

Student Workbook

California Education and the Environment Initiative

B

Biology Standard
B.8.d.



The Isolation of Species

California Education and the Environment Initiative

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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

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Key Partners:

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Key Unit Vocabulary

Lesson 1

Allopatric speciation: The formation of species due to geographical separation.

Dispersal: The spreading of a population or species to a new location.

Divergence: In terms of genetics, the genetic differences that occur over time between closely related organisms.

El Niño: Climatic events that occur about every 2 to 7 years and involve shifting trade wind patterns and changes in surface water temperatures in the equatorial Pacific Ocean.

Endemic: (noun) Species or taxa found only in a specified geographic region. (adjective) Prevalent in a particular region.

Gene flow: The movement of genetic material between two populations by successful interbreeding.

Generalist feeder: A consumer that eats a wide variety of foods based on the availability of those foods.

Genetic drift: Changes in allele frequencies in populations that result from the random sampling of alleles from generation to generation, and the chance survival and reproduction of individuals.

Geographic isolation: The separation of populations due to a geographic feature (natural or human-made).

Grazers: Herbivores that feed on plants, such as grass or other low vegetation.

Habitat fragmentation: The division of an ecosystem into smaller, noncontiguous areas.

Hybrid: Offspring of two animals or plants of different varieties, species, or genera.

Morphology: Study of the physical appearance (structure, size, shape, and form) of organisms.

Nonnative species: A species not originally found in an area, that was transported to the area through human activity.

Outcompete: To be more effective at finding and using resources, such as food or nesting sites, than another species.

Population: The number of individuals of one or more species living in a place at a given time.

Reproductive isolating mechanism (RIM): Morphological or physiological characteristics that inhibit successful interbreeding between two or more populations.

Speciation: The process through which new species are formed.

Species: Genetically related organisms that resemble one another and can successfully reproduce.

Subspecies: A group of organisms within a species that has distinct characteristics resulting from their geographical or physical isolation from other populations of their species.

Viable: Capable of living, developing, or germinating under favorable conditions.

Wildlife trafficking: Illegal capture, transport, and sale of animals, often involving endangered species.

Geographic Isolation of Species

Name: _____

Instructions: Complete the tasks below in the spaces provided.

1. Describe three possible ways in which organisms could have arrived on the Channel Islands. (3 points)

2. Complete the following chart. Describe the probability of each type of organism dispersing to the islands around the last ice age; provide an explanation (rationale) for your probability selection, and describe the mechanism by which each type could arrive on the islands. (1 point for each cell)

Dispersing to Islands

Organism	Probability of dispersing on the Islands (High or Low)	Rationale	Mechanism of Arrival
Large land mammal			
Small land mammal			
Marine mammal			
Bird			
Reptile			
Amphibian			
Plants			
Any organism introduced by humans			

Geographic Isolation of Species

Lesson 1 | page 2 of 2

Name: _____

Instructions: Use the Channel Islands or Grand Canyon examples to answer the following questions.
(5 points each)

3. What is geographic isolation?

4. What is speciation?

5. How does geographic isolation affect speciation? Provide an example.

Mechanisms of Species Isolation

Lesson 2 | page 1 of 3

Name: _____

Instructions: Complete the following tasks in the spaces provided.

1. As you observe and discuss the visual aids of the following organisms, describe the morphological differences between each island species and its mainland source species. In your description, include size, color, shape, and any other relevant features. (4 points each)

a. Island fox versus gray fox

b. Island scrub-jay versus western (mainland) scrub-jay

c. Island redberry versus redberry (mainland)

2. Examine the map of the Galápagos Islands. (4 points each)

a. Explain how the giant tortoise subspecies may have evolved.

Mechanisms of Species Isolation

Name: _____

- b. On Isabela Island, there are five subspecies of giant tortoise, one located on each of the island's five volcanoes. Propose an explanation for why these tortoises remain isolated from each other.

- 3. Review the map of the Channel Islands. There are six subspecies of island fox, one on each of six of the eight islands. Explain how these six subspecies may have evolved from a single source species. (4 points)

- 4. List three examples of reproductive isolating mechanisms. (6 points)

Tiger Distribution Grid

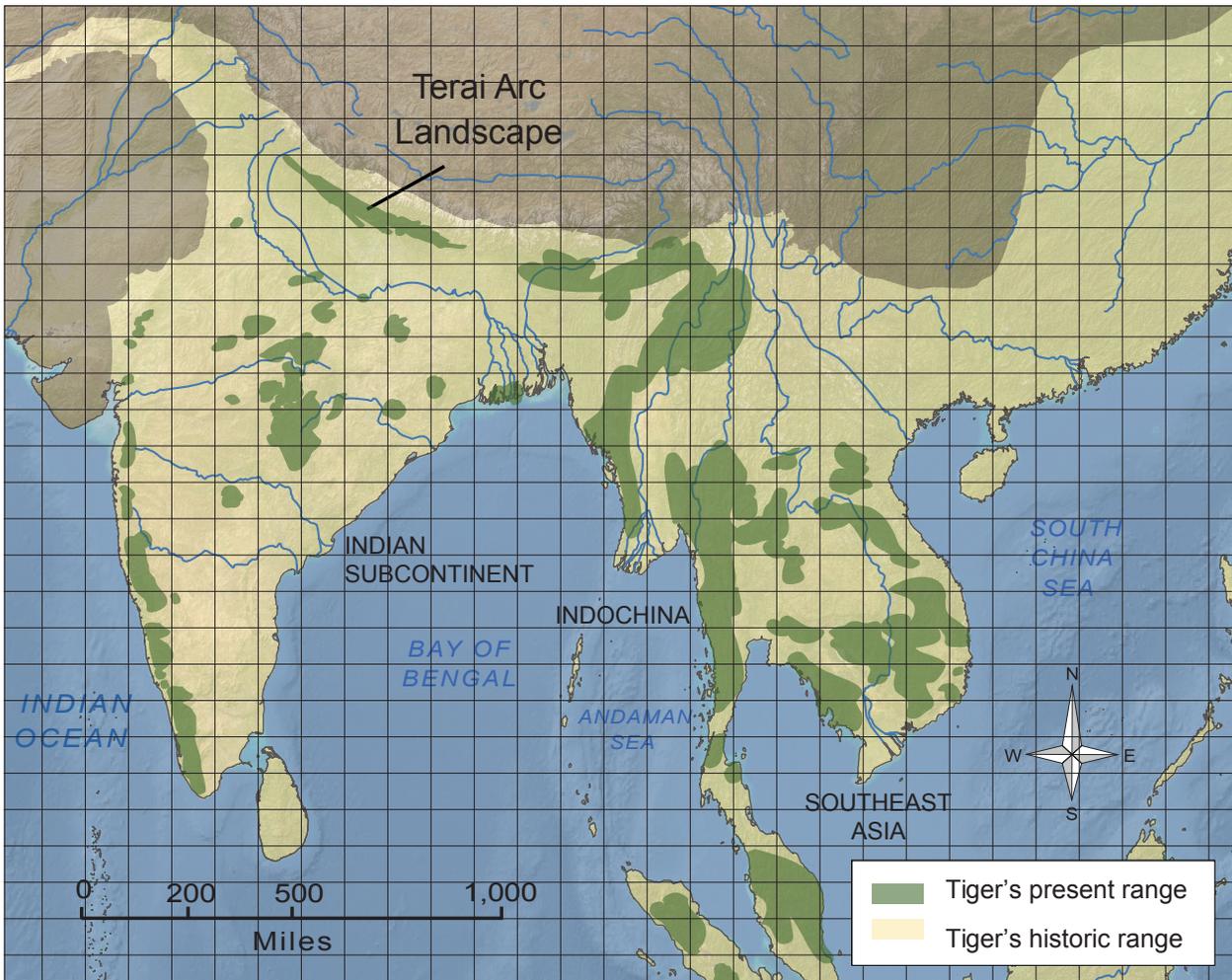
Lesson 3

Name: _____

Instructions: Complete the following tasks using the map below.

- Count the grid squares (including partial squares, see note below) indicated as tigers' historical range (light yellow) and record below.
- Count the grid squares (including partial squares) indicated as tigers' present range (dark green) and record below.

Note: While counting, combine partial squares and estimate how many more whole grid squares they represent.



Number of squares representing tigers' historical range: _____

Number of squares representing tigers' present range: _____

Difference between the number of squares representing tigers' historical and present range: _____

Calculate the percentage of remaining habitat: _____

Habitat Change and Species Isolation

Lesson 3

Name: _____

Instructions: Complete the following tasks in the spaces provided.

1. What are five human activities that affect the populations of tigers? Explain how each activity affects these populations. (2 points each, 10 points total)

2. Describe the correlation between the current range of tiger populations and land use in Southeast Asia. (2 points)

3. How might changes in land use practices have contributed to the dramatic decrease in the tiger's range, from historical times to the present? (3 points)

4. Summarize how human activities have increased the isolation of populations of species. (5 points)

Nonnative Species

Lesson 4 | page 1 of 2

Name: _____

Instructions: Use information from class discussions, **Changes in Populations** (Student Edition, pages 7–8) and **Consequences of Introductions** (Student Edition, page 9) to complete the following charts.

Nonnative Species (Original Location)	Organism Characteristics	Invaded Region	How Introduction Occurred/ Date of Arrival	Former Barrier	Predictions: Influence on Native Species (Plants and Animals)	Consequences: Effects on Geographic Isolation of Native Populations
Blackberry (South America)	Thorny bush that grows in thick hedges up to 4 meters (13feet) high. Produces thousands of seeds per bush that are viable for many years in the soil. Can reproduce within 3 months after germination.	Galápagos, Ecuador	Unknown 1900s			
Feral Goats (South America)	Strong grazers of vegetation, generalist feeders. Digs in the soil. Reproduces quickly.	Galápagos, Ecuador	Intentional— Ranching 1800s			

Nonnative Species

Lesson 4 | page 2 of 2

Name: _____

Nonnative Species (Original Location)	Organism Characteristics	Invaded Region	How Introduction Occurred/ Date of Arrival	Former Barrier	Predictions: Influence on Native Species (Plants and Animals)	Consequences: Effects on Geographic Isolation of Native Populations
Black Rats (Asia)	Adapts quickly to harsh environments and conditions.	Over 80% of the world's islands, including the Channel Islands, California, U.S.	Accidental— Exploration ships (invaded every island visited by ships) Unknown			
Red Fire Ants (South America)	Aggressive predators that can sting; territorial.	Galápagos, Ecuador	Hitchhiked on plants and in soil, rafting Early 1900s			

Introduced Species

Lesson 4

Name: _____

Instructions: Complete the following tasks in the spaces provided. (5 points each)

1. Identify and describe three specific ways that nonnative species directly influence changes in the populations of native species.

2. Explain how changes brought about by nonnative species influence the native species populations, including how decreasing population size influences genetic diversity.

3. How can changes brought about by nonnative species contribute to an increase in the geographic and reproductive isolation of native species?

Island Species and Environmental Change

Lesson 5

Name: _____

Instructions: Use information from this lesson to complete the right-hand column in the chart below.

Animal Species	Habitat	Food Source	Behavior	Potential Effects of El Niño on Island-Dwelling Organisms
Marine iguana	Rocky coastal areas, shallow reefs	Red or green algae	Lays eggs in sandy, terrestrial burrows	
Flightless cormorant	Near-shore coastal areas, rocky coastal areas on Fernandina and Western Isabela	Small fish and octopus	Builds seaweed nests in near-shore coastal areas above the high-tide line	
Galápagos penguin	Rocky coastal areas and open ocean	Small fish and crustaceans	Nests in rocky crevices	



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