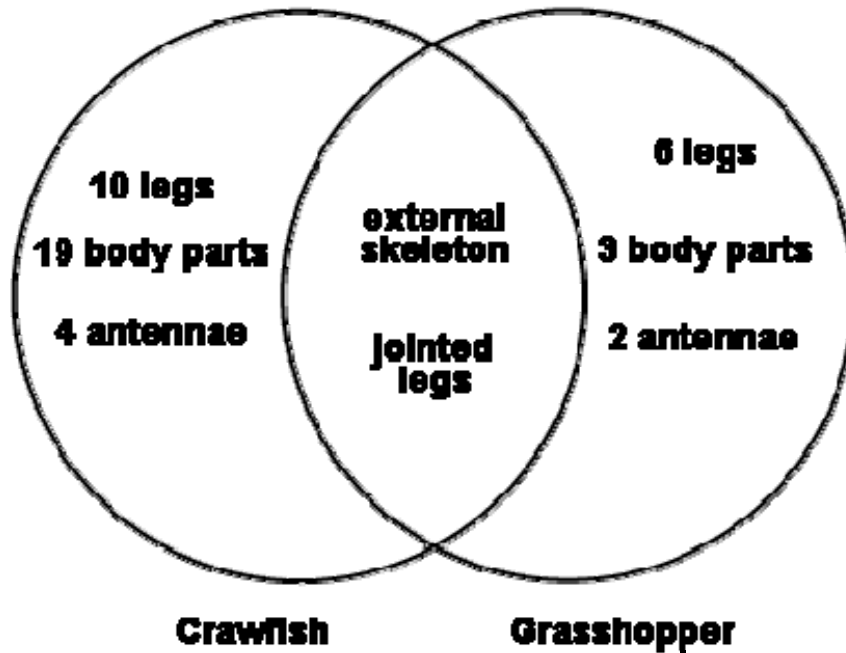
Arthropods	Number of Legs	Number of Antennae	Number of Body Parts	Examples
Insects	6	2	3 head, thorax, abdomen	ants, bees, cockroaches, moths
Arachnids	8	0	2 head, body	spiders, ticks, scorpions
Crustaceans	Variable 8 or more	4	variable	crawfish, crabs, shrimp
Myriapods	Variable 18 or more	2	2 head, segmented body	centipedes, millipedes

1. Name two things that insects, arachnids, crustaceans and myriapods all have in common.

2. Name two or more features that make them different.

Name _____

Date _____



1. A crawfish is a type of _____ (insect, arachnid, crustacean, myriapod).
2. A grasshopper is a type of _____ (insect, arachnid, crustacean, myriapod).

Look back at the chart on the previous page and draw a Venn diagram like the one above for spiders and millipedes.

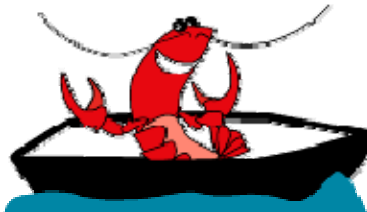
Third Grade: Grade Level Expectations for Science

Pages 61- 62

Life Science: Characteristics of Organisms

- 35. Compare structures (parts of the body) in a variety of animals (e.g., fish, mammals, reptiles, amphibians, birds, insects) (LS-E-A3)
- 38. Classify groups of organisms based on common characteristics (LS-E-A4)
- 39. Compare organisms from different groups (e.g., birds with mammals, terrestrial plants with aquatic plants) (LS-E-A4)
- 41. Describe how the components of the skeletal system function (LS-E-A5)

Louisiana CRAWFISH PROMOTION AND RESEARCH BOARD



Name _____

Date _____

Skeletal Systems

Animals that have backbones are called **vertebrates**. Animals that don't have backbones are called **invertebrates**.

There are three types of skeletal systems.

Vertebrates: Humans and complex animals have **internal skeletons**. These bones can grow, and they support our bodies from the inside.

Invertebrates: Other animals have **external skeletons**, like crawfish and beetles. Their skeletons are shell-like on the outside of their bodies. Their skeletons don't grow. When they outgrow their skeleton, they shed it. This is called molting.

Vertebrates: Some animals have internal and external skeletons, such as turtles and snakes. The turtles' shells grow, but they molt their hard skin just like a snake does.

Invertebrates: The last type of skeletal system is called **hydrostatic skeletal system**. This is not made of hard bones or shells. It is liquid. It works like a balloon filled with water. Worms and jellyfish have this type of skeletal system.

Put these animals in the right columns.

birds, crawfish, fish, bears, worms, bugs, zebras, shrimp

VERTEBRATES	INVERTEBRATES

Name _____

Date _____

Skeletal Systems

Internal Skeleton	External Skeleton	Hydrostatic Skeleton

Write the names of these animals in the correct columns above. Can you think of one more animal with each type of skeletal system to finish the chart?

caterpillar, dog, cat, crawfish, worm, grasshopper

1. Which type of skeletal system produces the largest animals?
2. What is it called when an animal with an external skeleton sheds?
3. Why do animals molt?
4. Name a vertebrate that also has a shell.

Third Grade: Grade Level Expectations for Social Studies

Pages 64- 65

Geography: The World in Spatial Terms

1. Describe characteristics and uses of various maps (e.g., physical, political, topographical, population) (G-1A-E1)
4. Use a compass rose and cardinal directions to locate and interpret a map of the community and Louisiana. (G-1A-E2)
5. Locate major geographic features of Louisiana on a map. (G-1A-E3)
6. Construct a chart, line graph, or diagram to display geographical information. (G-1A-E3)

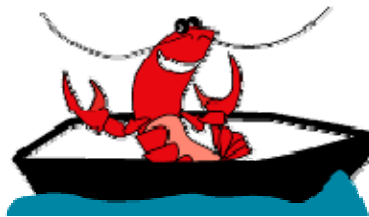
Places and Regions

9. Describe and compare the physical characteristics of various regions of Louisiana (G-1B-E1)
12. Use maps, charts, and pictures to describe how places in Louisiana are different (e.g., land use, vegetation, architecture) (G-1B-E4)

Physical and Human Systems

17. Identify the relationship between geography and economic activities in Louisiana (G-1C-E5)

Louisiana CRAWFISH PROMOTION AND RESEARCH BOARD



Name _____

Date _____

Mississippi River and Its Tributaries



1. Does the map above show (a physical characteristic or the population) of Louisiana?
2. Draw a compass rose near the map showing north, south, east and west.
3. Outline the state of Louisiana in red.
4. Color the area affected by the Mississippi River blue.
5. Color the Gulf of Mexico green.
6. Louisiana's coastline along the Gulf of Mexico is composed of marshes and wetlands. This area is very wet just like the area affected by the Mississippi river. What do you think is one of Louisiana's most plentiful natural resources?

Name _____

Date _____

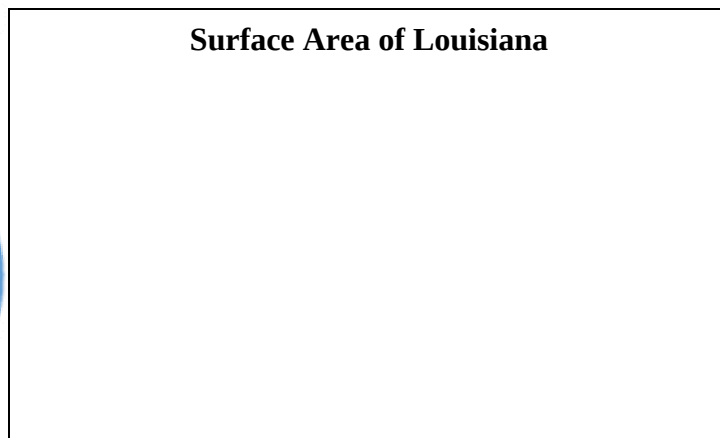
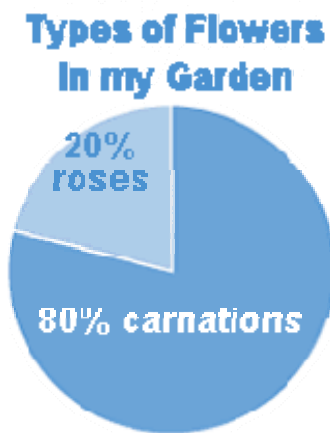
Read the passage below taken from the Department of Transportation and Development's Website: http://www.dotd.state.la.us/intermodal/division/div_introduction.shtml

*(11% modified to 10%)

Water, both above and below ground, is Louisiana's most abundant resource. Approximately ***10% of the total surface area** of the state is composed of water bodies. The state has more than 40,000 linear miles of rivers, streams and bayous and 400 miles of coastline. Not only is water Louisiana's most abundant resource, it is also the most important. Virtually every aspect of the state's economy can be tied to the orderly control and development of this resource. Louisiana is the terminal point for the largest capacity inland waterway system in the world - The Mississippi River and its Tributaries - and is the connection point of that navigation artery with the Gulf Intracoastal Waterway system.

Draw a pie chart showing about 10% surface water and 90% land for Louisiana.

Sample Pie Chart



Teachers: Discuss with the class the types of jobs and the other natural resources related to Louisiana's abundant water resources. For example 40%-45% of the world's crawfish are harvested in Louisiana.

Fourth Grade

GLE

(Grade Level Expectation)

Based

Worksheets

&

Activities

Louisiana

CRAWFISH PROMOTION

AND RESEARCH BOARD



Fourth Grade: Grade Level Expectations for Language Arts

Pages 68- 70

Reading and Responding

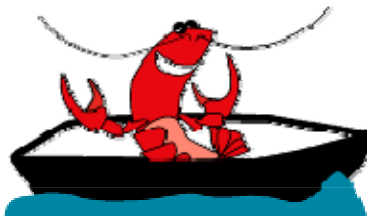
Standard 7

16. Distinguish an author's purpose for writing, including entertaining, expressing an opinion, an argument, or conveying information. (ELA-7-E3)

18. Explain how an author's purpose influences organization of a text, word choice, and sentence structure. (ELA-7-E3)

19. Demonstrate understanding of information in grade-appropriate texts by supporting differences between fact and opinion with information from texts and skimming/ scanning texts for various purposes. (ELA-7-E4)

Louisiana CRAWFISH PROMOTION AND RESEARCH BOARD



Name _____

Date _____

Crawfish Bait

<http://www.mackers.com/crayfish/info.htm#appearance>

Remember: crawfish and crayfish are two words describing the same animal. These words are used interchangeably in the passage below.

Crayfish are eaten by trout and bass. Fish can't afford to pass up such a large meal. They do make an effective bait. Crayfish to be used for bait are easily collected with a small minnow net. Small rocky streams are a good place to check. Numbers vary from stream to stream, so keep looking until you locate a hotspot. Softshells are good, but normal crayfish probably will do just as well. Collect assorted sizes.

I have had much success on trout with Rebel's Teeny Wee Crawfish, a 1.5-inch long crayfish-like crankbait. Of the dozens of trout that this lure has produced for me, several have been browns of over 16 inches. What really surprised me, however, were some of the smaller trout that I landed trout from 7.5 inches all the way down to tiny browns and rainbows of only 5 inches.

Because species and crayfish colors vary, it's best to fish with a bait or lure that matches the natural. Fish them in shallow, rocky places, for crayfish favor these areas. Fishing at dawn, dusk, or during the night would best imitate natural movement.

1. What is the author's purpose in writing this article?
2. Name two types of fish that eat crawfish?
3. How does the author catch crawfish?
4. Where does the author catch crawfish?
5. At what time of day does the author fish with crawfish?
6. What size trout has the author caught using crawfish as bait?

Fact or Opinion

1. They do make an effective bait.
2. I landed trout from 7.5 inches all the way down to tiny browns and rainbows of only 5 inches.
3. Softshells are good, but normal crayfish probably will do just as well.
4. Crayfish are eaten by trout and bass.

Who Killed the Otter's Babies?

from *Stories to Tell to Children* by Sara Cone Bryant <http://www.rickwalton.com/folktale/bryant31.htm>
(Adapted from the story as told in *Fables and Folk Tales from an Eastern Forest*, by Walter Skeat.)

Once the Otter came to the Mouse-deer and said, **"Friend Mouse-deer, will you please take care of my babies while I go to the river, to catch fish?"**

"Certainly," said the Mouse-deer, **"go along."**

But when the Otter came back from the river, with a string of fish, he found his babies crushed flat.

"What does this mean, Friend Mouse- deer?" he said. **"Who killed my children while you were taking care of them?"**

"I am very sorry," said the Mouse-deer, **"but you know I am Chief Dancer of the War-dance, and the Woodpecker came and sounded the war-gong, so I danced. I forgot your children, and trod on them."**

"I shall go to King Solomon," said the Otter, **"and you shall be punished."**

Soon the Mouse-deer was called before King Solomon.

"Did you kill the Otter's babies?" said the king.

"Yes, your Majesty," said the Mouse- deer, **"but I did not mean to."**

"How did it happen?" said the king.

"Your Majesty knows," said the Mouse- deer, **"that I am Chief Dancer of the War-dance. The Woodpecker came and sounded the war-gong, and I had to dance; and as I danced I trod on the Otter's children."**

"Send for the Woodpecker," said King Solomon. And when the Woodpecker came, he said to him, **"Was it you who sounded the war-gong?"**

"Yes, your Majesty," said the Woodpecker, **"but I had to."**

"Why?" said the king.

"Your Majesty knows," said the Woodpecker, **"that I am Chief Beater of the War-gong, and I sounded the gong because I saw the Great Lizard wearing his sword."**

"Send for the Great Lizard," said King Solomon. When the Great Lizard came, he asked him, **"Was it you who were wearing your sword?"**

"Yes, your Majesty," said the Great Lizard; **"but I had to."**

"Why?" said the king.

"Your Majesty knows," said the Great Lizard, **"that I am Chief Protector of the Sword. I wore my sword because the Tortoise came wearing his coat of mail."**

So the Tortoise was sent for.

"Why did you wear your coat of mail?" said the king.

"I put it on, your Majesty," said the Tortoise, **"because I saw the King-crab trailing his three-edged pike."**

Then the King-crab was sent for.

"Why were you trailing your three- edged pike?" said King Solomon.

"Because, your Majesty," said the King-crab, **"I saw that the Crayfish had shouldered his lance."**

Immediately the Crayfish was sent for.

"Why did you shoulder your lance?" said the king.

"Because, your Majesty," said the Crayfish, **"I saw the Otter coming down to the river to kill my children."**

"Oh," said King Solomon, **"if that is the case, the Otter killed the Otter's children. And the Mouse-deer cannot be held, by the law of the land!"**

Teachers: Discuss the following questions aloud with the class.

1. Why did the author write this story?
2. What lesson did the author want the reader to learn?
3. Why did the author use such repetitive language such as **"Yes, your majesty, but I had to"** and **"your majesty knows that I am..."**?
4. What do otters eat?
5. Do any of the animals think before they act? Or do they act out of instinct?
6. Do you think King Solomon is wise?

Fourth Grade: Grade Level Expectations for Math

Pages 72- 74

Data Analysis, Probability, and Discrete Math

34. Summarize information and relationships revealed by patterns or trends in a graph, and use the information to make predictions (D-1-E)

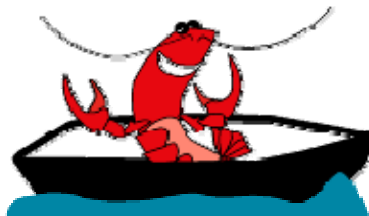
36. Analyze, describe, interpret, and construct various types of charts and graphs using appropriate titles, axis labels, scales, and legends (D-2-E, D-1-E)

37. Determine which type of graph best represents a given set of discrete data (D-2-E, D-1-E)

Algebra

15. Write number sentences or formulas containing a variable to represent real-life problems (A-1-E)

Louisiana CRAWFISH PROMOTION AND RESEARCH BOARD



Name _____

Date _____

Area Devoted to Crawfish Culture in Louisiana

Year	Area (acres)
1949	40
1960	2,000
1966	6,000
1968	10,000
1969	12,000
1970	18,000
1971	24,000
1973	44,000
1976	45,000
1978	48,000
1980	55,000
1982	100,000
1984	103,600
1986	118,500
1988	140,000
1990	125,000

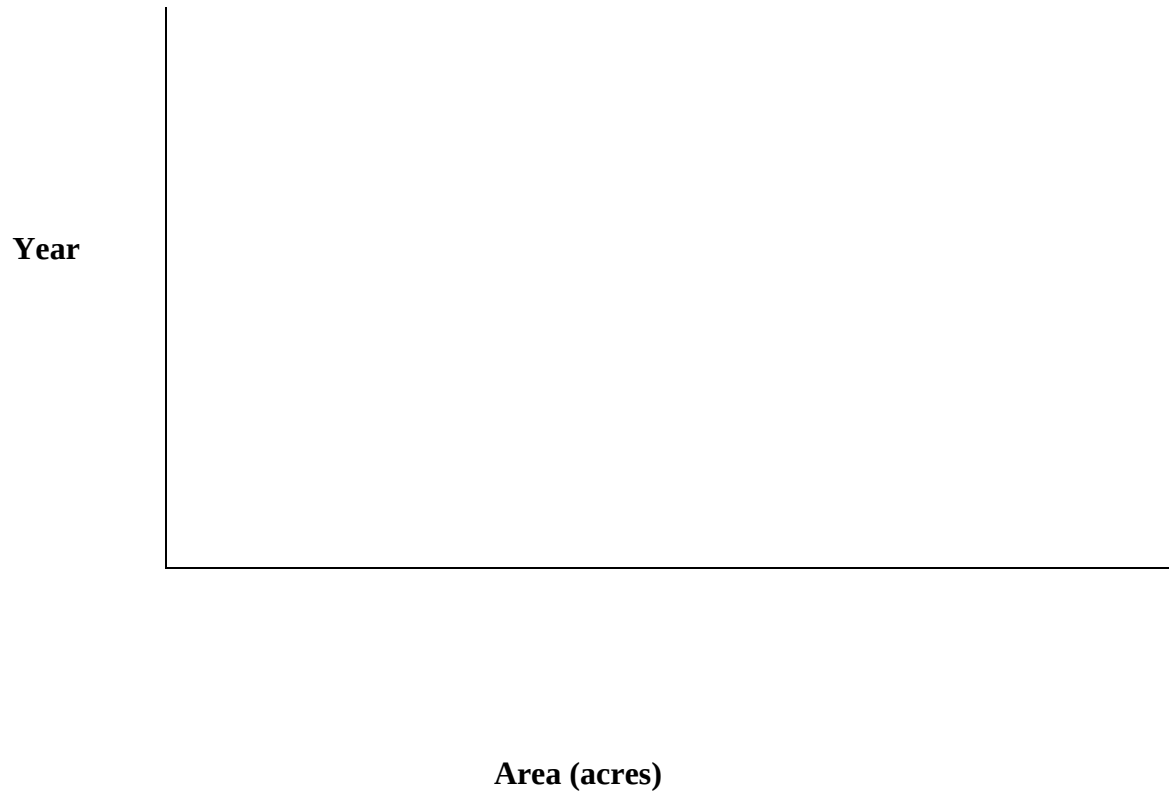
1. The number of acres devoted to crawfish culture is continually (increasing, decreasing).
2. The number of acres doubled from 1971 to _____.
3. In _____ the number of acres devoted to crawfish culture was only half that of 1971.
4. Write a number sentence showing how many more acres were devoted to crawfish culture in 1980 compared to 1976. Solve the equation.
5. Write a number sentence containing the variable (**X**) showing the multiplication in acres between 1960 and 1966. Fill in the answer: In 1966 there were _____ times the number of acres devoted to crawfish culture than in 1960.

Name _____

Date _____

Draw a line graph using the information in the table on the previous page.

Area Devoted to Crawfish Culture in Louisiana



Name _____

Date _____

Red Crawfish Habitat

Habitat Type	Percent
Marshes and marsh pools	35
Swamps and swamp forest	30
Ponds and borrow pits	14
Ditches	12
Bayous	8
Pineland sloughs and springs	1

Which type of graph would best show the information in the chart above? Circle the best answer. (line graph, bar graph, pie chart, tree diagram)

Create a graph using the information above in the space below.

Red Crawfish Habitat

Fourth Grade: Grade Level Expectations for Science

Page 76

Life Science: Characteristics of Organisms

41. Describe how parts of animals' bodies are related to their functions and survival (e.g., wings/flying, webbed feet/swimming) (LS-E-A3)

Page 77

Organisms and Their Environments

52. Describe how some plants and animals have adapted to their habitats (LS-E-C2)

53. Identify the habitat in which selected organisms would most likely live and explain how specific structures help organisms to survive (LS-E-C2)

Answers to page 76:

- 1. They are clumsy on land and need to notice prey right away in order to escape.**
- 2. antennas or antennae**
- 3. The claw is sometimes used to capture or hold prey or as a self defense means, but it is more often used as a "status" symbol to thwart attacks, for sexual attraction, etc. It is also used to hold the female during mating. Most of the food that enters the mouth is picked up by the front sets of walking legs.**

Answers to page 77

- 1. mud**
- 2. mudbug**
- 3. They have to stay damp and keep enough moisture on their gills to accept oxygen through them. The chimney can and does wash away and does not hold moisture/water in the burrow. The crawfish plugs the burrow with mud to hold moisture/water.**

Louisiana **CRAWFISH PROMOTION AND RESEARCH BOARD**

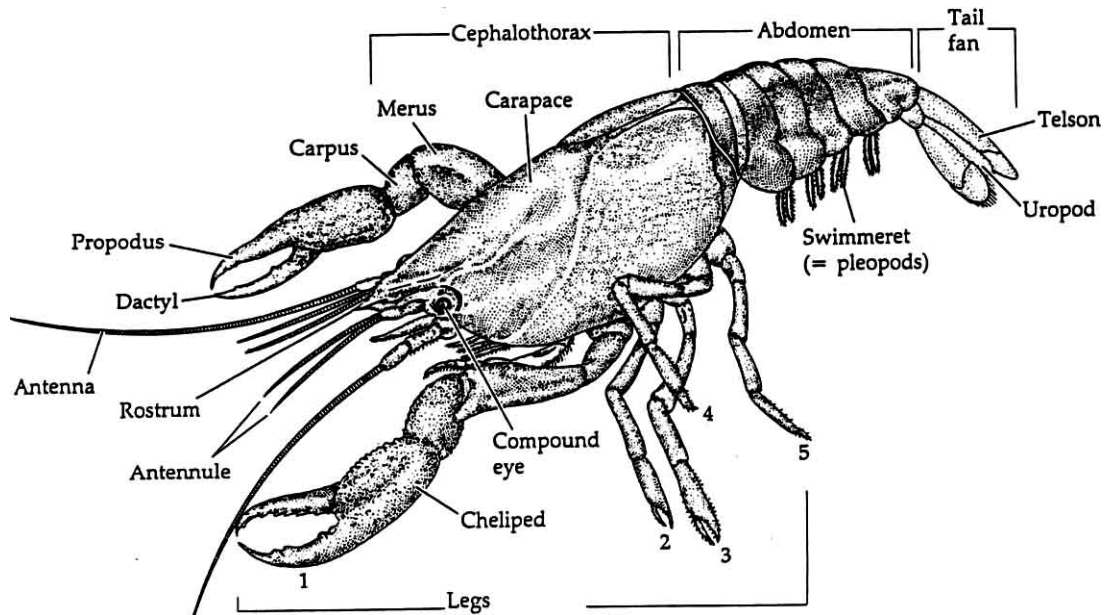


Name _____

Date _____

Crawfish Anatomy

image from: faculty.uca.edu



1. A crawfish has compound eyes that sit on stalks. They can see all around them. They primarily use their terrific eyesight on land. Why do you think they might need good eyesight when they are out of water?
2. If the water is muddy or dark, they cannot see well. What other part of their body would they use for sensing in the dark?
3. What would a crawfish use its claw for?

Answers found on page 75.

Name _____

Date _____

Crawfish Dry Weather Home



1. Above is a photo of a crawfish tower or chimney. What do you think it is made from?
2. The crawfish gets one of his nicknames from this house. Do you know what it is?
3. Crawfish breathe through their gills. How do you think this tower helps keep them alive during dry weather?

Answers found on page 75.

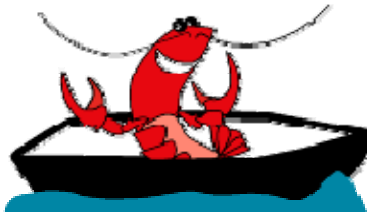
Fourth Grade: Grade Level Expectations for Social Studies

Pages 79- 80

Geography: The World in Spatial Terms

3. Locate and label places on a map or globe: the seven continents, the United States and its major land forms, waterways, referring to the poles, the equator, latitude, longitude and meridians. (G-1A-E2)
4. Identify all U.S. states by shapes and position on map. (G-1A-E2)
5. Draw, complete and add features to a map (including such map elements as a title, compass rose, legend and scale). (G-1A-E3)

Louisiana CRAWFISH PROMOTION AND RESEARCH BOARD



Name _____

Date _____

Some Countries where Red Swamp Crawfish are found.



1. Name the six continents shown on this map.

- 1.
- 2.
- 3.
- 4.
- 5.
- 6.

2. Which continent is not shown on this map?

Are crawfish found on this continent?

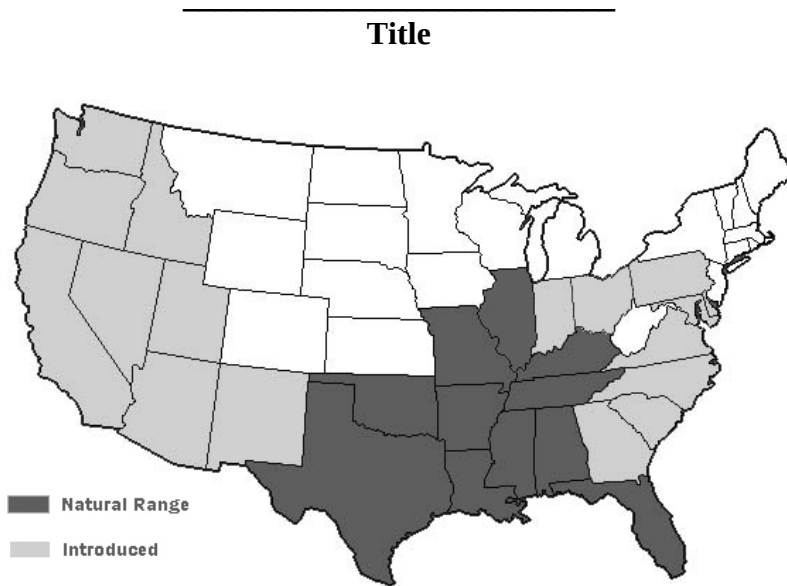
3. Draw a compass rose to go with this map.

4. List 6 countries where red crawfish can be found.

Name _____

Date _____

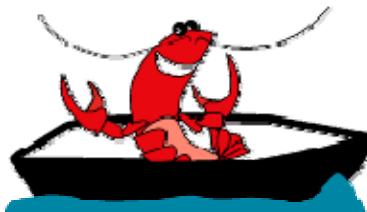
Complete the map below and answer the questions.



1. List 6 states where red crawfish (or red swamp crawfish) live naturally.
2. List 6 states where red crawfish have been introduced.
3. List 6 states where red crawfish cannot be found in the U.S.

Fifth Grade
GLE
(Grade Level Expectation)
Based
Worksheets
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Louisiana
CRAWFISH PROMOTION
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Fifth Grade: Grade Level Expectations for English Language Arts

Pages 83- 84

Reading and Responding: Standard 6

9. Identify cultural characteristics, including customs, traditions and viewpoints, found in national, world and multicultural literature in oral and written responses (ELA-6-M1)

11. Use knowledge of the distinctive characteristics to classify and interpret elements of various genres. (ELA-6-M3)

Reading and Responding: Standard 7

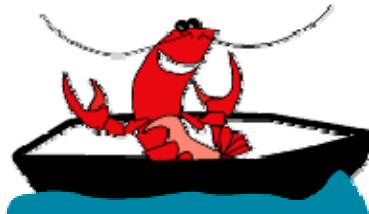
12. Demonstrate understanding of information in grade appropriate texts using a variety of strategies, including: sequencing events and steps in a process, summarizing and paraphrasing information, identifying stated and implied main ideas, comparing and contrasting literary elements and ideas, making simple inferences, predicting the outcome of the story, identifying literary devices (ELA-7-M1)

Page 85

Writing and Proofreading: Standard 3

26. Use standard English punctuation including parentheses and commas in direct quotations, commas to set off appositives and introductory phrases, use quotation marks around dialogue (ELA-3-M2)

Louisiana **CRAWFISH PROMOTION** **AND RESEARCH BOARD**



A Cherokee Creation Story

<http://www.turtletrack.org/>

Many, many moons ago, in the beginning of time, the earth was all water. There was no land. All the four-leggeds, all the animals, all the winged-ones, lived up in the sky on the clouds, they were waiting for the land to dry, but it would not dry.

They would send one animal but he would never come back unable to find dry land. The animals would regularly check the water below.

Finally, after a dog had looked and reported back that it was still wet, they sent the water beetle. The water beetle dove into the water, grabbed a handful of mud at the bottom, brought it up and placed it on top of the water, and it started to dry, started to build land. He brought more and more; and still they waited for it to dry, still they waited and waited.

Finally, they sent grandfather buzzard, the mighty buzzard, down and the land was almost dry. As the buzzard flew, he'd fly down close to the land; and every time he would flap his mighty wings, he would form a mountain and a valley. That's why the Cherokee land has mountains and valleys in it today.

All the animals came down and settled on the earth.

After they did, they realized they had no light. So they called to Grandfather and asked would he give them light, and he did. He brought to them the sun. He brought the sun down right by the ground, and it was too hot for the animals.

So they pushed and pushed, till finally they got it far enough out that it would not burn all the time, but it was still so hot that the crawfish was baked. That's why, if you look at him today, he is red from the sun being too close.

Finally, they got the sun far enough out so it would not burn and we would have night.

And Grandfather told them, "Now that I have done this for you, I ask that all the four-legged, and all the animals, and the plants stay awake for seven days and seven nights." This is why today, when a warrior goes to cross his manhood, he fasts and sweats for seven days.

All the animals and all the plants fell asleep except for some.

The owl stayed awake, and that's why he has vision to hunt at night now.

The plants, the Douglas fir, the cedar, the pine, and a few others stayed awake for seven nights and for seven days. That's why only these, among all the plants, are allowed to stay green all the year round. The other plants fell asleep and so must sleep part of every year.

Name _____

Date _____

Read the creation myth on the previous page and answer the questions below.

1. What culture does this creation story represent?
2. Are humans a part of this creation story?
3. Is this writing fiction or nonfiction?
4. Who or what is grandfather?
5. What does a Cherokee warrior do to respect the grandfather's commandment to all animals on Earth?
6. How were the plants and animals rewarded for obeying Grandfather?
7. Put the events in order. Number them from one to nine.
 - _____ All the animals settled on earth.
 - _____ Grandfather brought the sun.
 - _____ The animals lived on the clouds.
 - _____ The crawfish baked.
 - _____ The water beetle grabbed a handful of mud and placed it on top of the water.
 - _____ The animals pushed the sun farther away.
 - _____ Grandfather told the animals and plants to stay awake for 7 days and nights.
 - _____ The buzzard flew across the land.
 - _____ The owl stayed awake along with the cedar and pine trees.

Name _____

Date _____

Correct the following sentences by capitalizing and adding punctuation, such as commas and quotation marks.

1. the scientist said the red crawfish is adapted to living in areas that are periodically flooded and drained
2. in general both species of crawfish are very dark if they come from clear dark water or very light if the come from muddy water
3. in nature crawfish may live a year and a half
4. in laboratories they can live up to three and a half years
5. several days before laying eggs the female cleans the underside of her abdomen
6. the teacher explained autotomy is the casting off of a limb at the joint when pressure is applied
7. autotomy is a defense reflex she said

Fifth Grade: Grade Level Expectations for Math

Pages 87- 88

Number and Number Relations

2. Recognize, explain, and compute equivalent fractions for common fractions (N-1-M, N-3-M)

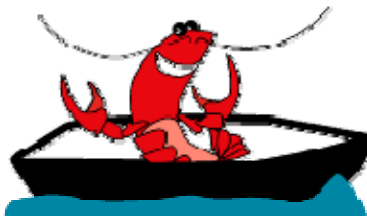
6. Select and discuss the correct operation for a given problem involving positive fractions using appropriate language such as *sum*, *difference*, *numerator*, and *denominator* (N-4-M) (N-5-M)

7. Select, sequence, and use appropriate operations to solve multi-step word problems with whole numbers (N-5-M) (N-4-M)

Data Analysis, Probability, and Discrete Math

28. Use various types of charts and graphs, including double bar graphs, to organize, display and interpret data and discuss patterns verbally and in writing (D-1-M, D-2-M, P-3-M, A-4-M)

Louisiana CRAWFISH PROMOTION AND RESEARCH BOARD



Name _____

Date _____

Work the math problems below.

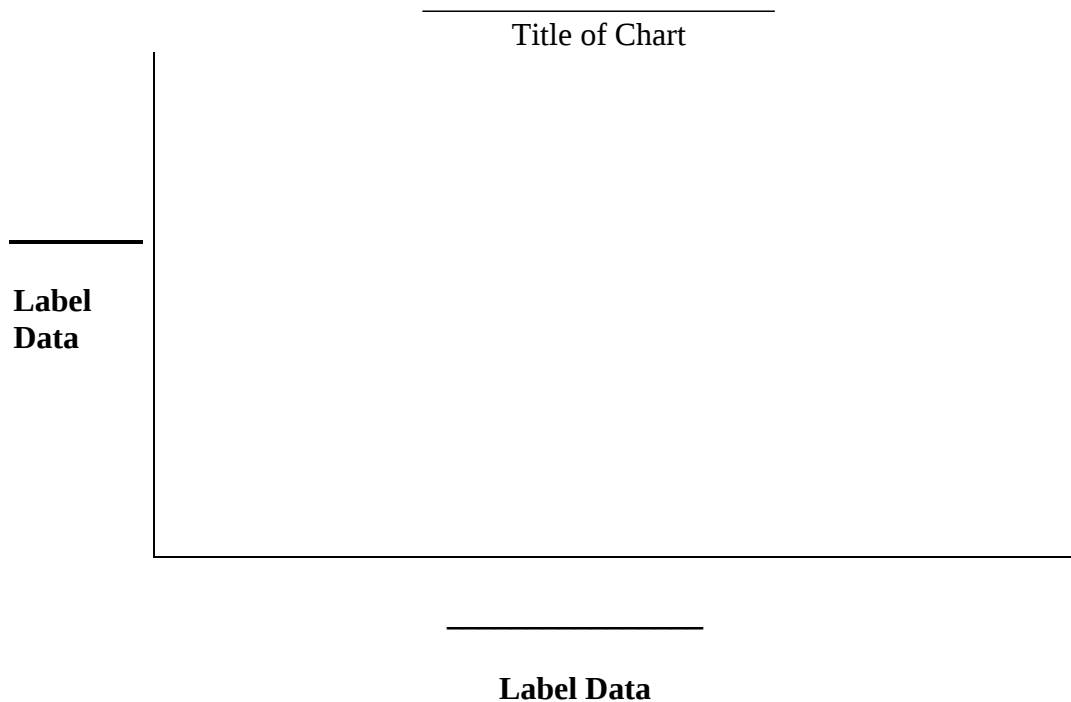
1. In the first year of business a crawfish dealer sold 1572 pounds of crawfish, in its second year he sold 1753 pounds, in his third year he sold 152 less than in his second year. How many pounds of crawfish did he sell in 3 years?

First, write a number sentence to show how many pounds he sold in the third year alone.

Then, write a number sentence to show how many pounds he sold in all three years together.

Solve the equations above.

Create a line graph showing the three year sales.



Name _____

Date _____

2. Solve the following problems using the information below.

- Bob caught twice as many fish using crawfish as bait than he caught using worms.
- John caught the same number of fish using crawfish as bait as Bob caught using worms.
- John caught two more fish using worms than he did using crawfish as bait.
- John caught six fish using worms.

Create a number sentence solving for the number of fish John caught using crawfish.
Solve the equation.

Create a number sentence showing how many fish Bob caught using crawfish. Solve.

Fill in the following table.

	Bob	John
Fish caught using crawfish.		
Fish caught using worms.		

Fifth Grade: Grade Level Expectations for Science

Page 90

Life Science: Populations and Ecosystems

22. Develop and use a simple dichotomous key to classify common plants and animals (LS-M-C1)

Page 91

Life Science: Populations and Ecosystems

23. Construct food chains that could be found in ponds, marshes, oceans, forests, or meadow (LS-M-C2)

25. Compare food chains and food webs (LS-M-C2)

Louisiana **CRAWFISH PROMOTION** **AND RESEARCH BOARD**



Name _____

Date _____

Dichotomous Key for Animals with External Skeletons

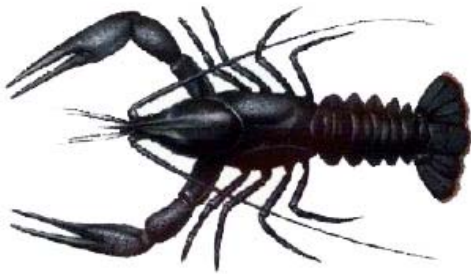
- 1a. Six Legs
- 1b. Eight Legs
- 1c. More than Eight Legs

Insect
Arachnid
Go to 2

- 2a. Two Antennae
- 2b. Four Antennae

Myriapod
Crustacean

Use the Dichotomous Key above to label the animals below.









Name _____

Date _____

List the plants and animals in the correct columns.

otters, blackberries, rabbits, crawfish, bobcat, water fleas, algae

Lives in Forests	Lives in Ponds

Create a food chain for forest animals.

Create a food chain for pond animals.

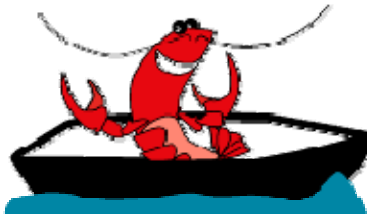
Fifth Grade: Grade Level Expectations for Social Studies

Pages 93- 94

Environment and Society

- 15.** Explain and give examples of how Native Americans and Europeans adapted to living in a particular North American physical environment (G-1D-M2)
- 16.** Identify the natural resources used by people in the United States (G-1D-M3)

Louisiana **CRAWFISH PROMOTION AND RESEARCH BOARD**



Name _____

Date _____

Crawfish History

<http://www.breauxbridgelive.com/crawfish.html> ; written in 2001

So how did the lowly crawfish gain such prominence in our culture? Well, actually, Native Americans in the area were the first credited with harvesting and consuming crawfish even before the Cajuns arrived on the scene. They used to bait reeds with venison (deer meat), stick them in the water and periodically pick up the reeds with crawfish attached to the bait. By using this method, the Native Americans would catch bushels of crawfish for their consumption. By the 1930s nets were substituted, and by the 1950s the now ubiquitous crawfish trap was widely used. The trap is still the current method of harvesting mudbugs.

Mrs. Charles Hebert is credited with being the first to put crawfish on a menu in the early 1920s. By the 1930s, crawfish were seen as a good source of protein, especially for poor Cajuns, though it actually took some convincing to get the locals to eat them. Crawfish étouffée made its debut in the 1950s, and now is the quintessential Cajun dish. Étouffée is prepared in as many ways as there are Cajun cooks living in our area-each one an original.

Today, more than 1,600 farmers produce crawfish, utilizing over 111,000 acres of man-made ponds. Louisiana is the largest producer of crawfish in the world. St. Martin Parish, Breaux Bridge's home, produces the most crawfish in the state and has the most crawfish acreage in the eight-parish area known as Acadiana. Crawfish is now a multimillion dollar industry. All of this from a relatively insignificant crustacean.

Sources: Kenneth Delcambre, Breaux Bridge City Historian; Jim Bradshaw, History of Acadiana; Jimmy Avery and Dwight Landreneau, Louisiana Crawfish, LSU Agricultural Center

1. Name two natural resources the Native Americans used according to the article above.
2. What other foods do you think Native Americans living in the area that is now Louisiana might have eaten?
3. Circle the things Native Americans would have eaten in this area.

Rice Gazelles Corn Ostrich Fish Turtles Deer Whales

Seals Geese Crawfish Rabbit Squirrel Ducks Blackberries

Footnote: The above history is specific to Southwest Louisiana. Crawfish were recorded as an item of commerce in the French Market in New Orleans in the late 1800s. The Foret family in LaPlace was canning crawfish bisque in the early 1930s. They hired people to catch crawfish with set nets in the swamp to the west of New Orleans along the Mississippi River.

Name _____

Date _____

Crawfish History (another version)

<http://www.cajuncrawfish.com/page.cfm?sct=club&pg=history>

History has always been a relative concept. The people who write the history books may not always have the most accurate memories. In the case of the history of Crawfish, we will let you, our Internet visitor, be our impartial judge and jury. According to Thibodeaux Comeaux, a rice farmer in Ville Platte, this story is true. Drop us some mail if you have an opinion on our version of history.

"Few people actually know this, but Crawfish have only been around since 1775. See, it all started when the French living in Acadie, Nova Scotia were expelled from their land by the British. By land and sea they traveled across North America to arrive in South Louisiana. They were then welcomed by the French who already lived there. The Spanish helped out by providing land grants to these "Acadians." Now you may be asking yourself what Crawfish have to do with this story. Actually, they have everything to do with it.

You see, people up in Nova Scotia really liked lobster. So it was only natural that when the Acadians made their move to South Louisiana, they brought their Lobster with them. The problem was that the lobsters lost their appetite along the way and shrunk up quite a bit. Since this smaller lobster didn't really look like a lobster any more, the Acadians, now known as Cajuns, called this small crustacean a Crawfish."

1. Is the historical account above truth or fiction?
2. What food did the French settlers really enjoy in Nova Scotia?
3. How did the French Canadian settlers adapt to moving to Louisiana?
4. How did this adaptation shape the current culture in Louisiana?

Sixth Grade

GLE

(Grade Level Expectation)

Based

Worksheets

&

Activities

Louisiana

CRAWFISH PROMOTION

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Sixth Grade: Grade Level Expectations for English Language Arts

Pages 97- 99

Reading and Responding: Standard 1

1. Identify word meanings using a variety of strategies, including:

- using context clues (e.g., definition, restatement, example, contrast)
- using structural analysis (e.g., roots, affixes)
- determining word origins (etymology)(ELA-1-M1)

3. Develop specific vocabulary (e.g., scientific, content-specific, current events) for various purposes (ELA-1-M1)

Reading and Responding: Standard 6

10. Use knowledge of the distinctive characteristics to classify and interpret elements of various genres, including:

- fiction (e.g., myths, historical fiction)
- nonfiction (e.g., newspaper articles, magazine articles)
- poetry (e.g., lyric, narrative)
- drama (e.g., short plays) (ELA-6-M3)

Reading and Responding: Standard 7

11. Demonstrate understanding of information in grade-appropriate texts using a variety of strategies, including:

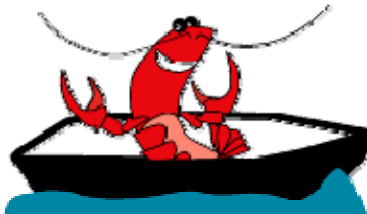
- sequencing events and steps in a process
- summarizing and paraphrasing information
- identifying stated or implied main ideas and supporting details
- comparing and contrasting literary elements and ideas
- making simple inferences and drawing conclusions
- identifying literary devices (ELA-7-M1)

14. Analyze an author's stated or implied purpose for writing (e.g., to explain, to entertain, to persuade, to inform, to express personal attitudes or beliefs) (ELA-7-M3)

Louisiana

CRAWFISH PROMOTION

AND RESEARCH BOARD



Killers from across the pond

By Dick Warner

IRISH_EXAMINER.COM

I was walking along the bank of a small river near my house when I came across the spraint (droppings) of a mink. I took out my pocket knife and dissected it. (**Naturalists** get up to some odd things!)

My worst fears were confirmed. The spraint was full of fragments of crayfish shell.

The white-clawed crayfish is an endangered species, and Ireland is one of its internationally important **strongholds**.

1. Define **naturalist**, and **stronghold**. Use clues from the reading passage.

2. Is the author a naturalist?

The crayfish, or little freshwater lobster, is also found in Britain, France and Spain. But in these countries crayfish are a commercially important species and are farmed.¹

The white-clawed crayfish is remarkably slow-growing, taking about seven years to reach full size. This is not appealing to crayfish farmers, so in Britain and on the continent they imported much faster-growing species from North America.

3. Why is the white-clawed crayfish not farmed?

But the imported crayfish carried a viral disease² which European crayfish had no immunity to. The white-clawed crayfish became virtually extinct in western Europe, except in Ireland, because the American species had never been introduced here.

4. What caused the white-clawed crayfish to nearly become extinct?

5. Why does Ireland still have a lot of white-clawed crayfish?

Then the mink came on the scene. It also came from North America there is a European mink but nowadays it is very rare in western Europe and has never been recorded in Ireland.

The American mink first arrived here in 1951. It too was a farm animal, bred for its pelt. By the mid-1960s mink were wild in our countryside. Some of them may have escaped from fur farms; others were probably deliberately released when the price of fur crashed in the 1960s.

¹ Crawfish in Europe are farmed to replenish stock. They are not farmed as a food source. The food-sized crayfish are harvested, almost totally, from natural stocks.

² Crawfish carry a fungal disease- not viral.

The mink spread rapidly. The last place to remain mink-free was Connacht, but I saw one swimming across a lake in west Mayo last week.

6. How did the American mink come to live wild in Europe?

They are not **exclusively aquatic** like their close relation, the otter, but they prefer to feed in and around water. One of their favourite foods is crayfish and I am convinced that they are making significant **inroads** into our important population of white-clawed crayfish.

7. Define the term **exclusively aquatic** and the word **inroads**. Use the text for clues.

The story of the crayfish and the mink is a **parable**. The introduction of foreign species, whether deliberate or accidental, has been identified as one of the **principal threats** to European **bio-diversity**.

7. Define **parable**, **principal threats**, and **biodiversity**. Use the text for clues.

8. Is this story fiction or nonfiction?

Gardeners have been guilty of some spectacular sins in this respect. Think of the **rhododendrons** strangling the native woodlands of Killarney, the giant hogweed which can put you in hospital if you merely brush against it, and the highly invasive Japanese knotweed.

Then there are sika deer which are not only pests of forestry and farming, but also interbreed with red deer. Or that's the way some scientists see it. Others are complicating the argument by claiming that the red deer is also an introduced species, originally brought in by neolithic farmers, with many introductions since. The study of wild red deer has become particularly difficult in the past 20 years because of the number of escapees from farms.

9. Are rhododendrons a type of plant or animal?

10. Why does the author start talking about plants and deer at this point in the article?

There is one hopeful sign where all these **invasions** are concerned.

Almost all the species that give trouble are relatively recent introductions. With the passage of time, the immigrants tend to get **assimilated** and the problems tend to **diminish**. In time the mink, the zebra mussel and the Japanese knotweed will find their niche in our native fauna and flora.

After all, pheasants, rabbits and hedgehogs were introduced a long time ago and now fit in pretty well to the pattern of our countryside.

11. Define **invasions**, **assimilate** and **diminish**. Use the context of the text as clues.

12. What do you think will happen to the white-claw crawfish in Ireland?

13. Why do you think the author wrote this article?

14. Write a short paragraph summarizing this article. What are the main points?

Sixth Grade: Grade Level Expectations for Math

Page 101- 102

Algebra

15. Match algebraic equations and expressions with verbal statements and vice versa (A-1-M, A-3-M, A-5-M, P-2-M)

16. Evaluate simple algebraic expressions using substitution (A-2-M)

17. Find solutions to 2-step equations with positive integer solutions (e.g., $3x-5=13$, $2x+3x=20$) (A-2-M)

Louisiana CRAWFISH PROMOTION AND RESEARCH BOARD



Name _____

Date _____

Match the statements on the left to the correct algebraic equations on the right.

Bill ate two more crawfish than Jill (x). They ate 14 crawfish together. How many crawfish did Jill eat?	$14 + 14 - 2 = x$
Jim used 2 fewer crawfish for bait than he did worms (x). He baited up his line 14 times. How many worms did he use?	$x + 2 + x = 14$
Tommy caught 14 fish. Gerald caught 2 less than Tommy. How many did they catch together?	$x + x - 2 = 14$

Let's use substitution to solve these equations.

1. Bill (y) ate two more crawfish than Jill (x). They ate 14 crawfish together. How many crawfish did Jill eat?

Bill (y) ate two more crawfish than Jill (x). $\text{Bill} = y = x + 2$

$\text{Jill} = x$

They ate 14 crawfish together.

$\text{Bill} + \text{Jill} = x + y ; x + y = 14$

Substitute y with $x + 2$ in the second equation. Write the new equation below.

2. Jim used 2 fewer crawfish (y) for bait than he did worms (x). He baited up his line 14 times. How many worms did he use?

$$\text{Worms} = x$$

$$\text{Crawfish} = y = x - 2$$

$$\text{He baited up his line 14 times. } \text{worms} + \text{crawfish} = x + y ; x + y = 14$$

Substitute $x-2$ for y in the last equation. Write the new equation below.

3. Tommy caught 14 fish. Gerald caught 2 less than Tommy. How many did they catch together (x) ?

$$\text{Tommy} = 14$$

$$\text{Gerald} = 14-2$$

$$\text{Number of Fish Tommy Caught} + \text{Number of Fish Gerald Caught} = X$$

Substitute the numbers given in the description into the word equation. Write the number equation below.

Solve each of the equations above.

How many crawfish did Jill eat?

How many worms did Jim use?

How many fish did Tommy and Gerald catch?

Sixth Grade: Grade Level Expectations for Science

Pages 104- 105

Science as Inquiry: The Abilities Necessary to Do Scientific Inquiry

15. Identify and explain the limitations of models used to represent the natural world (SI-M-A5)

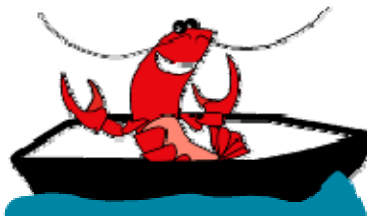
16. Use evidence to make inferences and predict trends (SI-M-A5)

17. Recognize that there may be more than one way to interpret a given set of data, which can result in alternative scientific explanations and predictions (SI-M-A6)

18. Identify faulty reasoning and statements that misinterpret or are not supported by the evidence (SI-M-A6)

19. Communicate ideas in a variety of ways (e.g., symbols, illustrations, graphs, charts, spreadsheets, concept maps, oral and written reports, equations) (SI-M-A7)

Louisiana CRAWFISH PROMOTION AND RESEARCH BOARD



Name _____

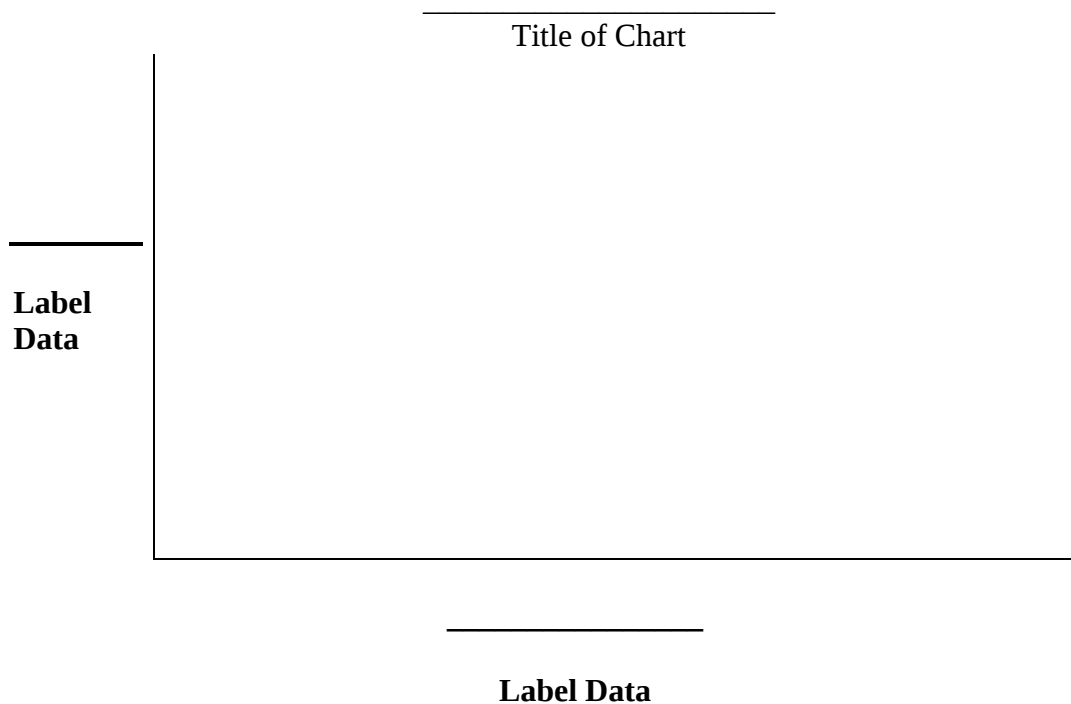
Date _____

Louisiana Crawfish Production

= pounds ; \$ = dollar

Year	Acres	Wild Production # Millions	Pond Production # Millions	Farm Value \$ Millions
2002	106,653	14.0	60.5	49.3
2003	129,849	10.2	73.0	47.5
2004	118,250	8.3	70.0	41.7
2005	116,734	8.2	73.8	40.6

Draw a line graph with the year as the y axis, and the # millions production as the x axis. Draw two lines, one showing wild production and one showing pond production.



1. What is the general trend of these two markets? Is wild production increasing or decreasing? Is farm production increasing or decreasing?

2. Looking aback at the original table, is the value for farmed crawfish increasing, decreasing or staying the same? Hint: Divide the \$ Million by the Pond Production # Million for 2002 and for 2005. How do they compare?

3. Can you tell from the chart why the pond production varies?

4. Is the pond production per acre decreasing, increasing or staying the about the same? Hint: Divide the Pond Production # Millions by the Acres for 2002 and for 2005.

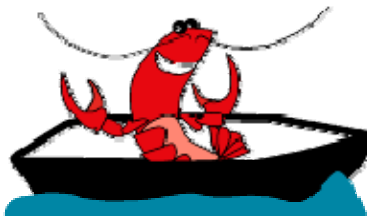
Sixth Grade: Grade Level Expectations for Social Studies

Page 107

Geography: The World in Spatial Terms

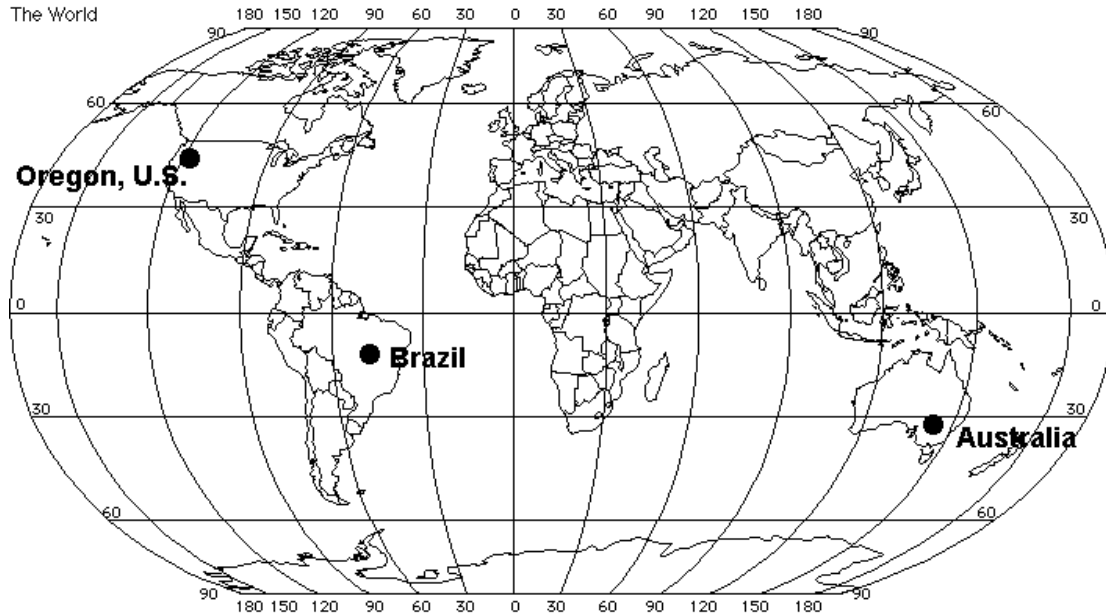
1. Use latitude and longitude to determine direction or locate or compare points on a map or representation of a globe (G-1A-M2)

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Latitude

Latitude is used to express how far north or south you are, relative to the equator. If you are on the equator your latitude is zero. If you are near the North Pole your latitude is nearly 90 degrees north. If you are near the South Pole your latitude is almost 90 degrees south.

Crawfish

Red Swamp Crawfish has been introduced and has survived in the wild as far north in the United States as Oregon and as far south in the world as Brazil.

1. Looking at the map above, estimate the range of crawfish by latitude. _____
2. Would you consider crawfish hardy and adaptable by the size of its range?

Seventh Grade

GLE

(Grade Level Expectation)

Based

Worksheets

&

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Louisiana

CRAWFISH PROMOTION

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Seventh Grade: Grade Level Expectations for Language Arts

Page 110

Writing: Standard 2

16. Organize individual paragraphs with topic sentences, relevant elaboration, and concluding sentences (ELA-2-M1)

Writing/ Proofreading: Standard 3

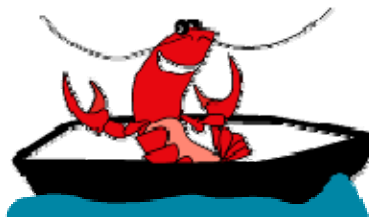
23. Use standard English punctuation, including:

- Commas to set off direct quotations, nouns of direct address, and after introductory words or phrases
- Semicolons or colons to separate independent clauses (ELA-3-Ms)

24. Write paragraphs and compositions following standard English structure and usage, including:

- Varied sentence structures, including complex sentences
- Antecedents that agree with pronoun in number, person and gender
- Sentences without double negatives (ELA-3-M3)

Louisiana CRAWFISH PROMOTION AND RESEARCH BOARD



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Use the facts below to write a paragraph. Use varied sentence structures, including complex sentences. Do not reuse the short sentences presented below. Either combine these sentences to make complex sentences or reword the sentences, while keeping the general concept.

For example, the first two sentences below could be combined to make the topic sentence of the paragraph. Topic Sentence: **Crawfish are crustaceans, meaning they have a hard shell.**

Crawfish are crustaceans.

Crustacean means that it has a hard shell.

This shell acts as a skeleton.

The shell protects the soft organs.

The shell does not grow.

Crawfish molt as they grow.

Molting means to shed its shell and grow a new, larger one.

Crawfish are vulnerable when they molt.

Crawfish are cannibals.

Crawfish eat other crawfish when the other crawfish are molting.

Crawfish molt about 11 times before they reach adulthood.

Many crawfish do not make it to adulthood.

Seventh Grade: Grade Level Expectations for Math

Page 112

Data Analysis, Probability, and Discrete Math

35. Use informal thinking procedures of elementary logic involving if/then statements (D-3-M)

Pages 113- 114

Algebra

14. Write a real-life meaning of a simple algebraic equation or inequality, and vice versa (A-1-M, A-5-M)

15. Match algebraic inequalities with equivalent verbal statements and vice versa (A-1-M)

Louisiana CRAWFISH PROMOTION AND RESEARCH BOARD



Name _____

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True or False

- _____ If all decapods are crustaceans and all crawfish are decapods, then crawfish must be crustaceans.
- _____ If some arthropods are crustaceans and all spiders are arthropods, then spiders must be crustaceans.
- _____ If all amphipods have exoskeletons and all crawfish have exoskeletons, then crawfish must be amphipods.
- _____ If all crustaceans are arthropods and some crustaceans are crawfish, crawfish must be arthropods.

Name _____

Date _____

Match the statements on the left to the correct algebraic equations connected with each statement on the right.

Crawfish pond A produced 500 pounds of crawfish. Crawfish pond B produced twice as much as Crawfish pond C. Ponds A, B, and C produced 1,700 pounds of crawfish. How much crawfish did ponds B and C each produce?	$1,100 - 500 + C = 1,700$
Crawfish pond A produced 500 pounds of crawfish. Crawfish ponds B and C produced 1,700 pounds of crawfish. Crawfish ponds A and B produced 1,100 pounds of crawfish. How much crawfish did ponds B and C each produce?	$500 + 3C = 1,700$
Crawfish ponds A and C produced 500 pounds of crawfish. Crawfish pond A produces 1,000 pounds less than crawfish pond B. Crawfish ponds A, B, and C produced 1,700 pounds of crawfish. How much crawfish did ponds A, B, and C each produce?	$200 + C = 500$

Check your work by working each problem out fully.

Crawfish pond A produced 500 pounds of crawfish. Crawfish pond B produced twice as much as Crawfish pond C. Ponds A, B, and C produced 1,700 pounds of crawfish. How much crawfish did ponds B and C each produce?

$$A = 500, B = 2C$$

$$A + B + C = 1,700$$

Substitute 500 for A and 2C for B and rewrite the equation.

Name _____

Date _____

Crawfish pond A produced 500 pounds of crawfish. Crawfish ponds B and C produced 1,700 pounds of crawfish. Crawfish ponds A and B produced 1,100 pounds of crawfish. How much crawfish did ponds B and C each produce?

$$A = 500$$

$$B + C = 1,700$$

$$A + B = 1,100$$

Substitute 500 for A. Then solve for B in the third equation.

Then substitute and solve for equation number two.

Crawfish ponds A and C produced 500 pounds of crawfish. Crawfish pond A produces 1,000 pounds less than crawfish pond B. Crawfish ponds A, B, and C produced 1,700 pounds of crawfish. How much crawfish did ponds A, B, and C each produce?

$$A + C = 500$$

$$A = B - 1,000$$

$$A + B + C = 1,700$$

Make appropriate substitutions and solve the problem. Hint: start by substituting 500 for the appropriate letters in equation number three.

Seventh Grade: Grade Level Expectations for Science

Pages 116- 117

Populations and Ecosystems

29. Predict the impact changes in a species' population have on an ecosystem (LS-M-C4)

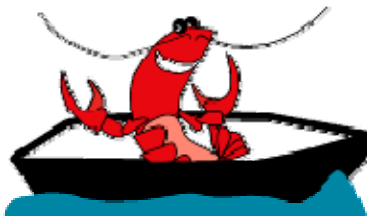
Adaptations of Organisms

31. Describe and evaluate the impact of introducing nonnative species into an ecosystem (LS-M-D1)

Science and the Environment

39. Analyze the consequences of human activities on ecosystems (SE-M-A2)

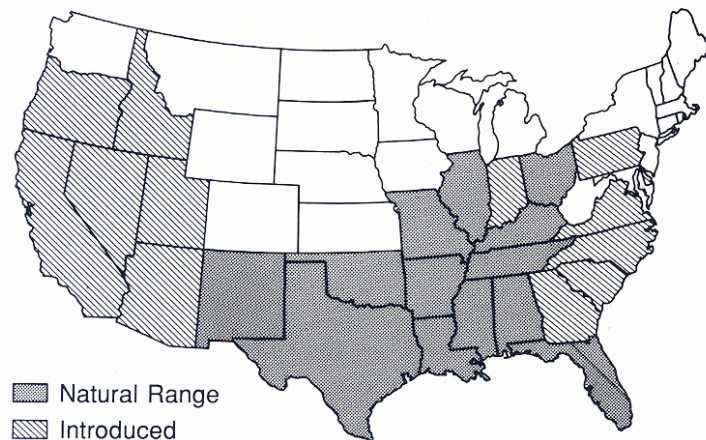
Louisiana CRAWFISH PROMOTION AND RESEARCH BOARD



Name _____

Date _____

Red Swamp Crawfish



Description: Adult red swamp crawfish are dark red, and juveniles are gray. The pincers are narrow and long.

Habitat: Red swamp crawfish are tolerant to a wide salinity range. They can be found in muddy banks of sloughs, rivers, swamps and irrigation ditches and in both fresh and brackish water.

Concerns: Crawfish are economically valuable. They are the basis of profitable aquaculture in Louisiana, where they are used for Cajun cooking. They have been intentionally introduced outside their native range for aquaculture operations. They are aggressive, territorial, and are generalist feeders. This makes them a threat to organisms that rely on the same resources. They may **out-compete native crawfish** in areas where they have been introduced. They also **prey upon endangered newts**. The **burrowing behavior can weaken banks and levees**, thereby increasing erosion and causing destruction to important wildlife habitat.

1. Name three states where Red Swamp Crawfish have been introduced?
2. What can happen in these areas as Red Swamp Crawfish populations increase?

Name _____

Date _____

3. Name three ways in which Red Swamp Crawfish can damage the habitat and native species in an area where they have been introduced?

4. How have human activities indirectly harmed newt populations?

5. Can you think of any non-native plant or animal species causing problems in Louisiana? Name at least one plant and one animal that have been introduced in Louisiana.

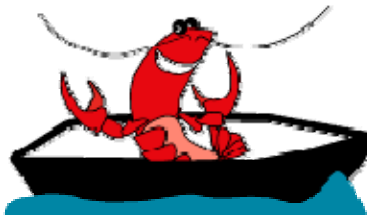
Seventh: Grade Level Expectations for Social Studies

Page 118

Environment and Society

9. Explain how the different physical environments in the American North and South led to different economic activities (G-1D-M2)

Louisiana CRAWFISH PROMOTION AND RESEARCH BOARD



Economic Resources

Teachers: Use the questions below to facilitate a discussion on how the physical environments led to different economic activities in different regions of the United States.

Natural resources: actual and potential resources supplied by nature; water, minerals, animals, etc.

Human Resources: employment of people, resources arising from investment in skills and education.

1. Historically, what area has had the greatest population in the United States, the north east or the south east?
2. Which area has a climate most conducive to the greatest number of crops?
3. Textiles and manufacturing has been a back bone for U.S. economics. Do you think the north or the south has relied more on manufacturing?
4. Name 6 states where you imagine fishing would be an important part of the economic structure.
5. Which state is known for lobsters?
6. Which state is known for crawfish?
7. Name 7 natural resources in Louisiana.

Eighth Grade

GLE

(Grade Level Expectation)

Based

Worksheets

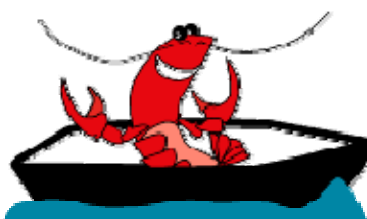
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Activities

Louisiana

CRAWFISH PROMOTION

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Eighth Grade: Grade Level Expectations for Language Arts

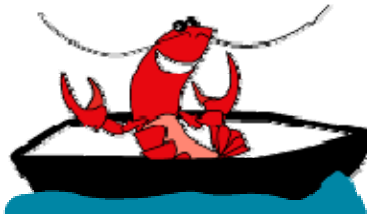
Pages 122- 124

Writing/ Proofreading: Standard 3

25. Apply knowledge of parts of speech in writing, including:

- Infinitives, participles, and gerunds
- Superlative and comparative degrees of adjectives
- Adverbs (ELA-3-M4)

Louisiana **CRAWFISH PROMOTION** **AND RESEARCH BOARD**



Name _____

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Gerunds are verbal words, which end in *-ing* and function as nouns.

Eating satisfies the rumble in my tummy.

Participles are verbal words, which usually end in *-ing* or *-ed*, and functions as adjectives.

I am uplifted by Tom, constantly smiling.

Infinitives are verbs in their simplest form (to + verb), which functions as nouns, adjectives, or adverbs.

I wanted to leave yesterday.

Circle the gerunds, draw squares around the participles, and underline the infinitives in the following sentences.

1. The scientist classified living organisms.
2. The exoskeleton, consisting of a chitin-protein matrix and calcium salts, protects the internal organs of the crawfish.
3. When young red crawfish are threatened, they may curl up into a ball to protect themselves.
4. The young will continue to return to their mother, because they are attracted by her pheromone.
5. The claw meat is tasty but difficult to pick out.

Name _____

Date _____

6. You'll need 10 pounds of whole crawfish to get one and half pounds of meat.
7. Crawfish farming is big business in Louisiana.
8. The harvest takes place during winter and spring.
9. Boiling crawfish is a popular way to prepare the meat.
10. Heavy feeding by adult crawfish takes place between dusk and daybreak.

Superlative Adjective: Of, relating to, or being the extreme degree of comparison of an adjective or adverb, as in *best* or *brightest*.

Comparative Adjective: Of, relating to, or being the intermediate degree of comparison of adjectives, as *better*, *sweeter*, or *more wonderful*, or adverbs, as *more softly*.

Draw a line under the superlative adjectives and circle the comparative adjectives in the following sentences.

1. Red Swamp crawfish are the most aggressive.
2. Red Swamp crawfish are darker than cave crawfish.

Name _____

Date _____

3. Red Swamp crawfish of Louisiana are hardier than White-Clawed Crawfish of Ireland.
4. Arthropods are the most successful terrestrial invertebrates.
5. Crustaceans are the most successful aquatic arthropods.
6. The antennae (plural) are longer than the antennules.
7. Female crawfish are usually smaller than males
8. Males have the largest claws.
9. Boiled crawfish are redder than live crawfish.
10. Crawfish have more legs than insects but fewer legs than centipedes.

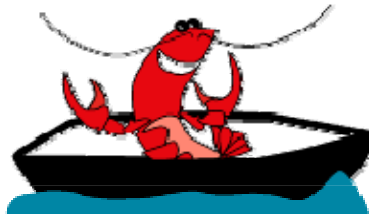
Eighth Grade: Grade Level Expectations for Math

Pages 126- 127

Measurement

- 19.** Demonstrate an intuitive sense of the relative sizes of common units of volume in relation to real-life applications and use this sense when estimating (M-2-M, G-1-M)
- 20.** Identify and select appropriate units for measuring volume (M-3-M)
- 21.** Compare and estimate measurements of volume and capacity within and between the U.S. and metric systems (M-4-M, G-1-M)
- 22.** Convert units of volume/capacity within systems for U.S. and metric units (M-5-M)

Louisiana CRAWFISH PROMOTION AND RESEARCH BOARD



Name _____

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Volume/capacity

Draw lines, matching the closest equivalent between the metric and U.S. measuring systems.

Metric

U.S.

liter	cubic yard
cubic meter	teaspoon
cubic dekameter	quart
milliliter	cubic foot

Fill in the table with the best choice to measure each item's volume.

Item	U.S. System	Metric System
Milk		
Crawfish pond		
Vanilla extract		
Lake		

Name _____

Date _____

Conversions

Milliliter = 0.2028841 Teaspoon	Cubic Meter = 1.3079506 Cubic Yards
Liter = 1.0566882 Quarts	Cubic Dekameter = 0.8107132 Acre Foot

Estimate Volume Conversions

1. A 900 cubic meter crawfish pond is about _____ cubic yards.
a. 1,000 b. 1,170 c. 1,200 d. 1,370
2. A 20 dekameter lake is about _____ acre feet.
a. 8 b. 12 c. 16 d. 20
3. Two liters of milk is about _____ quarts.
a. 1 b. 2 c. 3 d. 4
4. A teaspoon is about _____ milliliters.
a. 3 b. 4 c. 5 d. 6

Do the math. Figure actual conversions for the statements above, carrying out to the hundredths place.

1. 900 cubic meters = _____ cubic yards
2. 20 dekameters = _____ acre feet
3. 2 liters = _____ quarts
4. 1 teaspoon = _____ milliliters

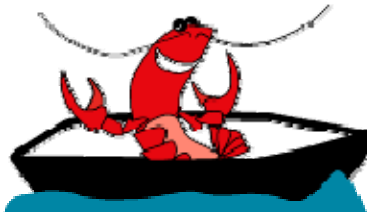
Eighth Grade: Grade Level Expectations for Science

Pages 129- 132

Science and the Environment

51. Analyze the consequences of human activities on global Earth systems (SE-M-A4)

Louisiana **CRAWFISH PROMOTION AND RESEARCH BOARD**



Name _____

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Crawfish and Water Birds

Jay V. Huner <http://www.americanscientist.org>

Just imagine the thrill of seeing several thousand white egrets, ibises and blue-hued herons, along with a hundred or more scarlet roseate spoonbills, exploding from the shallows of a southern Louisiana wetland. One does not have to be a birder to be amazed by the color and magnificence of these stately wading birds. Fortunately, such sights are now commonplace from mid-autumn into early summer in the Bayou State, a consequence of the expansion of rice farming and crawfish aquaculture there.

Brought nearly to extinction by hunters roughly a century ago, egret, heron, ibis and spoonbill populations have rebounded dramatically in southern Louisiana in the past 50 years. In other areas, the status of wading birds is not so rosy, as coastal wetlands succumb to the tide of development sweeping the American Sunbelt. Florida, for example, has long been noted for its many wading birds, but the loss of appropriate habitat in that state has forced some populations of these birds into decline. A million acres of coastal wetland in Louisiana have also disappeared, but the half million inland acres that are now flooded regularly to raise rice or crawfish have helped to compensate for that damage to the environment. So Louisiana's success merits attention—and nurturing.

1. Name two reasons that bird populations declined in Louisiana.

2. Why are these populations increasing now?

Although most people in my state admire such birds for their beauty and applaud their resurgence, crawfish "farmers" have become increasingly concerned about the damage that these animals do to their "crop" of small crustaceans. I began work in crawfish aquaculture when I was a graduate student at Louisiana State University in 1972, and even at that time owners were concerned about wading birds raiding the 40,000 or so acres of ponds they had by then built.

Today, Louisiana crawfish farmers have nearly three times that area in production. For the most part, they use these shallow ponds to raise red swamp crawfish (*Procambarus clarkii*), which look like tiny lobsters and are similarly tasty. Farm-raised and wild-caught animals now contribute equally to the 50,000 or so tons of live Louisiana crawfish sold each year, which accounts for nearly half of the global trade in this delicacy.

Despite the healthy growth of their industry, crawfish farmers continue to complain

Name _____

Date _____

loudly about losses from wading birds. They also worry about the large flocks of crawfish-eating cormorants, gulls, terns and, in some cases, pelicans, which have become common visitors to crawfish ponds in the winter and spring. Even coots, normally herbivorous, have become abundant and are feeding on crawfish to some degree.

Crawfish ponds are clearly water-bird magnets. Carnivorous birds have learned to take advantage of the concentration of nutrient-rich prey—crawfish, insects, worms, small fishes and tadpoles—that these artificial wetlands harbor. And herbivorous birds feast on the abundance of seeds and aquatic plants available in the ponds, which typically range from 10 to 20 acres in size and are normally a foot or so deep.

3. Although crawfish farmers can be thanked for bringing these birds back, the crawfish farmers are unhappy about the birds. Why?

Actually, the ponds are kept that full of water for only part of the year, typically from mid-fall through mid-spring, which simulates the natural hydrological cycle that local wetlands experience. Crawfish farmers often use the summer months to cultivate rice in their ponds by putting just a few inches of water in them. Raising this second crop adds to their profits and does not interfere with the production of crawfish, which normally begins again in October. (Incidentally, the combination of crawfish and rice makes an excellent gumbo dinner.)

Raising crawfish in this way is relatively inexpensive because, unlike farmed shrimp, these tiny crustaceans do not need to be fed fish or vegetable meal. Crawfish are omnivorous and can devour the sundry small animals that proliferate once the plants in the ponds begin to deteriorate. They also eat the decomposing vegetation itself, along with various seeds and stray rice grains, where rice was grown during the previous summer. So even the herbivorous birds that do not feed on crawfish directly compete with them for food. But gauging the damage that birds do to aquaculture operations has proved difficult, in part because crawfish management is an inexact science.

Farming Crustaceans

Adult crawfish stocked into new ponds in the spring burrow into the enclosing mud levees before the shallow pools are drained for the summer. There is no real control of how many crawfish survive, so there is no way to regulate the number of young crawfish that appear when these impoundments are refilled in the autumn. Because the growth of the animals slows when their density is too high, a given pond may have so many crawfish that they do not reach sizes that are desirable to market. In such cases, allowing birds to reduce the density of crawfish seems a logical method to assure adequate growth.

Name _____

Date _____

Thus many environmentalists contend that crawfish farmers should be happy that water birds thin their crawfish crops. The rub is that when small crawfish are culled in experimental ponds, there is no substantial compensatory growth in those remaining. Only when these same small crawfish are moved to underpopulated ponds do they thrive and attain large size. It would appear that some unidentified environmental factor in the original pond must limit the ability of small crawfish to grow there. In any event, computer simulations support the position of the farmers: Heavy predation from birds, regardless of the species involved, probably hurts crawfish production.

Louisiana crawfish aquaculture is also threatened by another increasingly common phenomenon: globalization. The problem is that the importation of frozen crawfish products from China has depressed market prices. Many crawfish farmers, disappointed by the loss of income, are instead trying to raise other crops, such as sugar cane, that do not require them to flood the land. As a way to make ends meet, some have begun leasing the right to hunt the many ducks and geese that visit their ponds.

If Louisiana crawfish aquaculture disappears, it is not only the farmers that will be displaced. Consider one well-known rookery for wading birds at Lake Martin, just east of Lafayette. This vast breeding ground—a breathtaking site to visit—undoubtedly takes this spectacular form because it is situated within 25 miles of some 30,000 acres of crawfish ponds, which support, in large part, these nesting birds and their offspring throughout most of the year. Losing too much crawfish acreage in that vicinity would thus devastate the rookery, which would be an environmental tragedy.

4. What global factor is causing a decrease in Louisiana crawfish farming?

5. How might this decrease in crawfish farming affect bird populations?

End of an Era?

Thanks to the rise of crawfish aquaculture, Louisiana provides the wintering and spring nesting grounds for a major portion of the wading birds inhabiting North America. What is more, the marginal areas around crawfish ponds shelter countless owls, hawks, eagles and ospreys, as well as migrating shorebirds and neotropical songbirds, not to mention their more sedentary cousins. The agricultural community in this one state has thus helped to maintain the legacy of an entire continent's birds—while doing quite well for itself—over the past half-century.

Name _____

Date _____

6. Name six kinds of birds, which benefit from crawfish farming. Hint: you may need to look back to the beginning of this article.

But crawfish farmers now need incentives to continue their traditional practices. A healthy crawfish industry is certainly important to the economy of Louisiana—and so is a healthy suite of wetland birds. Such flocks improve the quality of life for all residents and, in places like Lake Martin, can increase opportunities for eco-tourism, an avenue to greater income that crawfish farmers need to pursue more vigorously. Private and government conservation agencies can also help by subsidizing the construction and maintenance of crawfish ponds, just as they now pay for the creation of other sorts of artificial wetlands. Scientists, too, might be able to bring crawfish farmers and environmentalists closer together, if we can figure out how predatory birds can serve to thin overpopulated crawfish ponds in a way that boosts the size of those remaining. It is my hope that such efforts will effect meaningful changes soon, so that two treasured natural resources—crawfish and water birds—can be sustained on into the 21st century.

7. Name two things that are important to Louisiana's economy.

8. What efforts need to be made and by whom to ensure that crawfish farming in Louisiana continues for the sake of Louisiana's economy and for the sake of the nation's birds?

Eighth: Grade Level Expectations for Social Studies

Pages 134- 135

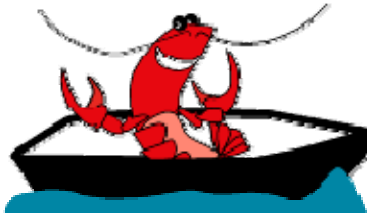
Louisiana History

75. Describe the contributions of ethnic groups significant in Louisiana history (H-1D-M1)

79. Explain how Louisiana's natural resources have shaped its history (H-1D-M4)

81. Explain cultural elements that have shaped Louisiana's heritage (e.g. festivals music, dance, food, languages) (H-1D-M6)

Louisiana CRAWFISH PROMOTION AND RESEARCH BOARD



Name _____

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Read the first three paragraphs from the article, Louisiana's Food Tradition. For the full article, visit the website, www.louisianafolklife.org.

Louisiana's Food Traditions

http://www.louisianafolklife.org/LT/CSE/creole_food_trad.html; written in 2000

Louisiana's complex blending of cultures over 300 years produced distinctive regional food traditions for which we are known worldwide. But we have other food traditions that are not so well known. Each cultural group has retained food traditions, and even within cultural groups, traditions vary from community to community, and family to family.

Food traditions are particularly intriguing because they are some of the most persistent of traditions. Generally, people resist changing their food patterns. As a result, food often becomes closely tied to cultural identity and can reveal cultural processes such as blending, diffusion, or maintenance.

Gumbo is an excellent example of cultural blending, or creolization. This dish so closely identified with South Louisiana, melds African, European, and Native American cultures. The word itself is derived from the Bantu word for okra, *nkombo*. The okra plant is of African origin, but filé (ground sassafras leaves) is Native American. The origin of gumbo--usually defined as a soup-like dish featuring two or more meats or seafood and served with rice--is often attributed to the French bouillabaisse, but the strong preference for soups in Africa reinforced the tradition.

Some of the ethnic groups, which have settled in Louisiana:

Native Americans Germans French (Acadians) Spanish Italian African

Which of the ethnic groups above influenced the popular foods below? Some foods may be blends of more than one culture.

Sausage	Étouffée	Muffulettas
Tamales	Pralines	Beignets
Corn	Jambalaya	Okra
Grits	Crawfish	Seafood pasta

Name _____

Date _____

Louisiana's Most Delicious Natural Resource

<http://www.crawfish.org>

Dating back to the native Americans and the early European settlers, the crawfish has been an inherent part of Louisiana culture. Abundant in the swamps and marshes across south Louisiana, crawfish were a favorite food of early residents. Centuries later, crawfish season in Louisiana is still exciting, with crawfish boils and backyard parties a time-honored tradition.

Crawfish are freshwater crustaceans. Louisiana has more than 30 different species of crawfish, but only two species are commercially important to the industry; the red swamp crawfish (*Procambarus clarkii*) and the white river crawfish (*Procambarus zonangulus*).

Both market incentives and technological advances have explained the Louisiana crawfish industry to include farming as well as fishing in the wild. In the 1960's, crawfish farming made its debut with the cultivation of crawfish in man-made ponds, using controlled water levels, forage management and water recalculation techniques to produce a highly marketable product.

During the next 35 years, crawfish farming developed into the largest freshwater crustacean aquaculture industry in the United States. Louisiana leads the nation, producing more than 90% of the domestic crop. More than 1,600 farmers produce crawfish in some 111,000 acres of ponds. More than 800 commercial fishermen harvest crawfish from natural wetlands, primarily the Atchafalaya Basin. The combined annual yield ranges from 75 million to 105 million pounds. The total economic impact on the Louisiana economy exceeds \$120 million annually, and more than 7,000 people depend directly or indirectly on the crawfish industry.

1. How long has crawfish been important to Louisiana's economy?
2. What happened in the 1960s to increase the importance of crawfish on Louisiana's history and culture?
3. How many people are dependent on the crawfish industry in Louisiana?
4. How has the importance of crawfish spilled over into Louisiana's culture, such as fairs and festivals? (Answer from personal experience.)
5. Can you think of other important natural resources in Louisiana?

Update on 2005 Statistics: Farmed crawfish production occupied almost 117,000 acres during the 2005 harvest season, down slightly from 118,250 the previous year. A total of 73.8 million pounds of crawfish were sold, with a value of \$40.6 million, making farm-raised crawfish the state's most valuable aquaculture crop.

<http://www.lsuagcenter.com/mcms/webtools/viewExternal.aspx?url=http://www2.lsuagcenter.com/agsummary/>

High School Biology

GLE

(Grade Level Expectation)

Based

Worksheets

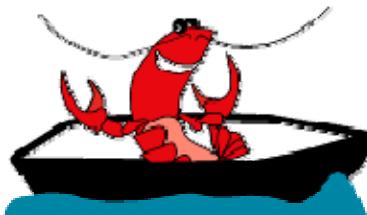
&

Activities

Louisiana

CRAWFISH PROMOTION

AND RESEARCH BOARD



**Science: Grade Level Expectations for Biology
Recommended for Grade 10**

Pages 138- 143

Systems and the Behavior of Organisms

- 32. Analyze the interrelationships of organs in major systems (LS-H-F1, LS-H-E3)
- 33. Compare structure to function of organs in a variety of organisms (LS-H-F1)
- 35. Explain how selected organisms respond to a variety of stimuli (LS-H-F3)
- 36. Explain how behavior affects the survival of species (LS-H-F4)

Page 145

Interdependence of Organisms

- 24. Analyze food webs by predicting the impact of the loss or gain of an organism (LS-H-D1)
- 26. Analyze the dynamics of a population with and without limiting factors (LS-H-D3)
- 27. Analyze positive and negative effects of human actions on ecosystems (LS-H-D4)

Pages 146- 153

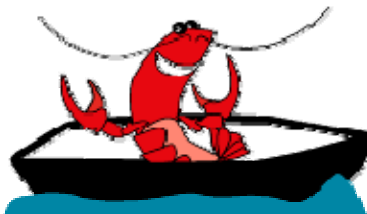
Science as Inquiry: The Abilities to Do Scientific Inquiry

- 3. Plan and record step-by-step procedures for a valid investigation, select equipment and materials, and identify variables and controls (SI-H-A2)
- 7. Choose appropriate models to explain scientific knowledge or experimental results (e.g., objects, mathematical relationships, plans, schemes, examples, computer simulations) (SI-H-A4)
- 9. Write and defend a conclusion based on logical analysis of experimental data (SI-H-A7)

Louisiana

CRAWFISH PROMOTION

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Crayfish Dissection

Pictures: Modern Biology, Holt

Teachers: Note that there are 34 species of crayfish in Louisiana but that the two commercial species are Red Swamp crayfish and White River crayfish. Separate your crayfish and use only one species for this dissection. Living Red Swamp crayfish have red pigment somewhere on their bodies- check the claws and the bases of the walking legs. Living White River crayfish do not have any red pigment. The two halves of the carapace almost always touch on the top of a Red Swamp crayfish's head. There is always a distinct, although narrow gap in White River crayfish. Also, Red Swamp crayfish have a distinctive blue pigmented line on the underside of the tail, which the White River crayfish does not have.

The Exercise below is reprinted with permission from the Stuttgart School District in Arkansas.

Objectives:

- Describe the appearance of various organs found in a crayfish.
- Name the organs that make up systems of the crayfish.

Materials:

- gloves, magnifying glass, a lab apron, plastic ziplock bag preserved crayfish, pen, dissecting tray, paper towels, scissors, forceps, dissecting needle, and dissecting pins.

Purpose:

In this lab, you will observe the external structures of a crayfish and dissect it to study its internal structures and systems.

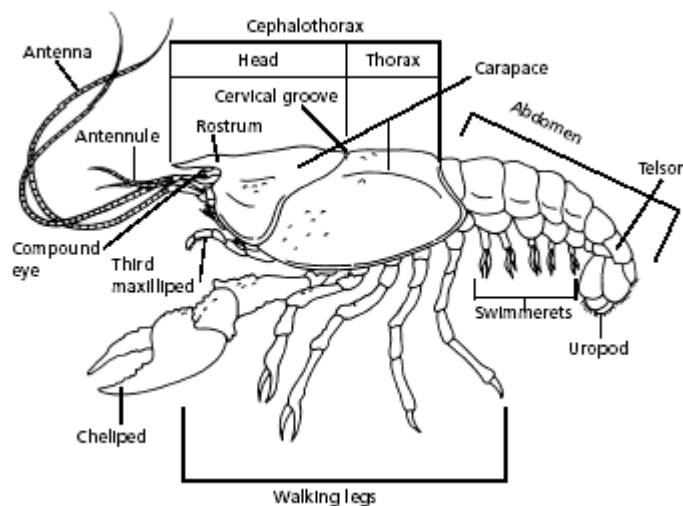
Background:

Like all crustaceans, a crayfish has a fairly hard exoskeleton that covers its body. As shown in the diagram on the next page, its body is divided into two main parts, the **cephalothorax** and the **abdomen**. The cephalothorax consists of the cephalic (or head) region and the thoracic region. The part of the exoskeleton that covers the cephalothorax is called the **carapace**. The abdomen is located behind the cephalothorax and consists of six clearly divided segments. The cephalothorax consists of 13 segments. Each segment of both the cephalothorax and the abdomen contains a pair of appendages. The head (or cephalic) region has five pairs of appendages. The **antennules** are organs of balance, touch, and taste. Long **antennae (plural)** are organs for touch, taste, and smell. The **mandibles**, or jaws, crush food by moving from side to side. Two pairs of **maxillae** hold

solid food, tear it, and pass it to the mouth. The second pair of maxillae also helps to draw water over the gills. Of the eight pairs of appendages on the cephalothorax, the first three are **maxillipeds**, which hold food during eating. The **chelipeds** are the large claws that the crayfish uses for defense and to capture prey. Each of the four remaining segments contains a pair of **walking legs**. In the abdomen, the first five segments each have a pair of **swimmerets**, which create water currents and function in reproduction. The sixth segment contains a modified pair of **uropods**. In the middle of the uropods is a structure called the **telson**, which bears the **anus**. The uropod and telson together make up the tail fan. The crayfish moves *backward* by forcing water forward with its tail fan.

Procedure Part 1—External Anatomy of a Crayfish

1. Put on gloves, and a lab apron.
2. Place a crayfish **dorsal** side up in a dissection tray. Use the diagram below to locate the **cephalothorax** and the **abdomen**. The **carapace**, a shield of chitin impregnated with calcium carbonate, covers the dorsal surface of the cephalothorax. On the carapace, observe an indentation, the **cervical groove**, that extends across the midregion and separates the head and **thoracic regions**. Flip the crayfish over. On the thoracic region, locate the prominent suture or indentation on the cephalothorax that defines a central area separate from the sides. Note the individual **segments** of the abdomen.



What is the main difference between the cephalothorax and the abdomen?

3. Turn the crayfish on its side, and locate the rostrum, which is the pointed extension of the carapace at the head of the animal shown in the diagram above. Beneath the rostrum locate the two eyes. Notice that each eye is at the end of a stalk.

4. Locate the five pairs of appendages on the head region. First locate the antennules in the most anterior segment. Behind them observe the much longer pair of antennae (plural).



Why is it useful to turn the specimen on its side for this part of your study?

5. Locate the mouth. Then observe the **mandibles**, or true jaws, behind the antennae . Now locate the two pairs of maxillae, which are the last appendages in the cephalic region.



Which appendages in the cephalic region are related to the eating of food?

6. On the thoracic portion of the cephalothorax, observe the three pointed **maxillipeds**.



How are the maxillipeds related to eating?

7. Next observe the largest prominent pair of appendages, the **chelipeds**, or claws. Behind the chelipeds locate the four pairs of **walking legs**, one pair on each segment.

8. To determine the **sex of your specimen**, first look at the upper two most sets of **swimmerets** (closest to the head). In females these will be similar to the others on her tail – long and flexible. In males, they will be modified and will not resemble the others either on the male or those on females. They will be stiff and hard (**calcified**), and in mature males will have a whitish appearance, especially at the tips. Usually, this is an easily distinguishable feature, even for young crawfish. The other feature to look for is the **sperm receptacle** (called annulus ventralis) on females. This is a small button-like feature with a slightly curved crevice (slit) in the center and may appear slightly “lumpy”. This sperm receptacle will be found in the center of the body between the last set of walking legs and will only be present in females.



Is your specimen a male or a female?

Exchange your specimen with a nearby classmate who has a crayfish of the opposite sex. Then study its genital pores.

9. On the abdomen, observe the six distinct **segments**. On each of the first five segments, observe a pair of **swimmerets**. The first two pairs of swimmerets are modified to transfer sperm in males.

10. On the last abdominal segment, observe a pair of pointed appendages modified into a pair of **uropods**. In the middle of the uropods, locate the triangular-shaped **telson**.

11. Observe the location of each pair of appendages from the ventral side.

 **From which view, dorsal or ventral, can you see the location of the appendages on the segments more clearly?**

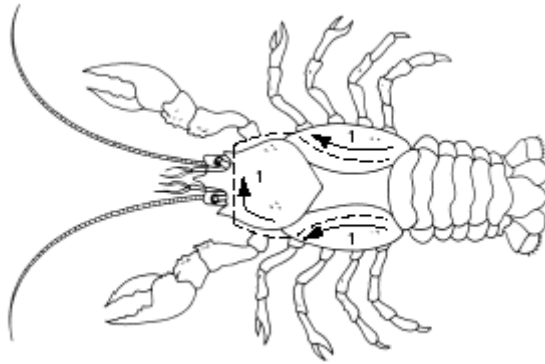
12. Next you will study the internal anatomy of a crayfish. If you must store your specimen until the next lab period, cover it with a dampened paper towel. Then place the specimen on the tray in a plastic bag. Close the bag with a twist tie. Write your name on the bag with a felt-tip marking pen, and give your specimen to your teacher.

13. Clean up your work area and wash your hands before leaving the lab.

Part 2—Internal Anatomy of a Crayfish

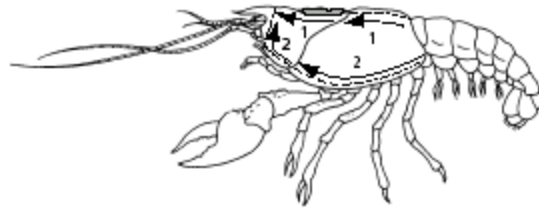
14. Put on a lab apron, gloves, and safety goggles.

15. Using one hand to hold the crayfish dorsal side up in the dissecting tray, use scissors to carefully cut through the back of the **carapace** along dissection cut line 1, as shown in the diagram below. Cut along the indentations that separate the thoracic portion of the carapace into three regions. Start the cut at the posterior edges of the carapace, and extend it along both sides in the cephalic region.



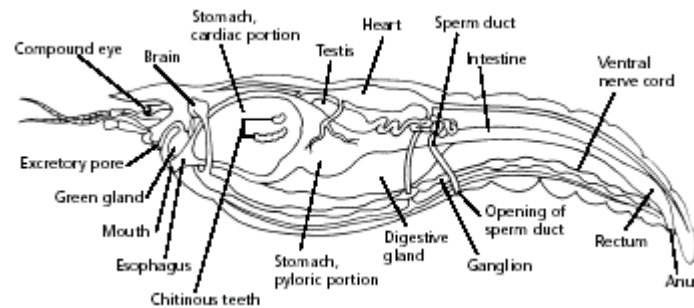
16. Use forceps to carefully lift away the carapace. Be careful not to pull the carapace away too quickly. Such action would disturb or tear the underlying structures.

17. Place the specimen on its side, with the head facing left, as shown in the diagram below. Using scissors, start cutting at the base of cut line 1. Cut along the side of the crayfish, as illustrated by cut line 2. Extend the cut line forward toward the rostrum (at the top of the head).



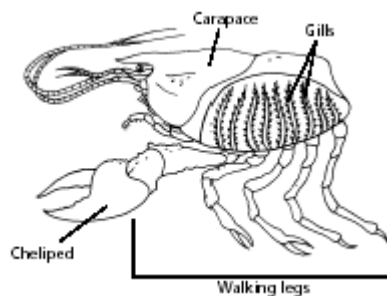
18. Use forceps to *carefully* lift away the remaining parts of the carapace, exposing the underlying **gills** and other organs.

19. Use the diagram below to locate and identify the organs of the digestive system. Locate the **maxillae** that pass the pieces of food into the mouth. The food travels down the short esophagus into the stomach. Locate the **digestive gland**, which produces digestive substances and from which the absorption of nutrients occurs. Undigested material passes into the **intestine**. Observe that the intestine is attached to the lobed **stomach**. The undigested material is eliminated from the **anus**.



Rows of chitinous teeth line the stomach. Predict their function.

20. Use the diagram below to locate and identify the organs of the respiratory system. Locate the **gills**, which are featherlike structures found underneath the carapace and attached to the chelipeds and walking legs. A constant flow of blood to the gills releases carbon dioxide and picks up oxygen.



 **The feathery nature of the gills gives them a very large surface area. Why is this important?**

21. Use the diagram of the internal anatomy of the crayfish to locate and identify the organs of the circulatory system. Try to locate the **dorsal tubular heart**, although this may be difficult to find.

22. Use the same diagram to locate and identify the organs of the nervous system. Find the **ventral nerve cord**. Locate a **ganglion**, one of the enlargements of the ventral nerve cord. Locate the **dorsal brain**, which is located just behind the compound **eyes**. Note the two large nerves that lead from the brain, around the esophagus, and join the ventral nerve cord.

 **Many nerves leave from each ganglion. Where do you think these nerves go?**

23. Use the same diagram to locate and identify the organs of the excretory system. The blood carries cellular wastes to the disk-like **green glands**. Locate these organs just in front of the stomach. The green glands excrete waste through pores at the base of each antenna.

 **What organs in your body carry out the same function as the green glands?**

24. Use the diagram once again to locate and identify the organs of the reproductive system. The animal shown in the diagram is a male crayfish. If your specimen is a male, locate the testis. The testis is the long, white organ under the heart and a bit forward. The sperm ducts that carry sperm from the testis open at the fifth walking leg. If your specimen is a female, locate the bi-lobed ovary. It is in the same relative position as the testis, but the ovary appears as a large, reddish mass under the heart. Then locate the short oviducts that extend from near the center of each side of the ovary and open at the third walking leg. **Exchange your specimen with a nearby classmate who has a crayfish of the opposite sex. Then study its reproductive system.**

25. Dispose of your materials according to the directions from your teacher.

26. Clean up your work area and wash your hands before leaving the lab.

Name _____

Date _____

Crayfish Dissection Worksheet

1. What structures are used for capturing prey and securing and eating food?
2. How are the antennae (plural), chelipeds, other walking legs, and swimmerets related?
3. What are the main structures you could have observed if you had removed the exoskeleton of the abdomen?
4. Is the crayfish most vulnerable to its enemies from the dorsal or ventral side? Why?
5. Young crawfish molt 11 times before they mature and do so over a period of 3-12 months depending on environmental conditions and species. Why does the crayfish "hide" after it molts?
6. Compare what happens to digested nutrients and undigested food in a crayfish.
7. Of the systems studied, which two are most unlike the related human system? Why?
8. Although the crayfish has an inflexible cephalothorax, the crayfish is classified as a segmented animal. Why?
9. What is the major function of the exoskeleton of a crayfish? How is the exoskeleton an adaptive advantage to the crayfish?
10. Investigate molting in crayfish. How does it occur? When? Why?

Name _____

Date _____

Interdependence of Organisms

Read the articles on pages 97-99 and on page 116.

Define:

limiting factor:

Draw a food web that includes crawfish.

What would happen to the population of the other animals in your web if you removed one animal from the scene? Choose an animal to remove and explain the effects it would have on the other animals in your web.

Write a paragraph discussing population dynamics with and without limiting factors and the positive and negative effects of human actions on ecosystems.

Crawfish Lab Projects

Jay Huner

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General Statement:

There are over 350 crawfish species in North America and at least 34 species in Louisiana. Two species are available in good numbers commercially from Louisiana's crawfish ponds and natural fisheries. These are the red swamp crawfish, *Procambarus clarkii* (Girard, 1852), and the white river crawfish, *Procambarus zonangulus* Hobbs and Hobbs 1991. The red swamp crawfish is the more abundant of the two species.

Proper research projects cannot be done unless the animals can be positively identified. Simply acquiring samples of crawfish from a nearby seafood market or crawfish farm does not assure a teacher that he or she has a particular species although chances are good that the crawfish will be red swamp crawfish. However, white river crawfish can sometimes be the dominant crawfish species in such samples. And, when small mesh traps, seines, and/or dip nets are used to catch small crawfish, smaller species such as dwarf crawfishes, *Cambarellus* spp., striped crawfish, *Procambarus hinei*, or others may be present in good numbers.

The projects listed below can be conducted without securing positive identification of the crawfish used in them. However, ANY project associated with science fairs or similar activities should not be done unless the instructor and student(s) have a positive identification of the species involved.

A final caution involves separation of mature and immature crawfish and male and female crawfish. The first two pairs of "walking legs" on the abdomens of male crawfish are modified to serve as sperm transfer organs, called gonopodia, to a sperm receptacle, a circular structure with a distinct crevice on it, located between the walking legs of the female. These secondary sexual characteristics are apparent on very small crawfish and become more apparent as they grow.

Crawfish have direct development which means that when the young crawfish hatch, they resemble tiny crawfish. They go through approximately 10 molts before they mature which are the equivalent of "instars" in insects such as grasshoppers which have "direct" development. Each stage is somewhat different with the most dramatic morphological changes occurring after the last molt in cambarid crawfishes (all Louisiana species). The gonopodia of males become heavily calcified and assume very distinct, species specific shapes which fit, lock and key, into the species specific crevices on the female sperm receptacles! The claws (chela) of male crawfish become greatly enlarged at maturity and very distinct "hooks" appear at the bases of one or two pairs of walking legs. The claws of female crawfish enlarge as well when they mature but not to the extent of those of the

males. In addition, the shapes of the sperm receptacle and its sperm retaining crevice become very distinct.

In many animal species, large specimens are the adults and small specimens are juveniles. In crawfish, size at maturity is associated with environmental factors with the most significant one being density – number per square meter. The higher the density, the smaller the crawfish are at maturity and, conversely the lower the density, the larger the crawfish are at maturity even if they all come from the same hatching! The only way to tell if a crawfish is mature and has stopped growing is to check for the referenced secondary sexual characteristics. Both red swamp and white river crawfishes mature at sizes as small as 55-60 mm total length and as large as 145-150 mm total length! Conversely, dwarf crawfishes mature at sizes under 40-45 mm total length!

[After mature cambarid crawfish complete their reproductive cycle, they either die or molt their old shells. At least in males, there is a transformation to a quasi-juvenile morphology with the newly molted crawfish resembling an immature male crawfish! When these crawfish molt again, they molt back to the “mature” morphology with enlarged claws and hooks on the walking legs. Females do not appear to go through this metamorphosis.]

1. Determining the amount of mineral matter in crawfish shells.

Teachers: Require the students to: a) Plan and record step-by-step procedures for a valid investigation, select equipment and materials, and identify variables and controls and b) choose an appropriate model to explain experimental results.

Crawfish are invertebrates whose bodies are covered with mineral impregnated exoskeletons, called shells for simplicity. Most of the mineral matter in crawfish shells is calcium carbonate although there is a bit of magnesium carbonate in the shells. These mineral “salts” are contained within a proteinaceous matrix of chitin. Close examination of a crawfish will show that the body consists of two parts, the “head” and the “tail”. The head is actually a cephalothorax with the head and thorax covered by a very hard “carapace”. The tail is actually the abdomen, of which the dorsal surface is heavily mineralized and the ventral surface is much less mineralized. The amount of mineral matter in the carapace and dorsal tail segments in the intermolt crawfish is roughly 35%. There is much less mineral matter in the ventral tail segments.

Until crawfish mature, they are almost always in a state of molting, hardening from the last molt, or preparing for the next molt. Under good conditions, crawfish molt every 7-20 days, depending primarily on temperatures. Molting ceases when they mature until reproduction has been completed. Crawfish store some calcium carbonate in stomach stones on either side of their stomachs as they de-mineralize their exoskeletons prior to the next molt. So, when crawfish are dissected, it is easy to determine if they are preparing to molt by checking for these stomach stones, also called gastroliths.

- Clean and dry shell overnight at 100 C.
- Weigh shell to 0.01 g.
- Soak in regular vinegar for 3 days. Cover completely. Change solution each day.
- Remove from vinegar on Day 4.
- Rinse with distilled or de-ionized water.
- Dry overnight at 100 C.
- Weigh shell to 0.01 g.
- Calculate % mineral matter:

$\text{Treated Shell Weight divided by Untreated Shell Weight} \times 100$

Note that the percentage of mineral matter will be similar in intermolt crawfish at all stages of development but the “density”, grams of mineral matter per square centimeter, will vary, being greatest in mature, non-molting crawfish.

2. Determining percent organic matter in crawfish organs.

Teachers: Require the students to: a) Plan and record step-by-step procedures for a valid investigation, select equipment and materials, and identify variables and controls and b) choose an appropriate model to explain experimental results.

Most people realize that all crawfish species can make burrows. Crawfish found in wetlands have to make burrows when the water periodically dries or they will die. This is especially true of the red swamp and white river crawfish. These crawfish also retreat into burrows when they are going to lay their eggs and incubate them. Once a crawfish retreats into a burrow and plugs it to conserve moisture and keep predators out, it is dependent upon the nutrients that it has stored in its body prior to burrowing. There are two major “organs” where nutrients are stored in crawfish, the hepatopancreas which functions as a liver, and the huge abdominal (or tail) muscle. The hepatopancreas is the large, variously colored organ in the cephalothorax commonly called “the fat”. Color varies according to species, being a purer yellow in the red swamp crawfish and greener in the white river crawfish. The nutrients stored in the hepatopancreas are used for development of eggs and sperm and for general metabolism when crawfish are confined to burrows. These nutrients are “used” first by burrowed crawfish. Once they are exhausted, the crawfish begins to metabolize the nutrients, mostly protein, in the abdominal muscle. The nutrients stored in the hepatopancreas and the abdominal muscles are very important to crawfish survival, because the crawfish may have to remain in its burrow for 6-8 months although the “normal” stay in burrows is 2-4 months.

Changes in the amount of nutrients in the hepatopancreas and abdominal muscle can be monitored by determining the amount of moisture – water – in those tissues. The amount of moisture in these tissues is inversely proportionate to the amount of nutrients. The percentage of moisture in the hepatopancreas can vary from about 50% in well fed crawfish to 95% in starved crawfish. The percentage of moisture in the abdominal muscle can vary likewise from about 78% to 98%.

The easiest way to remove the two tissues from crawfish is to first freeze the crawfish for at least 24 hours,³ thaw them quickly, and then immediately remove the two tissues. The hepatopancreas produces all of the digestive enzymes used by the crawfish. Freezing stops enzymatic action but as soon as the crawfish is thawed out, “self digestion” begins. So, the tissues need to be removed within 1-2 hours after a specimen has been thawed out.

³ **Note from Dr. McClain:** Tissues are best and easiest to remove from fresh, not frozen, crawfish. Besides, freezing ruptures cells and some moisture may be lost. I have tried it both ways (frozen and fresh) and while there may not be a big difference one way or the other, I feel that it is easier, quicker, and more accurate to dissect while fresh as long as one is not dealing with a large number of specimens.

When crawfish are being dissected, look for the testes in males and the ovaries in females. The testes never occupy much space but the ovaries can enlarge to fill the entire body cavity replacing the space occupied by the hepatopancreas as the eggs (ova) develop. But, because the ovaries develop primarily after a female crawfish enters a burrow and most crawfish are caught in “open water”, ovaries available from commercial sources are rarely well developed.

- Kill live crawfish by freezing them for 24 hours in a sealed plastic bag.
- Thaw in tap water about 2 hours and immediately dissect crawfish and remove hepatopancreas and tail muscle.
- Pat organs dry.
- Weigh organs to 0.01 g.
- Dry organs overnight at 100 C.
- Weigh dry organs.
- Calculate % organic matter:

Dried Organ Weight divided by Wet Organ Weight x 100

3. Identifying age classes of crawfish.

Teachers: Require the students to: a) Plan and record step-by-step procedures for a valid investigation, select equipment and materials, and identify variables and controls and b) choose an appropriate model to explain experimental results.

Fisheries biologists evaluate age classes of fishes and crustaceans by measuring a sample of the animals and graphing the results. Each age class of animal is typically represented by a rise in the graph called a mode. Now, a slow growing animal may wind up being the part of a mode of a group of younger, faster growing animals and a fast growing animal may wind up being the part of a mode of a group of older, slower growing animals. Fisheries biologists can take the otoliths (ear bones) from fish and estimate their ages from the number of rings laid down as the fish grows. There is no such equivalent structure in crustaceans. However, identifying age classes by measuring fish and crustaceans and graphing the data is the fastest, most productive way to identify different age classes.

When studying fish, one usually looks at year classes. But, when studying crawfish, especially in the southern USA, the concept of “month” classes arises because few crawfish live more than 2 or 3 years and most crawfish species including red swamp and white river crawfishes mature in 3-6 months from hatching depending, for the most part, on temperatures, because growth is directly related to temperatures.

A productive commercial crawfish population will have several different month classes. Females leave burrows in response to rain fall events as early as August and as late as December.

The carapace lengths should be measured from the tip of rostrum at the front of the carapace to the end of the carapace where it joins the abdomen. This measurement is recommended because it is stable. Yes, total lengths can be measured but the tail/abdomen is “flexible” and it is difficult to get consistent length measurements because of this flexibility. However, total length can be used if it is measured to the nearest 1.0 mm with a ruler or a measuring board.

[Note: Putting crawfish in ice water or holding them in a refrigerator overnight slows them way down and makes it easier to measure them. The most “humane” way to kill them is to freeze them. This makes them very easy to measure once they are thawed out.]

- Catch at least 100 crawfish in a ditch or crawfish pond with dip nets or take 100 crawfish from traps.
- Put crawfish into ice water to cool them down.
- Measure the carapace length with a caliper to 0.1 mm.
- Create a length-weight graph.
- Age classes show up as high points in graph.

4. Crawfish burrowing.

Teachers: Have students write and defend a conclusion based on logical analysis of experimental data.

All crawfish, regardless of species, construct burrows.⁴ Crawfish found in wetland habitats, such as ditches and crawfish ponds, must make burrows when the water dries up or the ponds are drained. Some species are much better burrowers than others. Those crawfishes found in wet fields far from any standing water are often called “chimney” crawfish because they build elaborate chimneys that can stand a foot or more high and literally cover the ground with their clay, lawn mower dulling turrets. These crawfish have even more elaborate burrows that can include multiple tunnels and chambers and some tunnels can extend as much as 20 feet down to reach a permanent water table. The red swamp and white river crawfishes make very simple burrows that rarely extend more than 5 feet deep.

Once hatched, cambarid crawfish, regardless of species, must remain with their mothers until they molt twice. They are then capable of leaving their mothers. Red swamp and white river crawfishes are about 8-9 mm long, total length when they reach this development stage. These tiny crawfish will make burrows. So, if female crawfish with young are available, the following experiment can be conducted with those diminutive crawfish. However, the smallest crawfish that most people can catch in ditches and crawfish ponds are usually 15-25 mm long, total length. That is why that size is recommended for this project. Frankly, ANY size crawfish can be used but one has to size the container according the size of the crawfish.

- Catch a number of 15-25 mm, total length, crawfish in a ditch or crawfish pond.
- Collect a soil sample from the location where the crawfish were collected and get a bag of sand from any convenient source – store, beach, wherever.
- Dry the soil and sand in an oven at low temperature for several days.
- Pulverize the soil.
- Fill a 7-10 ounce plastic cup $\frac{3}{4}$ full of soil or sand. Add water to the top of the soil or sand. Let sit over night.
- Add water so that there is at least $\frac{1}{4}$ ” of water above the top of the soil or sand.
- Put crawfish into container. Cover containers and put them in a dark location.
- Check the containers daily and record any burrowing behavior. Do not add any more water.
- After two weeks, cut the container in half and describe the shape of the burrows if any are present.
- Question – If crawfish do not burrow in sand or make poor burrows in sand, what do the results mean?

⁴ **Note from Dr. McClain:** Although most species can form some sort of burrow, many stream and lake dwelling species only make very shallow or rudimentary burrows, and then only when absolutely necessary to survive.

Another Interesting Project: What does the inside of a burrow actually look like?

Excavating burrows is a real challenge. Try it! But, you can create an artificial burrow to provide students with an idea about what the inside of a burrow looks like.

- Obtain a mature female red swamp crawfish (or white river crawfish) about 80-90 mm, total length.
- Find a two-three liter (2-3 quart) plastic food container.
- Put a cup of mud obtained from the bank of a crawfish pond or a ditch where there is a crawfish population into the bottom of the container.
- Add a cup of water to the bottom of the container.
- Put in the crawfish and seal the container.
- Leave the container for a week and open it. What do you find?
- For best results, set up at least 5 containers and compare the degree to which the crawfish “work” the mud. Some crawfish do nothing in such containers but most will work the mud around inside the container and completely seal it. That is what the inside of a crawfish burrow looks like. Imagine spending 2-6 months under such conditions and successfully laying and incubating eggs!

The crawfish gills are located in branchial cavities between the inside of carapace and the body walls. As long as these cavities have water in them, the crawfish can use atmospheric oxygen to breath. The dissolved oxygen in burrow water is so low that crawfish cannot remain submerged in it. In fact, they only use the water in burrows to keep their gills wet. Females with egg masses on their swimmerets under their tails dip the developing eggs/embryos into and out of the water constantly so that atmospheric oxygen can pass through the egg “shells” to the developing embryos! Bet you did not know that!