Standard #: SC.912.L.17.5

Analyze how population size is determined by births, deaths, immigration, emigration, and limiting factors (biotic and abiotic) that determine carrying capacity.

Clarifications

Annually assessed on Biology EOC. Also assesses SC.912.L.17.2; SC.912.L.17.4; SC.912.L.17.8; SC.912.N.1.4.

General Information

Subject Area: Science

Grade: 912

Body of Knowledge: Life Science

Idea: Level 3: Strategic Thinking & Complex Reasoning

Standard: Interdependence -
A. The distribution and abundance of organisms is determined by the interactions between organisms, and between organisms and the non-living environment.

B. Energy and nutrients move within and between biotic and abiotic components of ecosystems via physical, chemical and biological processes.

C. Human activities and natural events can have profound effects on populations, biodiversity and ecosystem processes.

Date Adopted or Revised: 02/08

Content Complexity Rating: Level 3: Strategic Thinking & Complex Reasoning - More Information

Date of Last Rating: 05/08

Status: State Board Approved

Assessed: Yes

Test Item Specifications

Also Assesses:

SC.912.L.17.2 Explain the general distribution of life in aquatic systems as a function of chemistry, geography, light, depth, salinity, and temperature.

SC.912.L.17.4 Describe changes in ecosystems resulting from seasonal variations, climate change, and succession.

SC.912.L.17.8 Recognize the consequences of the losses of biodiversity due to catastrophic events, climate changes, human activity, and the introduction of invasive, non-native species.

SC.912.N.1.4 Identify sources of information and assess their reliability according to the strict standards of scientific investigation.
Clarification :
Students will use data and information about population dynamics, abiotic factors, and/or biotic factors to explain and/or analyze a change in carrying capacity and its effect on population size in an ecosystem.

Students will explain that different types of organisms exist within aquatic systems due to chemistry, geography, light, depth, salinity, and/or temperature.

Students will describe the potential changes to an ecosystem resulting from seasonal variations, climate changes, and/or succession.

Students will identify positive and/or negative consequences that result from a reduction in biodiversity.

Students will assess the reliability of sources of information according to scientific standards.

Content Limits :
Items referring to chemical factors in aquatic systems are limited to pH, oxygen, carbon dioxide, nitrogen, phosphorous, and salinity.

Items referring to geography in aquatic systems are limited to water depth, latitude, temperature, underwater topography, and proximity to land.

Items will not require the identification of oceanic zones.

Items referring to reduction in biodiversity may include examples of catastrophic events, climate changes, human activities, and the introduction of invasive and nonnative species, but they will not assess specific knowledge of these.

Items referring to reduction in biodiversity will focus on the consequence and not require knowledge of the specific event that led to the reduction.

Items addressing climate change are limited to biodiversity and population dynamics contexts.

Stimulus Attributes :
None specified
Response Attributes :
None specified
Prior Knowledge :
Items may require the student to apply scientific knowledge described in the NGSSS from lower grades. This benchmark requires prerequisite knowledge of SC.7.L.15.2, SC.7.L.15.3, SC.7.L.17.3, SC.7.E.6.6, SC.6.E.7.7, SC.8.N.4.1, and SC.8.N.4.2.

Sample Test Items (1)

Test Item #: Sample Item 1
Question: The number of pythons found throughout Everglades National Park has increased in recent years. These huge snakes are not native to Florida and are believed to have been released into the wild by pet owners. Wildlife biologists have initiated attempts to capture and remove these pythons. Which statement best explains the biologists' reason for removing these pythons from the Everglades?
Difficulty: N/A
Type: MC: Multiple Choice

Related Courses

Course Number	Course Title
2000310:	Biology 1 (Specifically in versions: 2014 - 2015, 2015 - 2022 (current), 2022 and beyond)
2000320:	Biology 1 Honors (Specifically in versions: 2014 - 2015, 2015 - 2022 (current), 2022 and beyond)
2000430:	Biology Technology (Specifically in versions: 2014 - 2015, 2015 - 2022 (current), 2022 and beyond)
3027020:	Biotechnology 2 (Specifically in versions: 2015 and beyond (current))
2000380:	Ecology (Specifically in versions: 2014 - 2015, 2015 - 2022 (current), 2022 and beyond)
2001340:	Environmental Science (Specifically in versions: 2015 - 2022 (current), 2022 and beyond)
2002440:	Integrated Science 3 (Specifically in versions: 2014 - 2015, 2015 - 2022 (current), 2022 and beyond)
2002450:	Integrated Science 3 Honors (Specifically in versions: 2014 - 2015, 2015 - 2022 (current), 2022 and beyond)
2000390:	Limnology (Specifically in versions: 2014 - 2015, 2015 - 2018 (course terminated))
2002520:	Marine Science 2 (Specifically in versions: 2014 - 2015, 2015 - 2022 (current), 2022 and beyond)
2002530:	Marine Science 2 Honors (Specifically in versions: 2014 - 2015, 2015 - 2022 (current), 2022 and beyond)
2000800:	Florida's Preinternational Baccalaureate Biology 1 (Specifically in versions: 2014 - 2015, 2015 and beyond (current))
7920015:	Access Biology 1 (Specifically in versions: 2014 - 2015, 2015 - 2018, 2018 and beyond (current))
2000315:	Biology 1 for Credit Recovery (Specifically in versions: 2014 - 2015, 2015 - 2022 (current), 2022 and beyond)
2002445:	Integrated Science 3 for Credit Recovery (Specifically in versions: 2014 - 2015, 2015 - 2020 (course terminated))
7920040:	Fundamental Integrated Science 3 (Specifically in versions: 2013 - 2015, 2015 - 2017 (course terminated))
2001341:	Environmental Science Honors (Specifically in versions: 2016 and beyond (current))

Related Access Points

Access Points Number	Access Points Title
SC.912.L.17.In.2:	Identify that living things in an ecosystem are affected by changes in the environment, such as changes to the food supply, climate change, or the introduction of predators.
SC.912.L.17.Su.2:	Recognize how animals and plants in an ecosystem may be affected by changes to the food supply or climate.
SC.912.L.17.Pa.2:	Recognize what happens to plants and animals when they don't get enough food or water.

Related Resources

Lesson Plans

Name	Description
Bonefish Genetics:	Recent research has shown that bonefish (Albula vulpes) found all around the Florida Keys, The Bahamas, and many other places across the Atlantic, Gulf, and Caribbean are genetically related. In this lesson, students will learn about what it means to be "genetically related," how genetics are determined, and how this could change how we manage bonefish populations locally and internationally. They will work together in to create a "model treaty" that protects bonefish between countries.
The Ups and Downs of Populations:	Students will analyze population graphs, collect data to generate their own population graph, and experience limiting factors and their impact on carrying capacity in a small deer population. Students will be able to identify, explain, and evaluate the impact that different limiting factors have on the population of organisms including food, water, shelter, predation, human interference, changes in birth and death rate, changes in immigration and emigration, disease, and reproduction.

The Game of Population Changes:	This lesson plan uses multicolor paper dots to model how events change a bird population over time. "You are a scientist observing a community of birds in the forest. Periodically, different events occur and have an effect on the populations of different birds. As a dedicated scientist and observer, you record all of these changes and watch how the community changes over time."
Sea Otter Spotter - A Population Growth Curve Using Southern Sea Otter Census Data:	Students explore the world of population biology using the sea otter as a case study. The lesson involves reading technical reports from the US Fish and Wildlife Service as well as reading information about the sea otter from non-governmental organizations. Students are introduced to a specialized wildlife capture technique and monitoring of the endangered population through annual census data. Using that data students explore the limiting factors affecting sea otter growth and apply mathematical knowledge to analyze population growth curves. Students also produce an argument on whether the sea otter has met criteria and should be removed from the endangered species list.
Duck, Duck, Growth:	In this lab students will have a chance to explore the effects of limiting factors on a pair of ducks. Students will then examine why the limiting factors influences the carrying capacity of a population. Students will collect data and analyze it before drawing a conclusion about limiting factors and carrying capacity.
Dynamics of Populations:	This lesson addresses the different factors responsible for the size and dynamics of populations. Growth and decline in population numbers are both addressed through presentation, discussions and a plant growth experiment extension.
To The Limit:	"To The Limit" MEA has students identify several factors that can affect a population's growth. Students will examine photos to list limiting factors and discuss their impact on populations. As a group they will develop a solution to minimize the impact of pollution on fish population.
Population Dynamics:	This 7E lesson plan is broken down into 3 lessons used to teach high school students in grades 9-12 about the characteristics used to describe populations. There are inquiry based and project based inquiry activities incorporated within the lesson. Students will also learn the difference between exponential and logistic growth by doing hands -on activities. A Power Point is used to guide the activities, and learning.

Original Student Tutorials

Name	Description
Migration in the Kenyan Savannah:	Examine migration and factors affecting both population sizes and distributions of key species in the Kenyan savannah with this interactive tutorial.
Population Interactions:	Explore population interactions and how those interactions can affect population size in this interactive tutorial. You'll also learn about competition, predation and symbiosis.

Perspectives Video: Experts

Name	Description
Migration in the Kenyan Savannah:	Patrick Milligan discusses the impetus for organisms to migrate in the Kenyan savannah. Download the CPALMS Perspectives video student note taking guide.
Habitat Changes in Related to Phosphorous Pollution in the Everglades:	Watch as Dr. Stephen E. Davis, III explains how excess phosphorous pollution is impacting the Everglades. Download the CPALMS Perspectives video student note taking guide.
Limiting Factors Affecting Coral Health Populations:	Dr. Erinn Muller describes limiting factors affecting coral health. Download the CPALMS Perspectives video student note taking guide.

Teaching Ideas

Name	Description
Endangered Species Worldwide:	Students will be able to use a world map or globe to locate the distribution of at least 10 endangered species and describe the current threats and conservation efforts concerning one endangered species of animal or plant.
Manatees on the Move-SeaWorld Classroom Activity:	Students will be able to show four or more West Indian manatee habitats on a map and describe and/or illustrate yearly movements of manatees along the Florida coastline. Students will be able to describe the top three threats to manatees and create an educational campaign to target the causes of the threats.
Manatees on the 'Net-SeaWorld Classroom Activity:	Students will use the Internet to determine the population status of the Florida manatee and will use the information to debate the extinction or recovery of the manatee.
Fur Seal Survey-SeaWorld Classroom Activity:	Given a current environmental situation, the student will be able to gather information, organize, analyze, and present data. They will participate in a decision-making process.
Raptor Detectives-SeaWorld Classroom Activity:	Students will identify threats to raptor populations and conceptually model situations related to population dynamics.
Raptor Population Ecology-SeaWorld Classroom Activity:	Students will calculate population size, carrying capacity, annual change in population size, and maximum rate of population increase of different raptor species.

Text Resources

Name	Description
	This informational text resource is intended to support reading in the content area. When corals are stressed, they

Coral Reefs Show Remarkable Ability to Recover from Near Death:	release their algal partners and turn white, a phenomenon called coral bleaching. This occurs when they are under stress from warming waters or other environmental factors. Researchers monitored reefs in the Seychelles during and after coral bleaching events, and found that several factors, including depth of growth, branching shape, nutrient levels, and amount of fish grazing accurately predicted whether reefs were likely to recover from these events. Human impacts such as sediment or nutrient run-off also affect the corals' resiliency.
Plant vs. Predator:	Ecologist Daniel Janzen of the University of Pennsylvania describes how this plant's strategy came about and what's in it—both good and bad—for the bamboo, the rats and other predators, and anyone living nearby.

Tutorials

Name	Description
Underwater Evidence:	**Click "View Site" to open a full-screen version.** This tutorial is designed to help secondary science teachers learn how to integrate literacy skills within their science curriculum. This tutorial focuses on using specific textual evidence to support students' responses as they analyze science texts. The focus on literacy across content areas is designed to help students independently build knowledge in different disciplines through reading and writing.
Survive Within a Niche:	This tutorial will help the learners to understand how animals survive in their habitat. In order to survive, the organisms must have adaptations that make them successful in the area where they live.
Population Demographic Lab:	This lab simulation allows you to use real demographic data, collected by the US Census Bureau, to analyze and make predictions centered around demographic trends. You will explore factors that impact the birth, death and immigration rate of a population and learn how the population transitions having taken place globally.
Population Ecology:	In this interactive, explore one of the most well-understood mass seedings—that of oak-tree acorn crops—and its widespread effects on various animals in the ecosystem as well as on nearby human populations.

Virtual Manipulatives

Name	Description
Winn Bee Foraging Activity:	In this software simulation, students take on the role of bees and experiment with different foraging patterns in a field of flowers to maximize net energy input. Students generate quantitative data that can be analyzed and graphed.
Virtual Lab Population Biology:	In this investigation, students conduct an experiment and grow two species of the protozoan *Paramecium*, alone and together. Then they compare growth curves of the population of each species, alone and then together. Objectives: • Demonstrate how competition for natural resources in the environment can affect population growth. • Explain how availability of resources such as food can be limiting for a population.

Student Resources

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