



## Exploring the Diversity of Life

### Driving Question:

What do fossils and DNA evidence reveal about biodiversity and the evolution of species?

**Context:** Scientists study biodiversity to understand the health of ecosystems and life on Earth. Natural selection explains how living organisms are related and how changes in species occur over time. *Exploring the Diversity of Life* is presented as a mystery, in which students use fossil and DNA evidence to construct an argument for where to place whale species in the phylogenetic tree.

**Project:** Students work in groups to produce a scientific poster that explains their hypothesis regarding how many species of orca exist in the world. The poster includes written components in addition to a student-created phylogenetic tree that illustrates the evolutionary history of this group of whales, based on multiple lines of evidence.

**Approach:** Students use evidence from fossils and DNA sequence data to construct their own hypothesis of how orca whale species are related to each other and where they fit onto the tree of life. Students develop an understanding of the mechanisms of evolution and the principles of natural

selection through two different types of simulations, a variety of examples from nature, and class discussions. Students interpret and represent a species' evolutionary history through a phylogenetic tree and consider how environmental conditions have led to the diversity of life in particular places, and why biological diversity is important. After investigating evidence from either the past or the present, teams share their understanding and create scientific posters to exhibit what they have learned.

**Expert Involvement:** Classrooms using experts will invite them to answer questions about evolutionary biology or careers in the field through an online discussion board. As the unit progresses, students continue to post questions as they arise, as well as respond to other students' questions and ideas, particularly as they are working on their projects to determine how orca whales are related to other species.

### Primary Standards: Next Generation Science Standards- Performance Expectations

**HS-LS2-2.** Use mathematical representations to support and revise explanations based on evidence about factors affecting biodiversity and populations in ecosystems of different scales.

**HS-LS2-8.** Evaluate the evidence for the role of group behavior on individual and species' chances to survive and reproduce.

**HS-LS3-3.** Apply concepts of statistics and probability to explain the variation and distribution of expressed traits in a population.

**HS-LS4-1.** Communicate scientific information that common ancestry and biological evolution are supported by multiple lines of empirical evidence.

**HS-LS4-2.** Construct an explanation based on evidence that the process of evolution primarily results from four factors: (1) the potential for a species to increase in number, (2) the heritable genetic variation of individuals in a species due to mutation and sexual reproduction, (3) competition for limited resources, and (4) the proliferation of those organisms that are better able to survive and reproduce in the environment.

**HS-LS4-3.** Apply concepts of statistics and probability to support explanations that organisms with an advantageous heritable trait tend to increase in proportion to organisms lacking this trait.

**HS-LS4-4.** Construct an explanation based on evidence for how natural selection leads to adaptation of populations.

**HS-LS4-5.** Evaluate the evidence supporting claims that changes in environmental conditions may result in: (1) increases in the number of individuals of some species, (2) the emergence of new species over time, and (3) the extinction of other species.