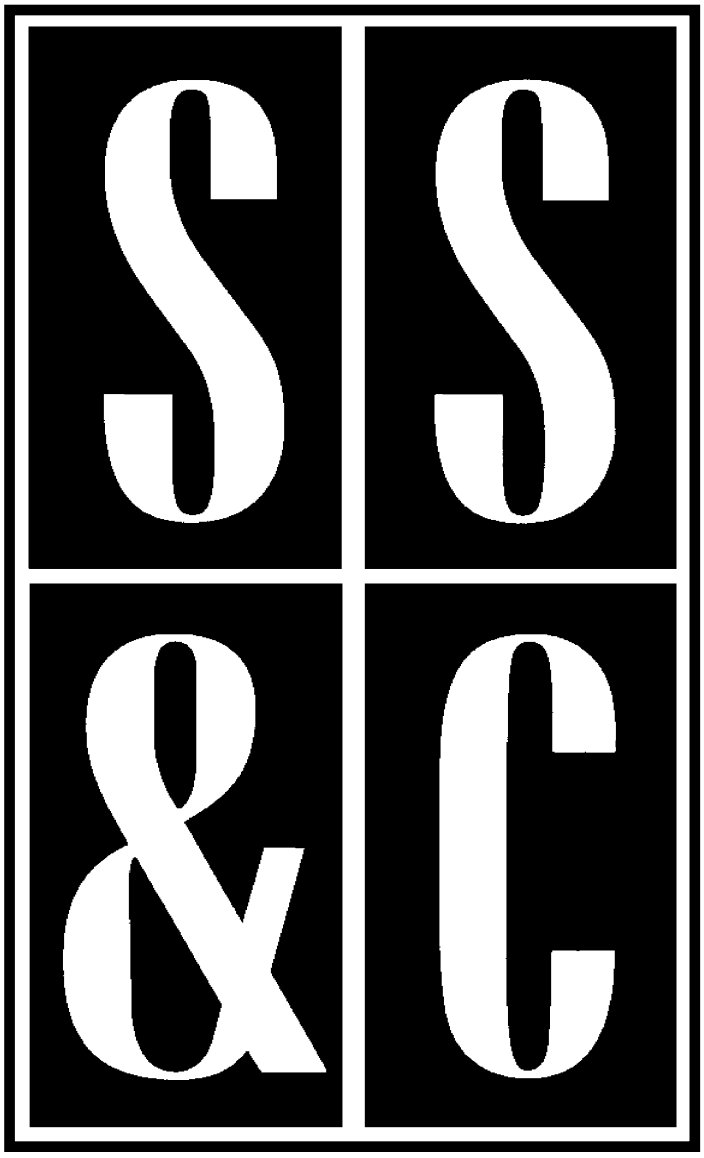
Scope, Sequence & Coordination

A National Curriculum Development and Evaluation Project for High School Science Education



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National Science Education Standard—Life Science

The Interdependence of Organisms

Organisms both cooperate and compete in ecosystems. The interrelationships and interdependencies of these organisms may generate ecosystems that are stable for hundreds or thousands of years.

Living organisms have the capacity to produce populations of infinite size, but environments and resources are finite. This fundamental tension has profound effects on the interactions between organisms.

Human beings live within the world's ecosystems. Increasingly, humans modify ecosystems as a result of population growth, technology, and consumption. Human destruction of habitats through direct harvesting, pollution, atmospheric changes, and other factors is threatening global stability, and if not addressed, ecosystems will be irreversibly damaged.

Teacher Materials

Learning Sequence Item:

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Populations

March 1996
Adapted by: Keith Lippincott

Organisms, Ecosystems, and Population Growth: Interrelationships and Interdependencies. Students should demonstrate that they understand the concept of population as it relates to ecosystems. (*Biology, A Framework for High School Science Education, p. 120.)*

Contents

This micro-unit was adapted by **Keith Lippincott** (Science Education Center, Iowa City, Iowa)

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Learning Sequence

Organisms, Ecosystems, and Population Growth: Interrelationships and Interdependencies. Students should demonstrate that they understand the concept of population as it relates to ecosystems. (*Biology, A Framework for High School Science Education, p. 120.)*

Science as Inquiry	Science and Technology	Science in Personal and Social Perspectives	History and Nature of Science
Why Am I Here? **Activity 1** Colors That Stand Out in Nature **Activity 2** Survival of Lions **Assessment 1`** Life Cycles **Assessment 3** Graphing Changes **Assessment 4** Population and Community **Assessment 6**	Cats—Rare Birds **Assessment 2**	Cats—Rare Birds **Assessment 2** Graphing Changes **Assessment 4** Natural Evolution? **Assessment 5**	

Suggested Sequence of Events

Event # 1

Lab Activity

1. Why Am I Here!

Event #2

Lab Activity

2. Colors That Stand Out in Nature

Event #3

Readings from Inquiry, Science and Technology, Personal and Social Perspectives, and History of Science. Students select two or three from list.

Reading 1
Reading 2
Reading 3

The above readings can be found in the student version of this publication.

Assessment items can be found at the back of this volume.

Assessment Recommendations

This teacher materials packet contains a few items suggested for classroom assessment. Often, three types of items are included. Some have been tested and reviewed, but not all.

1. Multiple choice questions accompanied by short essays, called justification, that allow teachers to find out if students really understand their selections on the multiple choice.

2. Open-ended questions asking for essay responses.

3. Suggestions for performance tasks, usually including laboratory work, questions to be answered, data to be graphed and processed, and inferences to be made. Some tasks include proposals for student design of such tasks. These may sometimes closely resemble a good laboratory task, since the best types of laboratories are assessing student skills and performance at all times. Special assessment tasks will not be needed if measures such as questions, tabulations, graphs, calculations, etc., are incorporated into regular lab activities.

Teachers are encouraged to make changes in these items to suit their own classroom situations and to develop further items of their own, hopefully finding inspiration in the models we have provided. We hope you may consider adding your best items to our pool. We also will be very pleased to hear of proposed revisions to our items when you think they are needed.

Science as Inquiry

Why Am I Here?

How do we count plant populations?

Overview:

Using gloves or forceps is strongly recommended for anyone when counting or handling plant specimens. This eliminates the likelihood of an allergic reaction when coming in contact with a plant or plants.

Materials:

Per lab group:

plant or weed identification chart (or books)
3 sheets of notebook paper
metric ruler
2-meter piece of string
4 stakes (or large nails)
forceps (or garden gloves)

Procedure:

Students work in groups of 3 or 4. Have students create three charts on different sheets of notebook paper. The title for the charts are *Sunlight, Shade,* and *Neglected.* The information they will collect will be listed under the headings *Plant Type* and *Number* for each chart.

Have students select three different locations that meet the criteria on the charts (i.e., in the lawn around the school or at a nearby accessible park). Note: *Neglected* means an abandoned area where weeds are allowed to prosper.

At the sunlight location, each group will nominate one student to toss an object, such as a pencil, into the chosen location. This person should close his or her eyes when making the toss. Another student will mark the spot where the object lands. Using the string and the stakes/nails, students mark off a 30 cm $\times$ 30 cm square around this spot. The object (pencil) should be in the enter of this square.

On the chart labeled "Sunlight," students record the type and number of all the plants inside the square. If a plant is not able to be identified, carefully remove a single leaf or flower. This will be identified using the plant charts or books in the regular classroom. Students should use forceps or gloves when making the removal for safety sake.

When finished counting the plants, students remove the string and the stakes, and move to the next designated location, repeating steps 1–7 for the other two charts.

Background:

A population is a group of individuals of the same species living in a given area. Biologists use two different methods for determining the number of living things in a given area. The most accurate data

would be obtained by actually counting all of the individuals. Usually, this is not a realistic or practical possibility. The other alternative is to count a sample of the population. This small count must be representative of the entire population. A random selection of areas in which to count organisms helps eliminate bias. This provides an opportunity for every member an equal chance of being counted.

Adapted from:
Prentice-Hall, Inc., Chapter 48.

Science as Inquiry

Colors That Stand Out in Nature

What do we know about relationships in an ecosystem?

Overview:

Materials:

Per class:

500 toothpicks (100 each of 5 different colors—one must be green)
pencil
note pad, small (or lab handbook)

Procedure:

Scatter the toothpicks over a grassy area. Tell the students that the toothpicks represent food and that the students are predators hunting this food. Decide on a time limit. Signal the predators to capture their prey. Signal the end of the "hunt." Count the number of prey each predator has captured. Separate the prey (toothpicks) into numbers which represent the number of each color of prey captured. Create a data table for the entire class.

Background:

An ecosystem consists of groups of organisms and their nonliving environment. The living material is called *biotic* and the nonliving factors are called *abiotic.* The abiotic factors include the soil, temperature, water, and light

If you examine an outdoor ecosystem, you will find producers, consumers and decomposers. These biotic factors will form a variety of food web. You would also find evidence of competition for both space and food sources.

In this investigation you and your students will examine an outdoor environment. It is important to disturb little of the environment and care should be practiced to prevent damage to this location. All creatures share this one Earth and humans should respect the rights of all organisms.

It is recommended to input the data into a computer program for a graphic display of the data.

Adapted from:
Prentice-Hall, Inc., Chapter 48.

Science as Inquiry

Survival of Lions

Item:

A remote foothill community is composed of deer, shrubs, grass, rabbits, mountain lions, and decomposers. Observations by wildlife management researchers studying the mountain lion population over many generations has concluded that the number of adult lions in the area has been declining. Which of the other living organisms in the community could affect the lions' ability to survive as a species?

A. Deer only.
B. Deer and rabbits only.
C. Deer, rabbits, grass and shrubs only.
D. Deer, shrubs, grass, rabbits and decomposers.

Justification:

Describe how each organism listed in the question above interacts with other organisms in the community. Include all organisms for which any relationship exists.

Answer.

D. Organization of ecosystems is based upon populations interacting with each other and with abiotic factors of the environment. Interactions of populations sets up a community. Predator-prey relationships show a positive as well as negative association. The cycling of nutrients in an ecosystem is essential to maintain a balance in that ecosystem and the overall health of each species in the community. Ecosystems are dependent upon resources which are utilized by organisms and the recycling of wastes disposed by them.

Science and Technology/Science in Personal and Social Perspectives

Cats—Rare Birds

Item:

A community of cats has established itself on a school campus. The principal is concerned that the number of cats will become so great that they will be a nuisance to the school and the neighborhood. Assume that there are equal numbers of male and female cats which will mate and reproduce as much as possible. The cats feed primarily on garbage left over from the students' lunches. They live in the large spaces under the school buildings.

A decrease in the number of a certain species of rare birds which live in the area has been blamed on the cats' increasing population. Some people say the bird population would have decreased on its own even without the cats.

Formulate and support an opinion on this controversy. Describe how you would organize a study to resolve this controversy.

Answer.

Science as Inquiry

Life Cycles

Item:

Students collect grass and place in pond water. After a couple of days, and using a microscope, they keep a record of their observations, identifying organisms and plotting their life cycles.

Answer.

Students should notice successions, i.e., different organisms moving and dying out.

Science as Inquiry/Science in Personal and Social Perspectives

Graphing Changes

Item:

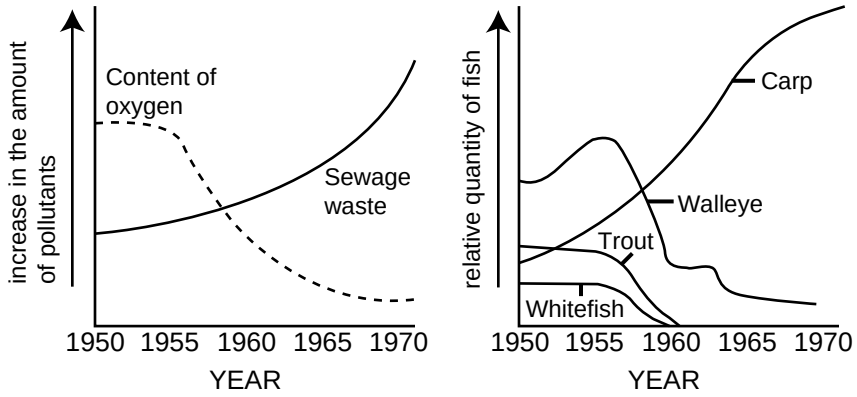
The two graphs below show data on several changes which have taken place in a large lake over a 20-year period. Write a paragraph (or paragraphs) in which you do the following:

A. Summarize the information shown in Graph 1 and Graph 2

B. Make one inference about Graph 1.

C. Make two inferences about the fish in Graph 2.

D. For each fish species, make one inference about the response of that species to the changes in its environment.



Answer:

Science in Personal and Social Perspectives

Natural Evolution?

Item:

Should animals be kept confined? Removing animals from their niches may interfere with the natural evolution of a species.

Should every attempt be made to save an endangered species? If there are too few, what will happen to the gene pool?

Should hybridization be encouraged in situations where a population has declined?

Answer:

Science as Inquiry

Population and Community

Item:

Choose the term which best completes the following analogy:
Population is to community as _____ is to biosphere.

A. ecosystem
B. abiotic factor
C. atmosphere
D. niche

Justification:

Explain and distinguish each of the above items.

Answer.