Habitat Change

A small, short-furred, gray animal called a divos lives on an island. This island is the only place on Earth where divos live. The island habitat is warm and provides plenty of the divos' only food—tree ants. The divos live high in the treetops, hidden from predators.

One year the habitat experienced a drastic change that lasted for most of the year. It became very cold and even snowed. All of the ants died. The trees lost their leaves, but plenty of seeds and dried leaves were on the ground.

Circle any of the things you think happened to most of the divos living on the island after their habitat changed.

A  The divos' fur grew longer and thicker.
B  The divos switched to eating seeds.
C  The divos dug holes to live under the leaves or beneath rocks.
D  The divos hibernated through the cold period until the habitat was warm again.
E  The divos died.

Explain your thinking. How did you decide what effect the change in habitat would have on most of the divos?
Habitat Change

Teacher Notes

Purpose
The purpose of this assessment probe is to elicit students' ideas about adaptation. The probe is designed to reveal whether students think individuals intentionally change their physical characteristics or behaviors in response to an environmental change.

Related Concepts
adaptation, behavioral response

Explanation
There is no one completely right answer to this question, but the best answer is E: The divos died. In common usage the term adapt is understood as any type of change over any span of time. Individuals generally do not intentionally adapt to drastic changes in their environment by changing their physical characteristics (such as fur length or ability to eat certain foods based on teeth or mouth structure) or inherited behaviors (such as where they seek shelter or hibernation). Some individual divos may have been born with variations that made them better suited to survive a change in the environment and to reproduce, passing on their traits to new generations that would be better adapted to the changed environment. However, most of the divos probably died because the physical structures, physiology, and behaviors they were born with no longer fit the
changed environment. Populations can adapt over time, but individuals do not change during their lifetimes.

Curricular and Instructional Considerations

Elementary Students
In the elementary grades students build understandings of biological concepts through direct experience with living things and their habitats. The idea that organisms depend on their environment is not well developed in young children. The focus in the early elementary grades should be on establishing the primary association of organisms with their environments, followed by the upper elementary ideas of dependence on various aspects of the environment and structures and behaviors animals were born with that help various organisms survive (NRC 1996). Students should have opportunities to investigate a variety of habitats of plants and animals and identify ways animals and plants depend on the environment and each other.

Middle School Students
Understanding adaptation can be particularly troublesome at this level. Many students think adaptation means that individuals change in major ways in response to environmental changes (i.e., if the environment changes, individual organisms deliberately adapt) (NRC 1996, p. 156). Teachers need to carefully select activities that do not imply to students that an individual organism can change its structures and behaviors at will when the habitat changes. Students at this level should develop the idea of variations organisms are born with that can lead to an individual's survival and reproduction.

High School Students
At the high school level students shift from thinking about the selection of individuals with certain traits that help them survive in their environment to the changing proportion of such traits in a population of organisms. The idea of natural selection, leading to the culminating idea of biological evolution, is a major focus in biology. However, some students still believe that a change in an organism's structures or behaviors in response to its environment can be controlled by the organism and passed along to future generations.

Administering the Probe
Explain to students that the divo is an imaginary organism. However, the challenges it faces, due to the drastic change in its environment, would produce similar responses from real organisms. Consider adding additional distracters for structural changes (such as growing stronger teeth for cracking open seeds) or behavioral changes (such as learning to swim so it could get off the island).

Related Ideas in National Science Education Standards (NRC 1996)
K–4 The Characteristics of Organisms
- Organisms have basic needs. For example, animals need air, water, and food; plants require air, water, nutrients, and light. Organisms can survive only in environments where their needs can be met.

K–4 Organisms and Their Environments
- An organism’s patterns of behavior are related to the nature of that organism’s environment, including the kinds and numbers of other organisms present, the availability of food and resources, and the physical characteristics of the environment. When the environment changes, some plants and animals survive and reproduce, and others die or move to new locations.

5–8 Regulation and Behavior
- All organisms must be able to obtain and use resources, grow, reproduce, and maintain stable internal conditions while living in a constantly changing external environment.
- Behavior is one kind of response an organism can make to an internal or environmental stimulus. A behavioral response requires coordination and communication at many levels, including cells, organ systems, and whole organisms. Behavioral response is a set of actions determined in part by heredity and in part from experience.

5–8 Diversity and Adaptations of Organisms
- Species acquire many of their unique characteristics through biological adaptation, which involves the selection of naturally occurring variations in populations. Biological adaptations include changes in structures, behaviors, or physiology that enhance survival and reproductive success in a particular environment.
- Extinction of a species occurs when the environment changes and the adaptive characteristics of a species are insufficient to ensure its survival.

Related Ideas in Benchmarks for Science Literacy (AAAS 1993)

K–2 Diversity of Life
- Plants and animals have features that help them live in different environments.

K–2 Heredity
- There is variation among individuals of one kind within a population.

3–5 Interdependence of Life
- For any particular environment, some kinds of plants and animals survive well, some survive less well, and some cannot survive at all.
- Changes in an organism’s habitat are sometimes beneficial to it and sometimes harmful.

6–8 Interdependence of Life
- In any particular environment, the growth and survival of organisms depend on the physical conditions.

* Indicates a strong match between the ideas elicited by the probe and a national standard’s learning goal.
9–12 Diversity of Life
- The variation of organisms within a species increases the likelihood that at least some members of the species will survive under changed environmental conditions.

9–12 Heredity
- An altered gene may be passed on to every cell that develops from it. The resulting features may help, harm, or have little effect on the offspring's success in its environment.

Related Research
- Many students tend to see adaptation as an intention by the organism to satisfy a desire or need for survival (Driver et al. 1994).
- Middle school and high school students may believe that organisms are able to intentionally change their bodily structure to be able to live in a particular habitat or that they respond to a changed environment by seeking a more favorable environment. It has been suggested that the language about adaptation used by teachers or textbooks may cause or reinforce these beliefs (AAAS 1993, p. 342).
- Most students seem to think that adaptation involves individual organisms changing in major ways as a response to survive a change in their environment (Driver et al. 1994).
- Students appear to confuse an individual's adaptation during its lifetime and inherited changes in a population over time. A large number of students appear to adopt a Lamarckian view of adaptation (Driver et al. 1994).

Suggestions for Instruction and Assessment
- Some "adaptations" are controlled by an organism. When dealing with individual organisms, acclimatization would be a better term to use for noninheritable changes in structure or behavior made by an organism during its lifetime.
- Be aware that Lamarckian interpretations of an individual’s adaptation to its environment may impede understanding of Darwinian evolution.
- A common activity used in elementary and middle school science is to have students design an imaginary organism that is adapted to a particular habitat. Be aware that this activity may perpetuate the misconception that organisms intentionally adapt.
- Compare and contrast with students the everyday common use of the word adaptation with the scientific meaning of the word. Add this to students’ growing number of examples of the ways we use words in our society that are not always the same as the scientific use of the words.

Related NSTA Science Store Publications and Journal Articles
American Association for the Advancement of Science (AAAS). 1993. Benchmarks for science litt-


References


