Lesson 2.1 Teacher's Guide

Ecology: Describing Populations

Standards:

- 9.4.2.1 The interrelationship and interdependence of organisms generate dynamic biological communities in ecosystems.

Benchmarks:

- 9.4.2.1.1 Describe factors that affects the carrying capacity of an ecosystem and relate these to population growth.
- 9.4.4.2.4 Explain how environmental factors and personal decisions, such as water quality, air quality and smoking affect personal and community health.

Tentative Timeline:

Overall timeframe: 10-12 days
2.1.1 Describing Populations and Growth Introduction 1-2 days
2.1.2 Populations Key Information 1 day
2.1.3 Logistic and Exponential Growth 2-3 days
2.1.4 Factors Affecting Growth Rate 1 day
2.1.5 Isle Royale Case Study/News 1 day
2.1.6 Human Population Example 1-3 days
2.1.7 Natural Selection Simulation 1 day together with 2.1.8 and 2.1.9
2.1.8 Populations Unit Review
2.1.9 Formative Quiz

Learning Targets

1. I can identify and explain different population growth patterns.
    a. I can identify the differences between exponential and logistic growth patterns.
    b. I can explain carrying capacity.
2. I can explain factors that affect growth and death in populations.
    a. I can define what birth rate, death rate, immigration, and emigration are and how they affect population growth.
    b. I can differentiate between density dependent and independent limiting factors and list examples of each.

Lesson 2.1 Sections

Apps to explore:

Experience Biology (free at the App Store) Teachers - feel free to use this app to explore the levels of Biology. They include organism, population, community, ecosystem, and biome, and biosphere.

- Click 'Start' on 'Journey to Biological Levels of Organization' ($.99)

2.1.2A Inquiry Introduction/Anticipatory Set

1. 2 minute ants in pants video Teachers - use this video to pique student interest and start a discussion about populations.
2. Populations Introduction Presentation Teachers - show this presentation to introduce concepts and start discussions. Have students take notes and talk over slides with an elbow partner.

2.1.2B Introductory text and overview:

2.1.3 Logistic and Exponential Growth

2.1.3A: Writing a R.A.F.T. about Ants

2.1.3B: Graphing skills

Answer key

1. Exponential
2. They are recovering from near extinction. DDT was banned in the 1960s and the Bald Eagle population is slowly recovering.
3. Florida, Minnesota, and Wisconsin. They probably have the best habitat and food sources for Bald Eagles.
4. Northeast Minnesota. There is lots of good habitat for bald eagles - rivers, lakes, and few large cities.

2.1.4 Factors Affecting Growth Rate

Use the "Core of the Core" method - have student read the articles - you can divide the class into two groups, one for each article. Each student or group should find the main idea, key supporting details, and write a 1-2 sentence summary. As a class, add comments on Google Docs to share where you got the information.

2.1.5 Isle Royale Case Study/News

Answer key:

1. Moose and wolves populations show classic predator/prey dynamics. As one increases, so does the other. If one decreases, so does the other.

2. Disease, competition for food, availability of food.
3. Number of predators and food availability.
4. This is the big debate. Yes - to introduce better genetic diversity. No - to protect the natural population dynamics.
5. To maintain a healthy population.
6. Stay away, treat for disease, introduce new wolves, introduce more prey, create a bridge to the island, etc.
7. Various answers.

There is a great quantity of additional information from the National Park Service about wolf management and population dynamics. Teachers can use these as time and interest allows.

2.1.6 Human Population Example - The Plague

TED Talk Discussion PowerPoint with teacher instructions

2.1.7 PhET Simulations

Natural Selection - how populations change over time.
Questions:

1. What factors affect growth and death in this simulation?
2. How do you get a population to grow exponentially?
3. How do you get a population to stay at a stable level or carrying capacity (K)?

Answers:

1. Fur color, tail size, teeth size, arctic or equator environment; Predator population size, and food availability.
2. Remove the selection factors of predators and food. The bunnies hop around so quickly and take over the world!
3. Add a friend, add a mutation, and then add a selection factor (wolves or food). The populations will grow and contract in a predator/prey relationship similar to Isle Royale.

2.1.8 Review and 2.1.9 Quiz

Populations review PowerPoint
Populations review Google Presentation

1. Exponential population growth
    a. grows slowly
    b. grows quickly
    c. stops growing
2. Logistic population growth
    a. grows slowly
    b. grows quickly
    c. stops growing
3. Limiting factors
    a. slow down population growth
    b. slow down reactions
    c. speed up reactions
    d. speed up population growth
4. Wolves eat moose at the
    a. Isle Royale
    b. Southern Minnesota
    c. Near the Mississippi River
    d. close to ant colonies
5. Bald Eagle populations in Minnesota are
    a. increasing
    b. decreasing
    c. staying the same
    d. growing logistically

Citations

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Figure 2.1.6 Dumas, Ray. “Tobin Harbor Moose.” CC BY-SA 2.0

Figure 2.1.1 Garvie, Steve. "Living a Crowded Life!" CC BY-NC-SA 2.0

Figure 2.1.3 Hixon, M.A.; Brian Fath (2008) "Carrying Capacity" in Encyclopedia of Ecology, Oxford: Academic Press, pp. 528-530 Retrieved on 6 March 2009.

Figure 2.1.4 Kalish, Jim. “New Black Carpenter Ant Queen with First Brood.” Department of Entomology, University of Nebraska-Lincoln

Figure 2.1.2 Lakshmix. "South Korea's exponential."Wikimedia. N.p., 13 Aug. 2008. Web. 25 Aug. 2014. CC BY-SA 3.0 <http://commons.wikimedia.org/wiki/File:South_Korea%27s_exponential_economic_growth.png>.

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