Teacher's Masters

California Education and the Environment Initiative

7

Science Standard
7.3.a.

Shaping Natural Systems through Evolution

California Education and the Environment Initiative

Approved by the California State Board of Education, 2010

The Education and the Environment Curriculum is a cooperative endeavor of the following entities:

California Environmental Protection Agency

California Natural Resources Agency

Office of the Secretary of Education

California State Board of Education

California Department of Education

California Integrated Waste Management Board

Key Leadership for the Education and Environment Initiative:

Linda Adams, Secretary, California Environmental Protection Agency

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Key Partners:

Special thanks to **Heal the Bay,** sponsor of the EEI law, for their partnership and participation in reviewing portions of the EEI curriculum.

Valuable assistance with maps, photos, videos and design was provided by the **National Geographic Society** under a contract with the State of California.

Office of Education and the Environment

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http://www.calepa.ca.gov/Education/EEI/

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None required for this lesson.

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None required for this lesson.

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None required for this lesson.

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None required for this lesson.

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None required for this lesson.

Assessments

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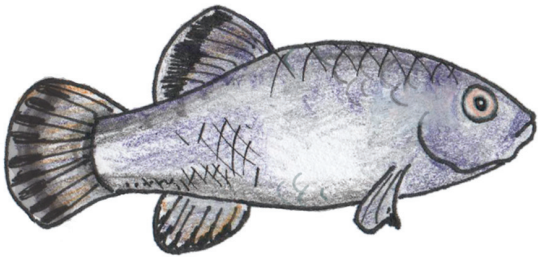
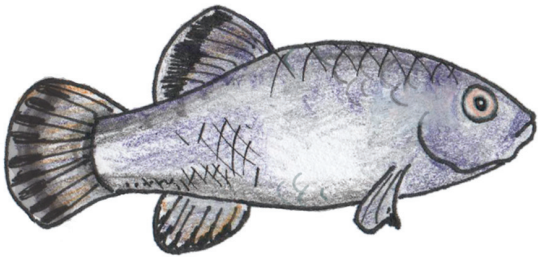


Fish A

Salinity: Can survive in low to high salinity.

Temperature for laying eggs: Can survive and lay eggs at low and high temperatures.

Breeding habits: Lays eggs in the spring. These eggs can remain in algae when water levels go down and hatch when water levels return the next year.

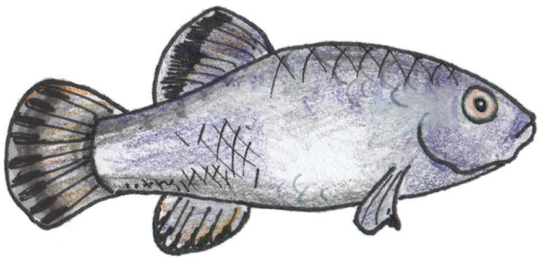


Fish B

Salinity: Can survive in low to high salinity.

Temperature for laying eggs: Can lay eggs only at 75–86° F (24–30° C).

Breeding habits: Lays eggs year-round.

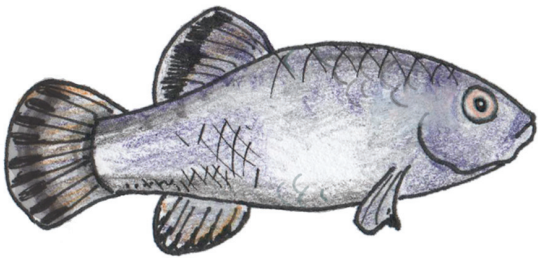


Fish C

Salinity: Can survive in low to medium salinity.

Temperature for laying eggs: Can lay eggs at low and high temperatures.

Breeding habits: Lays eggs year-round.

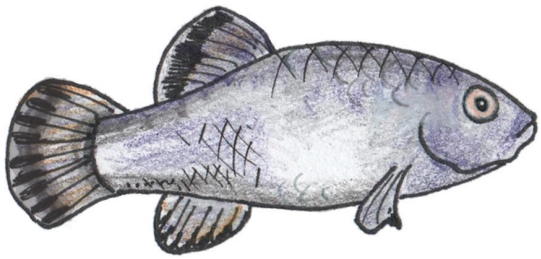


Fish D

Salinity: Can survive in low to medium salinity.

Temperature for laying eggs: Can lay eggs only at 75–86° F (24–30° C).

Breeding habits: Lays eggs in the spring. These eggs can remain in algae when water levels go down and hatch when water levels return the next year.

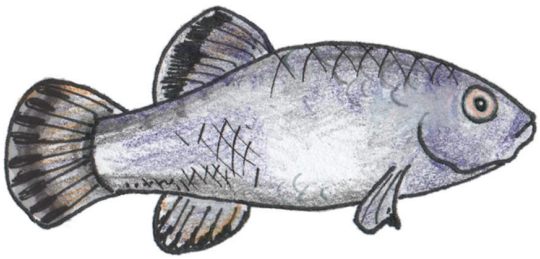


Fish E

Salinity: Can survive in fresh water with low salinity.

Temperature for laying eggs: Can lay eggs at low and high temperatures.

Breeding habits: Lays eggs year-round.

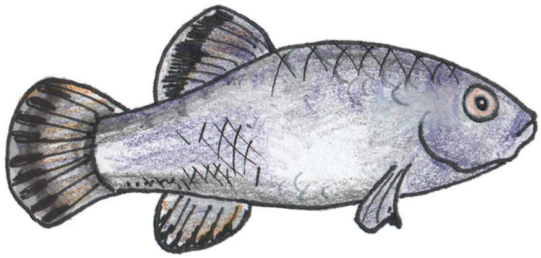


Fish F

Salinity: Can survive in fresh water with low salinity.

Temperature for laying eggs: Can lay eggs at low and high temperatures.

Breeding habits: Lays eggs in the spring. These eggs can remain in algae when water levels go down and hatch when water levels return the next year.

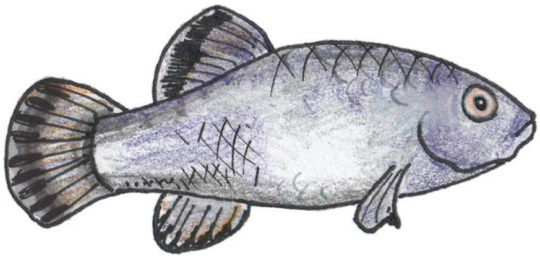


Fish G

Salinity: Can survive in fresh water with low salinity.

Temperature for laying eggs: Can lay eggs only at 75–86° F (24–30° C).

Breeding habits: Lays eggs year-round.



Fish H

Salinity: Can survive in fresh water with low salinity.

Temperature for laying eggs: Can lay eggs only at 75–86° F (24–30° C).

Breeding habits: Lays eggs in the spring. These eggs can remain in algae when water levels go down and hatch when water levels return the next year.

Environment #1: Amargosa River

The Amargosa River runs through a canyon east of Death Valley. Its name is a bit misleading, as this "river" is actually a small stream less than 2 meters wide and about 2.5 meters deep. The water in this part of the river is in constant motion year-round. Water temperatures in the Amargosa River range from 35–112° F (2–44° C) during the year. The temperature also changes significantly during a single day. Water at night can be over 60 degrees cooler than it is in the morning. The salinity (amount of salt in the water) is moderate.

Environment #2: Big Spring

Big Spring is located in the Ash Meadows National Wildlife Preserve in Nevada. It is just across the state border from California. Here, water rises up from underground to form a pool. The size of this spring is relatively stable. The salinity (amount of salt in the water) is very low. Big Spring stays at a mostly constant temperature, around 80–90° F (27–32° C).

Environment #3: Salt Creek

Salt Creek is a small stream on the floor of Death Valley. Part of the stream dries up during summer and fall. Salt Creek is two- to three-times saltier than ocean water. Water temperature varies greatly in the creek, from freezing to temperatures over 110° F (43° C).

Name: _____

Part 1

Instructions: Select the best answer and circle the correct letter. (2 points each)

1. Which sentence about natural selection is true?
   a. Natural selection only occurs in human populations.
   b. Variations of a single trait do not naturally exist in populations.
   c. Natural variations of a single trait exist in populations.
   d. Human activities do not alter natural selection.

2. Which of these sentences about evolution is true?
   a. When species evolve, they always become more complex.
   b. Evolutionary changes rarely occur.
   c. Evolution happened in the past, but does not happen in the present.
   d. Evolution results in change over time of the frequency of traits in a population.

3. Which of the following environmental factors can put pressure on species?
   a. changing climate
   b. the introduction of a new predator
   c. changing the chemistry of soil
   d. All of the above.

4. Which of these characteristics is an adaptation that allows pupfish to live in the desert?
   a. the ability to lay eggs when it is very hot
   b. bright stripes
   c. the ability to tolerate cold
   d. tails designed for fast swimming

5. Which of these sentences best describes the term “species”?
   a. All members of a species are genetically identical.
   b. Members of one species can mate with members of other species.
   c. Individuals are members of the same species if they can mate and produce fertile offspring.
   d. A single species cannot live in a variety of environments.

6. Which of these is not an inherited trait that would allow a species to survive or reproduce?
   a. the size of horn on bighorn sheep
   b. having access to more food
   c. the ability to sing songs to attract mates
   d. colors on a lizard that provide camouflage

Name: _____

Part 2

Instructions: Read the following paragraph and use the information to answer questions 7–10. (2 points each)

> Guppies are a kind of fish that live in streams on the island of Trinidad. In some pools, guppies are very colorful. In other pools, guppies are very drab and match the color of the bottom of the pool. Guppies that stand out are more likely to find mates. Guppies that blend in are less likely to be eaten by predators.

7. According to the reading, what trait varies for these guppies?

- a. length
- b. speed
- c. coloring
- d. egg-laying behavior

8. What kinds of guppies would you expect to find in a pool that contains many predators?

- a. mostly bright guppies
- b. mostly drab, colorless guppies
- c. an equal mixture of bright and drab guppies
- d. There is not enough information to make a prediction.

9. If you removed all the predators from a pool, how would natural selection proceed for the guppies?

- a. Bright guppies would be more likely to attract mates, so they would be more likely to reproduce. The bright-color gene's frequency would increase in future generations.
- b. Drab guppies would be more likely to survive, so they would be more likely to pass on their genes. The drab-color gene's frequency would increase in future generations.
- c. Without predators, the color of guppies would not matter for future generations. Some fish would be drab and some would be bright.
- d. Current guppies would be larger because more of their energy can now go into feeding instead of avoiding predators.

10. Which of the following statements is true if predators had a mutation that allowed them to see drab-colored guppies just as well as they could see bright-colored guppies?

- a. The guppies would need a new adaptation to avoid the predators, so they would develop one.
- b. Fewer guppies would be eaten.
- c. Being a bright-colored guppy has a lower survival rate than being drab colored.
- d. Being able to avoid predation is no longer a selective advantage for drab-colored guppies.

Name: _____

Part 3

Instructions: Select the best answer and circle the correct letter. (2 points each)

11. If a species does not have traits with much variation, and the environment changes, what might happen?
   a. The species may be at risk of extinction. It may not have any individuals with adaptations that help it cope with the new environment.
   b. The species can develop new adaptations on the spot, if it needs them.
   c. The species will be more successful, because all of its members can work together since they are so alike.
   d. The species will reproduce, and the new offspring will develop the adaptations needed to survive.

12. Which of the following environmental factors can influence how a species evolves?
   a. climate
   b. other kinds of plants and animals that live there
   c. geography
   d. all of the above

13. Humans have dramatically changed the environment in the San Joaquin Valley in California. In this region, 95% of the land has been altered for human use. These environmental changes have _____.
   a. led to more species diversity
   b. increased species' habitat range
   c. put several species at risk of extinction
   d. had little effect on species

Part 4

Instructions: Complete the following tasks in the spaces provided. (3 points each)

14. Give an example of an adaptation and the environment that it evolved in.

Name: _____

15. Why does California have so many different kinds of species?

16. List three examples of human activities that have changed the environment.

17. Pick one of the examples above. How has this activity influenced the evolution of a species?

Name: _____

Part 5

Instructions: Read the following paragraph and use the information to answer questions 18–20. (3 points each)

Bighorn sheep live in the mountains of western North America. These sheep climb steep cliffs and graze on grass and shrubs. Male sheep, called rams, have large horns. They use these horns to fight each other. Rams exhibit a range of horn sizes. Those with the largest horns often win the fights and get to mate with female bighorn sheep. For hundreds of years, people have hunted the bighorn sheep for its meat and its horns. Hunters prize the largest horns, which they take home as trophies. Rams with the largest horns are the ones most likely to be killed.

18. What trait was a mating adaptation for the bighorn sheep? Why?

19. What human activity has altered evolution for the bighorn sheep?

20. Based on the reading, make a prediction. How has natural selection acted on the population of bighorn sheep since the arrival of humans?

Name: _____

Instructions: Create an 8-panel storyboard that describes how different species of pupfish have evolved in California. Use the **Vocabulary** and **Concepts** on page 4 to guide you as you develop each frame.

Evolution is _____

This is the story of the evolution of the pupfish.

Evolution of the Pupfish	
	Ancient California environment for pupfish
	How this environment changed over time

Name: _____

Evolution of the Pupfish (Continued)

	Variety of special characteristics of pupfish population
	How some characteristics were favorable
	How a different characteristic was favorable elsewhere

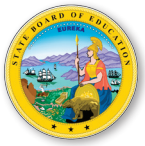
Name: _____

Evolution of the Pupfish (Continued)

	Why the pupfish in different environments could not mate
	Human intervention in the environment
	Will pupfish survive?

Name: _____

Vocabulary (1 point for each vocabulary word used correctly.)	
	Adaptation
	Environment
	Evolution
	Extinction
	Genes
	Human Activity
	Inherit
	Mutation
	Natural Selection
	Population
	Reproduce or reproduction
	Species
	Survive or survival
	Trait
	Variation
Concepts (2 points for a complete explanation, 1 point for a partial explanation.)	
	Is evolution defined and illustrated appropriately?
	Does the story explain how natural selection happens?
	Does the story explain the cause of variation and describe its role in evolution?
	Does the story explain one specific example of how environmental change can affect evolution?
	Does the story describe at least one specific example of how human activities have altered evolution for the pupfish?
	Total



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