

POPULATION DYNAMICS

Performance Standard 12 B/11A/13B.I

Students will apply the processes of scientific inquiry to explain population model studies to determine limiting factors and mathematical patterns of population growth in real-world situations accordingly:

- *Knowledge*: Understand the basis of population models, databases and foundations.
- *Application*: Graphically represent and analyze Humboldt penguin population using age-gender population pyramids.
- *Communication*: Apply measures of change to make predictions about captive populations.

Procedures

1. ***In order to know and apply concepts that describe how living things interact with each other and with their environment (12B) and the concepts, principles and processes of scientific inquiry (11A) and the concepts that describe the interaction between science, technology and society (13B),*** students should experience sufficient learning opportunities to develop the following:
 - Formulate hypothesis about Humboldt penguin population kept in zoos and aquariums in the United States and Canada.
 - Reference Species Survival Plans from American Zoo and Aquarium Association (AZA) research materials.
 - Identify roles and relationships of organisms (captive Humboldt penguins) in their community in terms of impact on populations and the ecosystem.
 - Propose options for appropriate questions, procedural steps and necessary resources to research population models to determine limiting factors and mathematical patterns.
 - Design investigation which addresses selected hypothesis.
 - Determine variables and control groups.
 - Use technologies to conduct investigation.
 - Analyze how resource management and technologies accommodate population trends.
 - Interpret and represent analysis of results to produce findings.
 - Evaluate data sets and apply statistical methods.
 - Present and defend process and findings.
 - Generate further questions for consideration to assess global consequences or ecosystem modifications.

Note to teacher: This activity relates to knowledge associated with standard 12B, while addressing the performance descriptions for stage I within standard 11A. It integrates information as suggested in standard 13 B. All materials referenced in this activity are available free from the website of Brookfield Zoo, Brookfield, IL:<http://www.brookfieldzoo.org/zoolink.asp?tosaveaspecies> These materials are a part of the project: Connections: To Save a Species: Managing a Captive Population. Their production was supported by the Chicago Zoological Society and the Public Museum Operating Grants Program—Illinois Department of Natural Resources and the Illinois State Museum. (ISBN 0-913934-31-3) Brookfield Zoo has graciously provided permission for offering this activity for the Illinois Learning Standards Performance Descriptors Project.
2. Have students review and discuss the assessment task and how the rubric will be used to evaluate their work.
3. The web-based materials provided in ‘To Save a Species: Managing a Captive Population’ offer materials for understanding how zoos help endangered animals, investigating the current population and making predictions and planning for the future. For these purposes, the population investigation will be highlighted. Practice activities for managing large amounts of data and the introduction to the provided Humboldt Penguin database should be used. Students will formulate queries needed to isolate the number of penguins alive in a given year and extract the necessary information from the provided AZA database. Students will graphically represent the penguin population over time using age-gender population pyramids and analyze their finding using class comparisons.

4. Evaluate each student's work using the Science Rubric as follows and add the scores to determine the performance level:
- *Knowledge*: The identification of the ecosystem's abiotic and biotic factors and organism niches, habitats, and trophic levels found within ecosystems were complete and correct,
 - *Application*: The analyses were thorough, well-detailed, and accurate, and
 - *Communication*: The report was well-organized, well-detailed and complete.

Examples of Student Work not available

Time Requirements

- One class period to orient students to assessment
- About 5 hours of out-of-class time to research and prepare the report

Resources

- Download the middle/high school (grades 7-12) curriculum materials and software from the Brookfield Zoo Managing a Captive Population from:
<http://www.brookfieldzoo.org/0.asp?nSection=15&PageID=196&nLinkID=31>
By phone: Contact the Education Department at (708) 485-0263, ext. 367 for information about ordering a printed copy of the curricula materials, including a CD with both the Macintosh and Windows software or a CD with both the Macintosh and Windows software, as well as the curriculum materials in pdf format.
- Science Rubric