Arctic Bird Migration Monitoring Protocol

Purpose

To observe when selected bird species first arrive at your study site, and to count the numbers until few or none of these birds are seen

Overview

Students select a common and easily identifiable bird species in their region and observe when the bird species first arrives. Students use binoculars or telescopes to scan a study site and count how many they see. They continue to observe every other day until few or none of the selected species can be seen.

Student Outcomes

Students will learn to identify different species of birds, their migratory patterns and behavior, as well as using standardized methods to gather scientific data.

Science Concepts

Life Science

- Organisms have basic needs.
- Organisms can only survive in environments where their needs are met.
- Earth has many different environments that support different combinations of organisms.
- All organisms must be able to obtain and use resources while living in a constantly changing environment.
- Energy for life derives mainly from the sun.
- Living systems require a continuous input of energy to maintain the chemical and physical organizations.
- The interaction of organisms in an ecosystem have evolved together over time.

Geography

- The characteristics and spatial distribution of ecosystems on Earth's surface

Scientific Inquiry Abilities

- Identify answerable questions.
- Design and conduct scientific investigations.
- Use appropriate mathematics to analyze data.
- Develop descriptions and predictions using evidence.
- Recognize and analyze alternative explanations.
- Communicate procedures, descriptions, and predictions.

Time

Field time 15 – 20 minutes (excluding travel time).

Level

All

Frequency

Every other day from about 2 weeks prior to expected arrival time until few or none of the selected bird species are seen

Materials

- *Arctic Bird Migration Monitoring Field Guide*
- *Arctic Bird Migration Monitoring Data Sheet*
- *Arctic Bird Migration Site Definition Field Guide*
- *Arctic Bird Migration Site Definition Data Sheet*
- *GPS Protocol Field Guide*
- *GPS Protocol Data Sheet*
- Compass
- Binoculars and/or telescopes
- Notebook (preferably a waterproof field-book)
- Pencils
- Bird identification book

Preparation

Decide upon study locations and the species to be monitored.

Practice using binoculars.

Use of a Bird Identification book

Prerequisites

None

Arctic Bird Migration Monitoring Protocol – Introduction

Both scientists and amateur naturalists have been recording the life cycles of plants and animals for many centuries. Since about 1850, records of climatic fluctuation and changes in distribution of plants and animals have become more reliable. These data sets are now being used to study the timing of biological events and to explore changes in bird migratory patterns (Whitfield, 2001). The data are of great importance and allow scientists to make better predictions about future impacts of climate change.

Ornithologists believe climate to be a primary factor influencing bird distribution. Many bird species that breed in the Arctic and near Arctic zones migrate in autumn to wintering areas. The general direction of migration is from pole to equator, but birds may go in other directions such as east or west (Harrison, 1982).

Data show an increase in temperature in northern Europe in the early 20th century (Icelandic Ministry of Environment, 2000). A gradual response by birds became apparent, and in the early 1950s, James Fisher listed 42 species that were spreading into Scandinavia from the south or east (Burton, 1995). Finnur Gudmundsson listed seven southern species that established themselves as breeding birds in Iceland between 1890 and 1950. Partially migratory species (species that have a portion of the population stay in the same place all year round), winter visitors and occasional visitors increased in Iceland. Increased temperature also caused northern species to retreat farther north (Gudmundsson, 1951). Since the 1950s, there has been a decrease in temperature in northern Europe and Iceland and some birds have responded by shifting southwards to breed. Other regions in the world have shown an increase in temperature during the same time period (Burton, 1995). It is important to realize that climate change can differ between areas and scientists would like a better understanding of how birds respond in different places.

Many factors affect bird migratory behavior. Temperature is often thought of as the obvious explanation for distributional limits of birds and other animals, but it also has secondary effects. For example, temperature affects vegetation growth and seed and insect availability for birds to eat. Precipitation also affects food availability and the types of land cover in an area. In addition to climatic changes, human activity has had an impact on bird distribution and abundance by changing land cover (Harrison, 1982).

Data from the GLOBE *Arctic Bird Migration Monitoring Protocol* will be important to scientists now and in the future. Gathering data in many different locations will increase knowledge, not only about bird migration patterns and its connection to climate changes, but also on changes in abundance and species distribution. Furthermore, the data collected can be compared with other phenological data gathered by your school or in cooperation with other schools and other institutions to get a more complete picture of the Earth system.

Teacher Support

Selecting a Bird Species

- First, students need to gather information about birds in your area. What are common birds in your area? Which species breed in your area? Which species stay the whole year? Which species are migratory and only stay for part of the year? Information on the bird species and their spring arrival time should be easy to locate. Most communities have a network of bird watchers who can help you. As well, you can contact experts at universities or government agencies.
- The species you choose needs to be common and easily identified. We suggest that you do not select hidden or secretive species or species that rest and/or feed in trees or on land where they cannot be easily seen as this makes it difficult to estimate how many are present at your site.
- What is the migratory pattern of the species you select? What time of the year do the birds migrate to your area? You may want to select a bird species that arrives in the early spring so that student observations can fit into the school calendar.
- You need to find information on where the birds can be found in your area.
- It would be helpful to learn about your selected species. Where does it come from? What does it eat? Does it gather in flocks at certain times, e.g. to feed on estuaries or on lakes? Does it come to your area to breed, or is it on a stopover and will be migrating farther to breed?

Following are some examples of bird species you can observe that can be easily identified and seen.

Arctic tern *(Sterna paradisaea)*

Eurasian Golden Plover (*Pluvialis apricaria*)

Oystercatcher *(Haematopus ostralegus)*

Site Selection

Depending on where you live, select a site in an estuary, a field, a shoreline, lake or pond, or ocean. A woodland or forest is more difficult since it can be difficult to see birds in the trees.

Select a site based on the known distribution of your selected species in your area. Students will make frequent visits, so the site needs to be fairly close to your school or to homes of students.

The location must be accessible to students so birds can be counted accurately. Observers need to be far enough away from the birds not to disturb them, but close enough to count them. You can use binoculars or telescopes to see the birds better at a distance.

The size of the site needs to be manageable for students to observe the birds. A very large area can be difficult for students to accurately count the birds. However, a large area can be divided into segments and the students can be divided into groups. Each group would count birds from one segment. Later the numbers from the groups can be pooled together to get the total number of birds on your entire study site.

Do not choose an area where the birds are fed, as feeding may affect the bird numbers and would not show the natural number of birds frequenting a place with a natural food source.

Avoid areas used for hunting if you are observing birds during hunting seasons.

Bird Monitoring

As the arrival time of birds can vary between years, start monitoring your site one or two weeks before the expected arrival.

Choose a convenient time of day to observe. You need enough light to see the birds. Go at about the same time each day. If you are studying a shorebird along an ocean, make your observations within two hours of low tide. Look at tide tables for your area to know when to go.

If you observe anything unusual during your observations, such as a bird of prey or high winds, record on the comment section on the *Arctic Bird Migration Monitoring Data Sheet*. Additional information can often help explain discrepancies or unusual values in the data.

Each year students can select which bird species they would like to monitor. However, scientists would like to have at least one species that is consistently monitored each year.

Continue observing until all or most of the selected bird species have left your area.

Student Preparation

Familiarize the students with the study site and methods before students start to observe and count birds.

Have the students visit the site together and practice using binoculars or telescopes to count birds while scanning the area. Since you will be practicing before your chosen bird species arrives, decide beforehand what you will count. It could be all birds on the site or one species familiar to all students. It takes practice to use binoculars for counting birds. Have the students adjust the focus as necessary so that the data collected are reliable.

Have the students compare notes on how they did, how many birds did they see and what problems they had or can foresee.

Ideas and Variations

- It is suggested that students work in groups of at least two so that one student can record the count as the other student observes the birds.
- If there are many students in your class you could choose more than one species of bird. Divide the students into groups and each group could be responsible for one species.
- Separate the students into different groups and observe the same species at different locations. Students could compare arrival times and numbers of birds among the sites and explore reasons why there may be differences.
- Choosing two different locations with different species would also be interesting, as the students could also study why different species choose different locations.
- Have students determine the difference in elevation between the *Arctic Bird Migration Study Site* and the nearest Atmosphere Study Site. They should do this using the corrected elevation values supplied by GLOBE. This may indicate that temperature and other variables are different at the two sites.
- Students could share what they learn about their chosen species by making posters, giving oral presentations, or writing essays.

Questions for Further Research

Does temperature affect the arrival time of selected bird species?

Do other weather or ocean conditions affect the arrival and departure of selected bird species?

Is there a difference in arrival time between bird species? If so, why?

How does the land cover in your area affect the types of birds you see?

Do different bird species react differently to changes in temperature?

Would an unusually wet spring affect the migratory patterns of birds?

References

Burton, John F. 1995. *Birds & Climate Change*. Biddles Limited. Surrey. Great Britain.

Guomundsson, Finnur. 1951. *The effects of the resent climatic changes on the bird life of Iceland.*

Harrison, Colin. 1982. *An Atlas of The Birds of the Western Palearctic*. William Collins Sons & Co Ltd. Glasgow. Great Britain.

Veourfarsbreytingar og afleioingar peirra. Sk´yrsla vísindanefndar um loftslagsbreytingar (Meteorological changes and consequences. Scientific Committee Report). October 2000. Umhverfisráuneytio, Reykjavík (Icelandic Ministry of Environment, Reykjavík).

Whitfield, John. 2001. *The budding amateurs*. Nature 414: 578-579.

Arctic Bird Migration Monitoring
Site Definition Field Guide

Task

Measure the latitude, longitude and elevation, take photos and describe your Arctic Bird Migration Monitoring Study Site.

What You Need

- ❑ GPS receiver
- ❑ *Basic GPS Field Guide and Data Sheet*
- ❑ *Arctic Bird Migration Monitoring Site Definition Data Sheet*
- ❑ Camera
- ❑ Compass
- ❑ Pencil

In the Field

1. Fill out the top portion of the *Arctic Bird Migration Monitoring Site Definition Data Sheet.*
2. Determine the latitude, longitude, and elevation following the *GPS Protocol Field Guide*. Record these values on your *Arctic Bird Migration Monitoring Site Definition Data Sheet*.
3. Take photographs in the North, East, South, and West directions. Use the compass to determine the directions. Remember that you want true north and not magnetic north.
4. Describe the type of site: field, estuary, lake or pond, ocean, woodland/forest, or other.

Arctic Bird Migration Monitoring Protocol

Field Guide

Task

To observe the number of birds of your selected species at your Study Site

What You Need

- ❑ Binoculars or telescope
- ❑ Bird Identification book
- ❑ Pencil
- ❑ *Arctic Bird Migration Monitoring Data Sheet*

In the Field

1. Fill out the top part of the *Arctic Bird Migration Monitoring Data Sheet*.
2. Record date and starting time.
3. Using the binoculars or telescope, start scanning the study site from one side to the other side. Count the number of birds of the selected species. Record the number of birds you see as you scan the site.
4. Record the end time of monitoring.
5. If your site is located by the ocean, record the approximate time of low tide.

Arctic Bird Migration Monitoring Protocol – Looking at the Data

An Example of a Student Project

Oystercatchers (Haematopus ostralegus) Observed on Akureyri Estuary

Here is an example of a possible student research project using Oystercatchers data collected between 1994-1999. It is based on data collected by adult volunteers in Akureyri, Iceland. Bird enthusiasts in Akureyri have been recording birds at the estuary since 1993. They visit the estuary approximately once a week and record all the different species.

Figures EA-BI-1 through EA-BI-6 show the number of Oystercatchers observed at the estuary. Each figure shows the data for a single year from 1994 to 1999. The y-axis represents the number of birds observed and the x-axis represents the day in the year starting from January 1. May 1, for example represents day number 121 in a normal year and day number 122 in a leap year. It should be noted that the data set is not consistent between years. The number of days visited to take observations differs, and for some years, observations were not started before birds started to arrive in the spring.

Figure EA-BI-1: Oystercatcher arrival to the Akureyri estuary in 1994

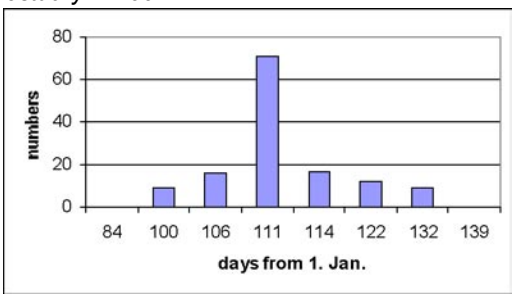


Figure EA-BI-2: Oystercatcher arrival to the Akureyri estuary in 1995

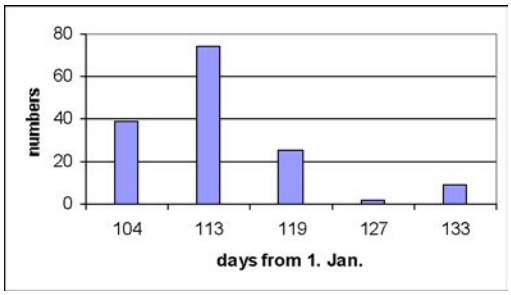


Figure EA-BI-3: Oystercatcher arrival to the Akureyri estuary in 1996

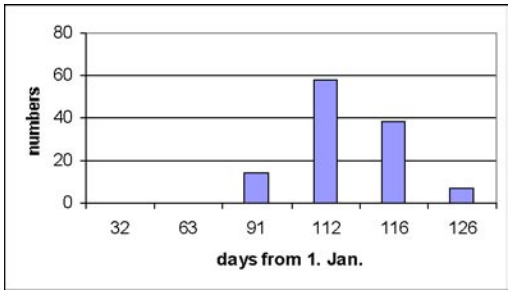


Figure EA-BI-4: Oystercatcher arrival to the Akureyri estuary in 1997

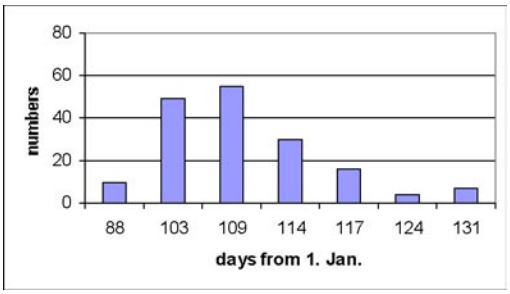


Figure EA-BI-5: Oystercatcher arrival to the Akureyri estuary in 1998

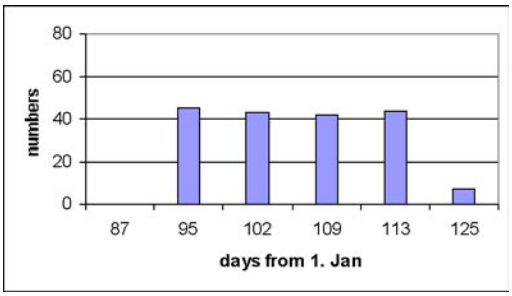
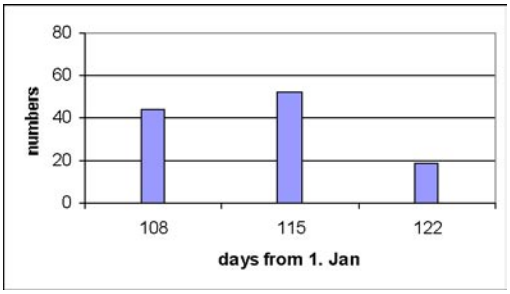


Figure EA-BI-6: Oystercatcher arrival to the Akureyri estuary in 1999



After examining Figures EA-BI-1 through EA-BI-6, one can see that in 1994 and 1995, the maximum numbers of Oystercatchers in the estuary are higher than in the following years. This can be shown better in Figure EA-BI-7 comparing the maximum number of Oystercatchers observed each year.

The year 1998 shows a slightly different pattern than the other years. The maximum number of birds observed in 1998 was observed earlier in the spring (day 95 compared to day 111, 113, 112, 109, and 115). Figure EA-BI-8 compares the days when the maximum number of Oystercatchers was observed each year. In 1998, the birds arrived more or less all at once, stayed for about one month and then left together. There was no gradual increase or decrease in numbers as shown for the other years.

Figure EA-BI-7: Maximum number of Oystercatchers observed on the Akureyri estuary 1994 – 1999

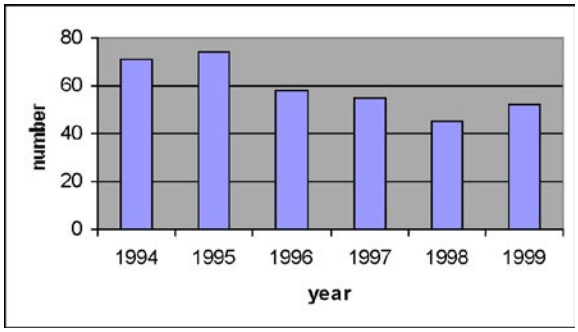
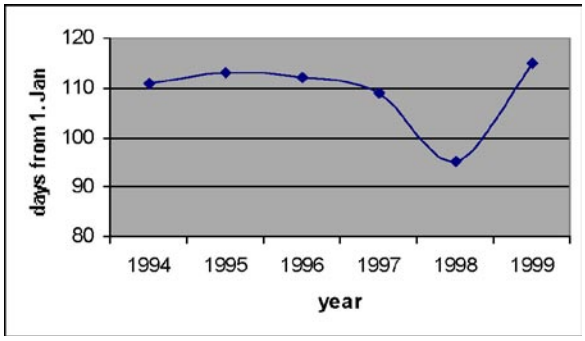


Figure EA-BI-8: Day of maximum number of Oystercatchers on the Akureyri estuary 1994 – 1999.



Now that some patterns and possible deviations from a general trend have been seen, let's explore possible connections with atmospheric measurements such as temperature. Table EA-BI-1 shows the average air temperature for the month of April for each year. The days when the maximum number of Oystercatchers were observed are in April each year.

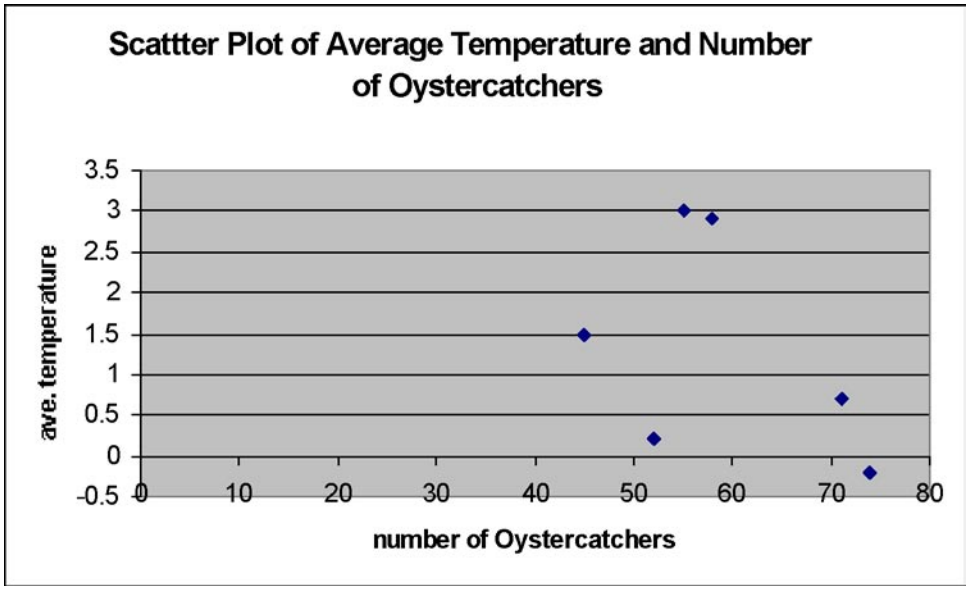
Table EA-BI-1: Maximum number of birds seen on Akureyri estuary each year, day maximum number of birds was observed, and average temperature (°C).

Year	Day number	Max number	°C April
1994	111	71	0,7
1995	113	74	-0,2
1996	112	58	2,9
1997	109	55	3
1998	95	45	1,5
1999	115	52	0,2

Note: some countries use a decimal point instead of a comma.

A scatterplot (Figure EA-BI-9) of the average temperature in April and the maximum number of Oystercatchers observed shows no correlation.

Figure EA-BI-9



According to this analysis, there is a poor correlation between monthly average temperature and the date when the maximum number of birds was observed. It might be more advisable to use the temperature from where the birds winter and not their destination at Akreyri. Perhaps there would be a better correlation with those temperature values. It is also possible that the data set is not yet sufficient and needs more years to demonstrate a pattern that correlates with monthly average temperature.