Welander

FOUR

Herring Gulls

Man: A Course of Study
Developed by Education Development Center, Inc., under grants from the National Science Foundation.

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First commercial edition 1970.

Disseminated and produced by Curriculum Development Associates, Inc., Suite 414, 1211 Connecticut Avenue, Washington, D.C. 20036.

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HERRING GULLS

INTRODUCTION

In the fall and winter herring gulls forage in flocks, moving from islands to beaches on the mainland, and sometimes farther inland in their search for food. In the spring they return to the islands where, during the spring and summer months, they mate and raise their young.

As the children study gulls, they see them being cared for by their parents, fighting, gesturing, standing around doing nothing: all behaviors that the children can observe in the human world. But the causes of the gull behaviors are quite different from those of the human behaviors. As the children contrast the motivation for the gull behaviors with motivation for similar human activities, they begin to understand the importance of learning in human lives.

Like humans, young herring gulls have a period of dependency. For several months, the adults nourish and care for their chicks. Some learning takes place during this time: for example, the chicks learn to recognize the edges of their territories, and the parents learn to recognize their young. But much of what happens is dependent upon a series of innate behaviors, based upon urges that are present in both the adults and chicks. If a chick is to eat, it must have an urge to peck at the red spot on its parent's beak, and the parent must then have an urge to regurgitate food. An examination of the gull's period of dependency offers new understanding of the comparable human period when children are experimenting, imitating, trying new things, and when parents are raising their children differently in every family and in every society.

We use the word urge to describe an animal's innate motivation. No attempt is made to give a physiological explanation of how an urge arises. The salmon's urges include an urge to swim upstream and an urge to swim where the strongest current is moving against it. Some

of the gull's urges include the urge to establish territories and the urge to brood.

Most animals have urges. But animal species differ in the degree to which the urges direct the behavior of the animals, depending upon the balance between behaviors that are innate and those that are learned. Learning can be defined as the modification of behavior. The species that have a greater capacity for learning have a greater capacity for modifying behavior. In the human species, the balance is so strongly in favor of learning that almost all behaviors, even if biologically triggered (like hunger or sex drives), are capable of immense modification. And because learning is dependent upon the experience of every person, and every person's experiences are different from everyone else's, the modification of behavior varies greatly from individual to individual.

You will find it helpful to read the background paper by DeVore, "Innate and Learned Behavior," in Talks to Teachers, and you might also enjoy chapter 6 in Tinbergen's Animal Behavior, especially pages 132-136.

Central to the course is the process of natural selection. Experience has shown this to be a very difficult concept for children in upper elementary grades. A description of natural selection appears on p. 33 followed by suggested exercises and worksheets to accompany the optional booklet Natural Selection.

Bibliography

See the bibliography in A Guide to the Course for publication information about these books and for additional titles.

BOOKS FOR THE CLASSROOM: HERRING GULLS

*Darling, Louis, The Gull's Way

Children particularly enjoy this beautiful book because they recognize several of the pictures from the filmstrip. The 17 herring gull frames used in the following lessons are part of Mr. Darling's collection.

*Wright, Dare, Look at a Gull

The photographs in this book are beautiful and, although the text is anthropomorphic, it is usually accurate.

The pictures in Tinbergen's Animal Behavior (recommended in the Salmon bibliography) are useful during this part of the course.

BOOKS FOR THE TEACHER: HERRING GULLS

*Tinbergen, Niko, The Herring Gull's World

An excellent, informative book about gulls. Children enjoy reading some parts of it.

BOOKS FOR THE CLASSROOM: NATURAL SELECTION

Barrett, Lincoln, The Wonders of Life on this Earth

Burton, Virginia Lee, Life Story

The history of the earth, its plants and its creatures is told in pictures, with a brief text.

Mech, Dave, "Animal Arithmetic," Nature and Science, February 21, 1966

An article concerned with animal populations and what controls them.

*Books essential for classroom library

HERRING GULL LESSONS

A. INTRODUCTION TO HERRING GULLS (1 day) 8

Using a method of observation and research, the children learn about the life of the herring gulls.

B. EXAMINING THE CAUSES OF GULL BEHAVIOR (1 day) 12

After examining the motivation behind the interactions between gull parents and offspring, questions are raised about the behaviors of human parents and their offspring.

C. INNATE AND LEARNED BEHAVIOR (1 day) 17

Children read the third booklet that develops ideas applicable throughout the animal kingdom. Here, behavior is discussed in terms of what the animal is able to do automatically and what it is able to learn.

D. EXAMINING THE BEHAVIOR OF GULLS IN GROUPS (1 or 2 days) 20

Topics such as territoriality, fighting and communication come up when studying gulls in groups. These are topics that have meaning to the human world, and certainly to children.

E. EVALUATING ANIMAL MATERIAL WITH A NEW PERSPECTIVE (1 day) 25

Children use their increased understanding of the causes of behavior as they read stories in which gulls are given the power of human thought.

F. THE KITTIWAKE (OPTIONAL) (1 day) 27

This contrast case provides an illustration of the relationship between an animal's structures and behaviors and its environment.

G. STRUCTURE AND FUNCTION (2 days) 30

This booklet stresses the relationship between the structure of an object and its function.

H. NATURAL SELECTION (OPTIONAL) 33

Although there is no classroom time alloted for this lesson, interested students can use the booklet and the worksheets to explore natural selection as the process of adaptation. (The exercises in the lesson can be used for the whole class, for a small group, or for individual instruction.)

I. OTHER ACTIVITIES AND QUESTIONS (5 days) 48

These may be used for independent assignments or homework throughout this unit. The time alloted for "Other Activities and Questions" includes not only time for the suggestions in that topic, but also time for your class to visit zoos, observe animals, work on related projects in art and science, as well as extra time you would like to spend on any lesson in the section.

Before teaching these lessons, it is helpful to read through the entire Herring Gull unit.

A. Introduction to Herring Gulls

1 DAY

In this lesson, a series of slides introduces gulls and gull behavior. Children use their observations to raise questions and then search for answers in a variety of books.

Herring gull filmstrip Booklet, Herring Gulls	Prepared dittoed sheets Filmstrip projector Screen Optional: The Gull's Way, Louis Darling Look at a Gull, Dare Wright; The Herring Gull's World, Niko Tinbergen

1. LOOKING AT THE FILMSTRIP

Show the class the Herring Gull filmstrip. Ask each group to write down on a sheet of paper what they think they know about these animals by looking at the filmstrip, and what questions the filmstrip makes them wonder about. You might prepare dittoed sheets with two columns:

Things we know about gulls from the slides	Questions the slides raise about gulls

2. LOOKING FOR INFORMATION

Distribute the booklet Herring Gulls and, if possible, have available the books mentioned in the materials list so the children can look for information to answer some of the questions they have raised. Explain that pages 3-11 of Herring Gulls will be most useful to them. (The rest of the booklet will be read as part of the next several lessons.)

As they complete their research, children can fill in the life cycle information for the individual and classroom charts begun during the salmon lessons.

NOTES ON THE FILMSTRIP

These notes are intended to give you some information about each frame. You might want to make dittoed copies of the notes to have available for the children as they do their research.

FRAME 1. Herring gulls are one of a variety of sea gulls. Other sea gulls include black-backed gulls.

Gulls are excellent fliers. Some birds are especially adapted for specific kinds of flight such as hovering, gliding, turning suddenly, or flying quickly. The herring gull, while not an expert in any particular way, is adept at all kinds of flight. (Some children may never have noticed the differences in bird flight, differences they can easily observe. They probably have not considered the advantage of the different kinds of flight for the birds. Many children's books have chapters on the flight of birds.) Why would hovering, gliding, long-distance flying be of advantage to herring gulls?

Gulls' feet are webbed. They are adapted for swimming as well as for walking. Gulls do most of their foraging on foot.

The bill is long and strong. (When the gull opens its mouth, you can see the wide gullet. It can swallow amazingly large pieces of food: moles and rats are swallowed whole.) The red spot on the beak is important. •See also Frame 8.

Herring gulls' eyesight is excellent, probably better than that of the men who study them. Gulls can distinguish colors.

FRAME 2. This frame shows a gull's nest and the usual three eggs. Gulls are able to reproduce when they are five years old. They gather on islands in the early spring, form pairs, and mate. Tinbergen has observed that often the same pairs come back together year after year. They probably do not stay together during the winter, but in the spring, they are able to recognize each other. They probably build their nests on the same site or territory. The eggs are camouflaged and, unlike the adult birds, are difficult to spot among the rocks. See also Frame 17.

The parents take turns incubating the eggs (sitting on them, keeping them warm and protecting them from bad weather).

FRAME 3. About a month after the eggs are laid, chicks begin to hatch. The chick has an egg tooth, a tiny structure on the end of its beak used to break away the shell.

A few days before they hatch, the chicks begin peeping inside their shells.

FRAME 4. When the chicks come out of their shells, the parents continue to cover them until their plumage is dry and fluffy. If the young are exposed to the air during this time, the downy feathers stick together and do not spread out. If they are exposed too long, they die.

FRAME 5. This frame shows one chick (dry and fluffy). In the second egg, you can see a hole pecked by the chick inside. All three chicks do not hatch on the same day but over a period of several days.

Like the eggs, the chicks blend well into the environment.

FRAME 6. In this picture of two dry chicks, the spots on their heads are visible. Probably the parent gulls learn to recognize their chicks by these spots as well as by their voices. As the chicks grow older, they keep these spots.

FRAME 7. When the chicks are a few hours old, they begin crawling around under the parent, male or female, making it move and shift its position. Here, where the parent is standing up and looking into the nest, we see the first begging behavior of the chicks.

FRAME 8. The chick immediately starts pecking at the red spot on the parent's beak, without even studying the parent's face. The parent in turn immediately responds and feeds the chicks. If the chicks do not peck at the spot, they will not be fed.

FRAME 9. This frame shows an experiment performed with a newly hatched chick. It was shown a piece of red wood and it immediately began pecking at the wood, as it would peck at the red spot on its parent's

beak. Tinbergen has a detailed description of his experiments in chapter 22 of The Herring Gull's World.

FRAME 10. In this frame, you can see an adult regurgitating food for the chicks after they pecked at its red spot. Note that the fish might be too large for the chicks to digest. If the chicks don't eat the food quickly, the adult swallows it again. Then when the chicks peck at the spot later, the regurgitated fish will be more digested.

FRAME 11. The young gulls are beautifully camouflaged. Notice how important the dots are. Chicks of a single, undifferentiated color would be much easier to spot in the shadowy environment. The spots take your eyes away from the outline of the gull.

FRAME 12. Probably the grass was damp and the chick crawled on the parent's back.

FRAME 13. As an adult, the gull spends a great deal of its time preening. This is an important activity because the plumage protects the bird in cold weather and is important to flight. Preening involves putting the feathers in order and spreading a fatty substance over them. The fatty substance protects the bird in cold or hot weather. (The fatty substance is produced in a tail gland of the bird.)

FRAME 14. Here the chicks are preening themselves -- without any feathers to preen. At this age, they have urges to perform certain adult behaviors, even though their body structures are not yet mature.

FRAME 15. The chick is spreading its stub-like wings well before it is able to fly.

FRAME 16. Chicks grow rapidly. At six weeks, they are almost the size of their parents. (You can see the difference in color.) Although they are beginning to fly and find food on their own, they are still dependent, and still beg for food from their parents.

FRAME 17. This frame shows the hide from which men study the gulls. Notice that the gulls become so accustomed to the hide that they accept it as part of the scenery. Some gulls even seem to use it as a lookout.

B. Examining the Causes of Gull Behavior 1 DAY

In this lesson, children examine the causes of some of the gulls' behaviors. They compare their own dependency with the dependency of gulls, thinking particularly about the motivation for the behaviors of the young and the parents.

Booklet, Herring Gulls
Film, "Herring Gull Behavior" (10 min., narrated)
Projector
Screen

1. READING THE BOOKLET AND SEEING THE FILM

Read and discuss with the class pages 11-14 in the herring gull booklet, saving the question "What makes a gull a successful parent?" for after the film. Then show the film. The sequence of urges in the reading material parallels the sequence that is shown on the film.

2. DISCUSSING THE MEANING OF SUCCESSFUL

The word successful, as it is used here, refers to survival, and a successful parent is one that is able to raise its young. This ability is probably based upon its innate capacities. Some of these questions might be helpful for discussion:

What things does a parent gull do for its offspring?

What kind of control do you think it has over what the offspring does or does not do?

"Successful" for human beings can be used to mean other things than

contributing to the survival of the species; it has meanings that differ from one society to another, and even from individual to individual. If the children are interested they might consider some of the following questions:

> What kinds of things must all human parents do for their young? Are any of these things similar to the kinds of things gulls do?
>
> What kinds of things do parents do for their children that are different from family to family?
>
> For human beings, what do you think are the characteristics of a successful parent?

3. THINKING ABOUT URGES

The urges which most gulls seem to share arise year after year and direct gulls to leave islands in the fall, to return to them again in the spring, and to raise their young. Most of the members of the species have similar urges and act upon them in similar ways.

Often, when children read about urges, they begin using the idea of an urge to explain everything they, as humans, do. For example, a child may speak of his urge to play hookey. Encourage the children to think about the differences between individual "urges" of this sort and the gull urges they have read about. Questions that might help explicate the differences are:

> Do you think all members of the species want to play hookey? Do all people in your society want to do this? What about all other societies?
>
> When you have this desire, do you always act on it?
>
> Does this desire have something to do with what you have learned from your friends or your family?

After studying gull urges, some children decided to use the word urge with humans only when it referred to an innate drive that all members of the species share. They felt that the other "urges," such as an urge to play hookey or an urge to eat an ice cream cone, are so different

from the gull urges that they should be called something different, such as desires or wants.

TRANSCRIPT OF NARRATION: HERRING GULL BEHAVIOR (10 minutes, narrated)

Every spring herring gulls form pairs and return to this island off the coast of Massachusetts. Here they occupy territories, mate and raise their young.

Seals often drop bits of food which the gulls pick up. This black-backed gull, a close relative of the herring gull, is also looking for something to eat.

Although a colony is a scene of intense activity, there are always many gulls standing around doing nothing.

Though it is not difficult for a gull, it is difficult for us to tell the difference between males and females. The male is on the right. He is slightly larger than the female and his head is a bit longer and flatter.

This bird giving a long call is telling others that he has no intention of moving from his present perch.

Each pair defends its territory against other birds. The male nearest us is threatening another gull by standing stiffly with his neck stretched and rigid, his wings slightly lifted.

These two gulls are at the edge of their territory. They are highly aggressive but vigorously pull grass instead of pecking each other.

Sometimes, though not very often, these threats abruptly turn into a real fight. This male pulls another into his territory. The bird that is being dragged flees as soon as he gets free. Notice that the first bird loses his nerve as he nears the edge of his own territory.

The male on the right doesn't know what to do. He is caught between conflicting urges. He makes the very human gesture of looking down at his feet. The female meanwhile begins to head-toss while the male walks to the territorial boundary to pull at sticks and mud.

As the female's head-tossing increases the male begins to toss his head also. At the same time his neck thickens. The swollen neck indicates that he may regurgitate food for her. This is part of courtship behavior.

When the neck is very swollen it is a sign that the male will shortly mount the female. As they mate, the female continues to toss her head and touch the neck of her partner.

The gulls' nest-building urge is not very strong at first. They carry nesting material around but don't seem to know what to do with it.

When the urge reaches its peak a nest is built and three eggs are laid. Both the male and the female incubate them.

At the end of about twenty-four days the parent hears a peeping noise from inside the egg. At the same time the unhatched chick begins to crack the shell with the egg tooth that is part of its beak.

Covered only with down, a three-day-old chick preens just as its parents do. This adult is unaware that it is stepping on its offspring.

Hungry chicks peck at the red patch on the parents' beak. The adult responds by regurgitating some food. If the food is not eaten immediately the parent will swallow it again.

Chicks very quickly learn to know the edge of their territory and do a great deal of exploring. If they wander outside its boundaries they will be attacked by other gulls.

This slightly older chick is able to balance itself while scratching, but, unlike its parents, not while stretching.

This three-week-old chick is beginning to get its feathers.

These three chicks are the offspring of one set of parents. During the month and a half they have survived, many others have died. Parents that are successful in raising one chick are often able to raise all three.

Wings drooping, this bird is weak from hunger. It has not been fed by its parents for some time. Neglected in this way it will die.

Six weeks old and almost the size of their parents, the young hunch themselves when adults are nearby. If they stretched to full size, the adults might consider them a threat and attack.

While they make awkward attempts to fly, older chicks grab and hold sticks in their beaks as if to play. No one knows why they do this.

At about the age of two months the young can really fly. They are then able to go wherever they please in search of food and a safe resting place. Later, when they become independent, they leave the island and come back again after several years.

C. Innate and Learned Behavior 1 DAY

Innate and Learned Behavior, the third booklet focusing on an idea applicable to all animals, discusses the causes of behavior. Any behavior that an animal performs automatically we call an innate behavior. The animal may be able to perform the behavior at birth (a herring gull chick automatically and immediately pecks at red spots), or the behavior might appear later in the animal's life (herring gulls automatically incubate eggs, but not until they are old enough to reproduce). A behavior that develops through experience is called a learned behavior (herring gulls learn the location of food).

However, the distinction between innate and learned behavior is not as clear as the examples imply. (To see how biologists approach this issue, we refer you again to the "Innate and Learned Behavior" paper in Talks to Teachers and pages 132-136 of chapter 6 of Tinbergen's Animal Behavior.)

We use the word innate rather than instinct. This is because children easily say, "Oh, that happens because of instinct," without thinking about what they mean. They do not consider the complexity of the behavior, its internal motivation, and the environmental clues necessary for the behavior to be performed. It is not incorrect to use the word instinct as long as the children think about the complexity of the causes of the behavior.

Booklets: Innate and Learned Behavior
Salmon
Herring Gulls
Optional: Animal Studies

1. READING THE BOOKLET

Either in small groups or as a class read and discuss the pictures in the booklet. The children have encountered earlier many of the ideas in the booklet. Here, they are introduced to a new way of organizing their thoughts. A careful reading of this booklet may take the whole class period.

2. LOOKING AT OTHER ANIMALS

This could be a homework assignment, or project for individual research. After reading the booklet, ask children to choose an animal (salmon, herring gull or another animal they know about) and make a list of some of the things they think that animal learns and some of the things they think the animal is born able to do. Booklets and the Animal Studies pamphlets should be available for the children to look through. A question to consider after completing the list:

> What do you think the differences might be between the kinds of things an animal is born able to do and the kinds of things it learns? (Things that are completely dependent upon the environment are probably learned. For example, a salmon probably learns where a good food supply is located; it learns the smell of its river.)

3. LOOKING AT INNATE AND LEARNED BEHAVIORS OF MAN

These questions could be considered in class, or a few of them could be given for a homework assignment.

> What are humans able to do without learning? (At birth, they can grasp, suck, cry, etc.) What are some of the things they learn?
>
> Now think about the first hour you were awake today. What did you do? What have you learned during your lifetime that helped you be able to do these things? What things were you born able to do that made it possible for you to do these things?

> Use the montages that the children made at the beginning of the year. Let each child choose a picture of someone with a culture different from his own. What might this person learn as he (she) was growing up? How is it different or similar to what you learn? What were you both born able to do?

As the children consider these questions, it is particularly important to encourage them to think about attitudes and ways of feeling as well as the outward differences among various ways of life.

D. Examining the Behavior of Gulls in Groups

1 DAY (or 2 if the observation project is introduced and some children have their first kindergarten visit)

> Now the more we probe into these problems of the causation of the social behavior of gulls, and discover that the organization is (in comparison with that of our own social behavior) relatively simple, the more we are impressed by the efficiency of their social system; by the fact that in spite of all the limitations of the gulls' nervous system, they manage to build up their society every spring and make it function. In this respect they attain as much, and perhaps even more, than man, who is becoming a serious threat to his own kind.
>
> It is scarcely necessary to stress the differences in type of organization between human societies and those of gulls. It is clear that much in the gull society is organized on a purely instinctive level, and in that respect differs from human society. In the gulls we find infinitely greater rigidity, and an almost complete lack of adaptability. There is no insight, no foresight -- or at the most very little.*

In this lesson, children study the behavior of gulls as they interact. Through gestures and sounds, gulls are able to communicate their needs to each other. This makes possible the perpetuation of the gulls' way of life generation after generation.

The word territory is used in the children's booklet to mean the space an animal will defend against members of its own species. When a gull establishes a territory, it lets other gulls know the boundaries by keeping intruders away from them. An observer can define territorial boundaries by noticing how the gulls are spaced and which areas they defend.

*The Herring Gull's World, by Niko Tinbergen, (c) 1960. Revised Edition by Niko Tinbergen, Basic Books, Inc., New York, 1961; reprinted with permission of Basic Books, Inc.

The idea of a fighting urge is introduced in the booklet. You may wish to use the word aggression with the children, defining it as the urge to fight members of one's own species. Children are intrigued with the idea of an aggressive instinct, and in this lesson they are asked to consider the ways a human handles his aggressive feelings without really fighting.

While the class is studying herring gulls and baboons, we suggest that some or all of the students work on one or two observation projects. The data they collect will help them understand human behavior and can be compared with that of other animals. These projects should not become the focus of classroom lessons; children can work on them individually or in pairs. This is a good place for students to begin the project "Observing Conflict," The Observer's Handbook.

Booklet, Herring Gulls "Observing Conflict," The Observer's Handbook	Dittoed sheets

1. READING THE BOOKLET

Read with the class the final section of the booklet, "Gulls in Groups." When reading the pages on adult male fighting, the children may want to act out the situation that is described. After reading the first paragraph on page 20, look back to the chart on page 17 and ask the children to pick another example of the adult male interacting with another gull at a certain time (for example, with the chicks when he feeds them), and to describe the communication that results in interaction between gulls.

2. FOLLOWING THE BOOKLET

These questions are useful for discussion:

To human observers, gull islands appear to be orderly places. What makes this order possible?

Can you think of any purposes that the aggressive feelings of the gulls serve?

If a gull were unable to overcome feelings of aggression, what would its life be like?

A book that gives helpful background for this part of the lesson is On Aggression by Konrad Z. Lorenz. The third chapter has some particularly interesting examples of aggression and territory.

3. HOMEWORK OR INDEPENDENT PROJECTS

The following questions, centered around aggression, are ones that children enjoy writing or drawing about:

What do gulls fight about? What do you fight about? Do all humans fight about what you would fight about?

Think of a time when you were angry and felt like fighting but did something else instead. When was it? What did you do?

Other questions stressing communication are on pp. 36-39 of this manual.

4. INTRODUCING THE OBSERVATION PROJECT

Pass out the booklets and read the introductory paragraphs with the children. You might discuss with children situations they remember when children were fighting or a fight was avoided. Who was involved? What was it about? What were the first words or actions? the last?

Times should be arranged for small groups of children to visit the kindergarten. We suggest that during the time the children are working on the first project, you spend time in class every once in a while, discussing their observations.

You should ditto several copies of the sample data sheet on the next page for the children to use in their observations.

DATA ON CONFLICT

DATE _____

PLACE _____

NUMBER OF BOYS, NUMBER OF GIRLS	HOW FIGHT STARTED: ACTION(A) WORDS(W)	FIRST THING SAID OR DONE	ACTION THAT TOOK PLACE	LAST THING SAID OR DONE	HOW FIGHT ENDED: ACTION(A) WORDS(W)

OPTIONAL READING ASSIGNMENT

You or one of the better readers in your class might read to the children parts of the last chapter of Lorenz's King Solomon's Ring. This chapter describes many instances of animals fighting each other, and Lorenz discusses the gestures they use to keep from inflicting serious harm upon each other.

E. Evaluating Animal Material with a New Perspective

1 DAY

As the children read books or watch movies and television programs about animals, they should be able to decide whether the author is assigning human motivation to the animals or portraying the animal with its own abilities. This lesson gives them an opportunity to use the understanding they have gained.

Children's books on animals

Dittoed gull stories
(see p. 26)

1. READING THE STORIES

Pass out the gull stories and encourage the children to comment upon them. They might draw cartoons illustrating parts of the stories, or write similar tales about salmon.

2. LOOKING AT OTHER BOOKS

Find some children's books on animals and encourage the children to question the author's statements. Is he describing some of the animal's behaviors as if the animal had human powers? Or is he describing them in terms of the animal's real abilities?

3. LOOKING AT TELEVISION SHOWS AND MOVIES

For a homework assignment, you might ask the children to watch animal programs on television. What is the point of view of the writer of the show? Is he attributing human motivation to the animals? Is he describing the animal's abilities? Or watch cartoons that use animals. What human qualities is the writer giving to the animals? Why? Why has he chosen to use an animal other than a human? Why has he used one animal and not another one?

GULL STORIES

Nest Building

"Dick," mother gull asked one spring day, "don't you think it's time we began building a nest? I'm due to lay eggs in a few days, and those chicks won't survive without a nest."

"I was thinking the same thing, Marie," Dick answered. "Let's both collect some sticks and grass for the nest, and we'll have the nest built in no time."

"You can do it, Dick," replied Marie. "Frankly, I don't have the urge."

"You'd better get it quick," warned her husband, "if you want to have your characteristics carried on by the next generation."

And so Dick and Marie Herring Gull went about their work and soon had built a fine nest.

Chick Feeding

Junior pecked and pecked at his father's beak. "If he doesn't feed me soon," thought Junior, "I don't know what I'll do. I've pecked so long I'm getting a beak ache. Besides, his red spot is scarcely red enough to see and I keep missing."

Junior's father was aware of the pecking. "So Junior is hungry," he thought. "I'll regurgitate a little food here for him so he can have some dinner."

Junior's father regurgitated the food, and Junior ate a hearty dinner. "Remember, Junior," said Dick, "the whole point is for you to survive to reproduce -- so eat all your meals, defend your territory, and watch out for low-flying hawks. Your mother and I are trying to set a record of having more than three chicks to give us grandchildren."

F. The Kittiwake (Optional)

1 DAY

The kittiwake gull is distributed throughout northern seas and lives on tiny rocky ledges, often only four inches wide. The demands of this environment have caused the evolution of behaviors that provide a contrast to the herring gull.

The following pages are meant to be read aloud to children; discussion questions are interspersed.

THE KITTIWAKE GULL

Kittiwake gulls are very much like herring gulls. The kittiwake is smaller but it has a similar body structure. Both gulls have a similar life cycle. Kittiwakes start flying when they are five and a half to six weeks old. Females are ready to have offspring when they are three to four years old, and males when they are four or five.

But kittiwakes do not nest on the ground. They live in the open sea, sleeping and resting on the water. (Ocean water is often warmer in winter than land is.) When it is time for kittiwakes to mate, they build their nests on tiny ledges of rocky cliffs overlooking the sea.

> Think about where kittiwakes live. Which of their behaviors might be different from herring gull behaviors?
>
> What are some advantages of cliff living? some disadvantages?

<u>Nest Building</u>

Kittiwakes make many trips from nearby land collecting mud and fibrous material like grass for their nests. Male and female trample the mud for a long time, often for several hours, until a mud and grass foundation has been firmly stuck to the narrow ledge. This enlarges their nesting space because the foundation sticks out beyond the ledge.

The pair then collect more grass. They trample this onto the mud to make a nest. It is a deeper nest than the herring gull's nest.

What makes the kittiwake's nest particularly suitable to the rocky ledge?

Running Behavior

Because of their rocky ledge environments, young kittiwakes never have the opportunity to run around. Not until they are able to fly can they reach places that have enough space to run. But it is interesting that if a kittiwake is raised in a herring gull's nest, it can run around as well as the young herring gulls.

Size of Brood

The kittiwakes usually lay two eggs in a season. Sometimes they lay only one; they hardly ever lay three eggs.

What might be the advantage of the smaller broods?

Feeding and Flying

The main causes of death for the kittiwake young are falling out of a nest that comes apart, or not getting enough food. Their food is fish and tiny plant life from the sea brought to the chicks by the parents.

The kittiwake does not have a red spot, but parents do feed their young directly. The young kittiwake takes its food from the mouth or throat of the parent.

What is the advantage of feeding directly from the parent's mouth?

Because they live on crowded ledges, kittiwakes are less active in their wing-flapping, primping and other early movements than young herring gulls. But the young start to fly at about the same age as herring gulls.

Threats

The kittiwake attacks another gull by trying to grasp its beak, and twist the opponent off the ledge. Kittiwakes cannot pull back from an attacker as herring gulls do, and kittiwakes cannot get above a bird to peck downwards because the cliff winds are tricky. Kittiwakes threaten other kittiwakes by showing off their beaks or twisting another bird's beak.

What might a kittiwake do to calm down another kittiwake?

The beak is so important in an attack and as a threat, that both adult and baby kittiwakes calm other birds by turning their heads and beaks to the side and hiding their beaks in their feathers.

Recognizing the Young

Kittiwakes come back to the same colony and to the same nest year after year. The kittiwake territory is its nest.

Would it be as important for kittiwakes to recognize their young as for herring gulls?

Kittiwake parents will accept any offspring put into their nest and will treat the strange young like their own during the first few weeks. On the other hand, parent kittiwakes may attack their own young when they are placed outside the nest. Parents recognize their young by where they are, rather than by what they look like.

How do herring gulls recognize their young?

The kittiwake young are completely white. And the kittiwake's nest on the tiny ledge is surrounded by white droppings which make the nest easy to see.

Do you think kittiwake young have many predators?

G. Structure and Function

2 DAYS

The booklet Structure and Function offers a way of analyzing the relationship between the structure or form of an object and the purpose or function the object fulfills. Man-made structures as well as living structures in the natural world are fashioned in certain ways in order to perform certain functions. The structures and behaviors that allow a salmon to return to its home stream, or a herring gull to regurgitate food, or a kittiwake to live on a ledge, are perpetuated through the process of natural selection, and the following lesson outlines a series of optional materials and exercises for teachers and students who wish to pursue the topic.

The words structure and function can also be used to examine social groups such as the baboon troop or the family. But the booklet focuses on physical objects in both the natural world and the man-made world of technology. As the study of the Netsilik unfolds, students will see that many of the structures that enable man to live in his varied environments are of his own creation.

Two days are allowed for this lesson. You may wish to spend one day at this time and another during the baboon or Netsilik lessons, relating the ideas of structure and function to other parts of the course.

Booklet: Structure and Function	Such objects as: a cup bottle cap screw-in door stop melon ball scoop wooden drawer knob molly screw and board (with hole bored in it before class) other puzzling objects

1. EXAMINING A SIMPLE STRUCTURE

Consider the structure of a cup or a bottle cap. What is its function? How does its structure serve its function? (What is its shape? What is it made of?)

2. EXAMINING MORE COMPLICATED STRUCTURES

Have small groups of children examine unusual objects (the melon ball scoop, screw-in door stop, etc.), describing their structures and guessing (if they do not know) their functions. When everyone has had an opportunity to examine a few objects, discuss them together, using the words structure and function when appropriate.

3. READING THE BOOKLET

As the children read the booklet, ask them to look closely at the pictures. You may find some of the following questions useful.

Page 4. How would you describe the structure of the tree? How do the different parts relate to each other? (Similar questions can be asked about the crutch.)

Page 6 and 7. What other structures can you think of that have many functions? (For a special project, a few children might enjoy demonstrating some of the functions of a coat hanger.)

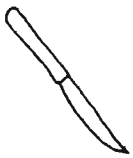
Pages 12 and 13. After considering the common function of the structures, ask: How do the functions differ for each of the structures on these pages?

Pages 14 and 15. Examine the man-made structures and the elephant's structures. What functions do they have in common? Then, have the children work in pairs on this question: What major differences are there between structures that are created by man and those that develop in nature through natural selection? (Some of the children's answers might include: The structures that develop in nature are parts of living things, and living things reproduce themselves. Man can quickly create objects to suit his needs. Structures in the natural world com about and change slowly over many generations, and animals are not able to make decisions about how their structures should change.) Teachers and students wishing to pursue the subject of Natural Selection could use this as a starting point for the optional lessons on Natural Selection on page 33.

4. POSSIBLE HOMEWORK ASSIGNMENTS

a. You could give each child a sheet of paper divided into two rows of boxes, one labeled Structure, the other Function. Suggest one or two structures for the top boxes and have the children write the function of the structure in the boxes below. Then have them choose other structures and write in their functions.

Or: In the row of boxes, ask the children to draw a structure for a given function.

Structure					
Function	to cut				to hold

b. Suggest that the children build structures to serve various functions using materials such as paper clips, rubber bands, tape, soda straws, paper cups, pipe cleaners and straight pins. The functions might be:

to weigh things
to make musical sounds
to play with
to hold something

c. A written assignment. Look at the picture on the front of the booklet. What does it have to do with the subject of the booklet? Some children might enjoy drawing a series of pictures about another structure and its possible functions.

H. Natural Selection (Optional)

While studying the salmon and herring gull, children examined behavioral and structural adaptation. Some children may have asked about the process which enables animal species to adapt to an environment or to change in response to changing conditions. The following readings and exercises are provided to help answer children's questions about natural selection. The exercises in the lesson can be used for the whole class, for a small group of interested children, or for individual instruction. (Children not studying natural selection might choose from among the optional herring gull activities pp. 48-52.)

Natural selection is the process by which an animal species becomes adapted to a certain environment. Some members of the species will have body structures and ways of behaving that will help them cope more successfully in that environment than other members. Some members may be able to survive better than others because they can use scarce food more efficiently, or they are able to get along more peaceably with other members of a group. An animal that is well camouflaged may be less likely to attract a predator than a more brightly colored member of the same species. Members that cope successfully with environmental factors (food and water sources, and presence of predators, in the main) tend to survive to produce offspring, and the offspring will tend to resemble their parents in their structures and behaviors. The offspring are likely to be well adapted to that environment.

It is only because of the incredible variation in body structures and in ways of behaving found among members of a species that natural selection works. In every species, most animals die before they produce offspring, and their individual variations are not passed on to the next generation. Animals whose structures and ways of behaving

are well adapted to the particular environment tend to live to produce offspring, often many offspring, and it is their structures and behaviors that are perpetuated in the population.

The human species emerged through the pressures of natural selection in the adaptation of a primate species to a changing environment. This may have taken several millions of years. With the emergence of Homo sapiens some 100,000 years ago, a radically new evolutionary stage, different in kind from preceeding stages, was reached. Here was a species whose mastery of tools and symbolic communication altered totally the relationship of a species to the environment: rather than changing over successive generations through natural selection to fit the demands of the environment, a species could now change the environment to suit its own needs. Man continues to evolve, but for 100,000 years the most rapid and radical changes have been cultural ones. There continues to be selection in the variations passed on to the next generation, but social and cultural factors rather than pressures from the environment are likely to determine which variations are to be perpetuated. It is selection, but hardly "natural" selection in the traditional sense. (Before teaching this lesson, read "Natural Selection" in Talks to Teachers.)

Booklets: Natural Selection (10 copies) Salmon Herring Gulls	Dittoed copies, question sheet for Natural Selection Dittoed worksheets, Natural Selection and Salmon Dittoed worksheets, Natural Selection and Herring Gulls Dittoed copies, The Peppered Moth The Wonders of Life on Earth, the editors of Life and Lincoln Barnett, pp. 58-59

1. NATURAL SELECTION

The booklet Natural Selection describes the process that is continually occurring, allowing for the adaptation of members of species and thus for the survival or extinction of the species. The Question Sheet for Natural Selection, p. 40, is designed for individual or small group work and will guide students' reading.

2. NATURAL SELECTION: SALMON AND HERRING GULLS

Using their knowledge of salmon and herring gulls, children speculate about how natural selection operated within these species. Some children probably do not know the word "species." Explain that it refers to a group of animals in which the males and females can mate and have offspring that can also mate and have offspring, e.g., robins, sparrows, zebras, giraffes, etc. All men, all over the earth, are members of the same species: Homo sapiens.

The worksheets, Natural Selection and Salmon, p. 41-43 and Natural Selection and Herring Gulls, p. 44, illustrate how natural selection is continually occurring within these species. Children may choose either one and ought to be encouraged to share their work. For example, the following discussion took place:

> A child in one classroom suggested that his salmon had a paralyzed right fin. But it also had a lot of energy and fight and all the urges that would get it to its homestream at the appropriate time. The class agreed that this fish might survive to reproduce. Then they discussed whether the salmon would pass the characteristics on to its offspring. Was the characteristic inherited, or was it caused by a bear swiping at it from the bank of a river? No, this fish was born not being able to use its right fin. So the children decided that the offspring could inherit the characteristic, and if they did, their survival would depend on the other characteristics they had. If, like their father, they had a great deal of energy and fight, they might. Otherwise they might not.

Notes on worksheet, Natural Selection and Herring Gulls. If students have difficulty thinking of possible causes of death for each period, you might suggest:

a) The first critical period: Many eggs die in the first week as a result of the parents' behavior. Will they sit on the eggs? Will they protect them through the whole day? If they do not, the eggs die. If they do, they will continue to do so for the whole month, and the eggs will most likely survive.

b) The second critical period: The relationship of the parents to the chick at the time of hatching is especially crucial. Will the parents eat the cracked egg? Will they sit on the newborn chick? Will they protect it from rain and cold? Will they respond to pecking by feeding the chicks? Will the chicks peck? If any one of these things does not happen, the chicks will die. If all parental responses take place, the chicks will most likely survive.

c) The third critical period: The chick's transition to independence is a period that tests whether it can fend for itself. If it cannot, it dies immediately. If it can, it will have a good chance of surviving the winter. But a chick needs help in this transition period. If at first it fails to find its own food, it turns to its parents. Those chicks who can still get their parents to feed them stand the best chance of surviving. The chicks that die are usually those that cannot rely on their parents.

3. A SPECIAL PROJECT: STUDYING "VANISHING ANIMALS"

Some children might be interested in going to the zoo and learning about a "vanishing animal," a species that is close to extinction. These species are usually identified by special signs at the cages of the animals. A child could pick one of these animals and find out why it is becoming extinct. There may be people at the zoo who

would talk with the child and give him information. If there is no zoo in the community, children could look up information about such vanishing animals as the white rhinoceros and the whooping crane.

4. PEPPERED MOTH

Natural selection is occuring constantly and most of the variations selected for are only slightly different from those in the previous generation. Therefore, it is difficult to detect the changes in the species as they are occurring. One dramatic and highly visible example of natural selection was the rapid change in color of the peppered moth species as it adapted to the changing environment of the English countryside more than a century ago.

Discuss with children the idea that most changes that occur in a species between one generation and the next are very slight. Therefore, it takes a long time to observe any change in the general characteristics of a species. How soon a change can be observed depends in part on how quickly one generation produces the next. Explain that the change in the peppered moth was an exception in that it happened very rapidly and was very obvious.

Distribute dittoed copies of The Peppered Moth, p. 46-47, to the children. After they finish, some children might wish to make a "before-and-after" tree specked with appropriate moths to illustrate the phenomenon of change in the species. Others could look through books like Wonders of Life on Earth that contain articles about the peppered moth. There are many such books in most children's sections of libraries, usually listed in the card catalogues under "Evolution." Children should look for more information on the peppered moth that they can report to their classmates or use to raise further questions. As a review students should reread Natural Selection. After the previous activities children should find they have a better understanding of the ideas it contains.

5. NATURAL SELECTION AND MAN

Man continues to evolve, but the most radical changes in the past 100,000 years have been cultural ones. Characteristics and behaviors are culturally selected, but this is not "natural" selection. This complicated topic is not explored in the course, although it is the subject of a Teacher Education Seminar. You may wish to take up some of these questions with your students:

a) What happens to an animal species when the environment changes? (Think about the herring gull and the kittiwake.) Does man have to change to be able to survive in many different environments, or in an environment that is changing? Give an example to explain your answers.

b) It is now possible for most human beings to survive to reproduce. How has this happened? How is this an advantage for each individual? How is this an advantage to the species? What problems might it cause?

c) Some children might bring in news articles about people who survive to reproduce today but who might not have been able to survive years ago. You might emphasize particularly people who survive because of the advances in medical science, agriculture, engineering and institutions of social welfare. After discussing the articles, ask the children whether these examples modify the process of natural selection, and if so, how.

d) There is variation among members of the human species just as there is variation among members of all animal species. Are the variations among herring gulls mostly innate or mostly learned? What about lions? Are the variations in the way people live all over the world mostly innate or mostly learned? (Could you learn to live in a different way if you went to live in another country?)

e) In most animal species, only those members who produce offspring contribute to the survival of the species. Is this true for the human species? In animal species, only those members who produce offspring contribute to the ways of living of future generation. Is this true of human beings? Give examples to explain both your answers.

QUESTION SHEET FOR NATURAL SELECTION

Page	
2,3	What environments do these animals live in? What are a few of their structures and behaviors that adapt them to their environments?
10-13	What differences do you notice between the lions on these pages?
14	How could variations in lions' feet make a difference between life and death?
18, 19	How do the pictures illustrate Rudebech's statement: "Larger flocks would almost certainly have noticed the danger"?
20	How do these drawings illustrate Herr Stein's observations?
22, 23	Lions prey upon hoofed animals like gazelles. What characteristics would you expect a lion that successfully hunted prey to pass on to its offspring? What characteristics would you expect a gazelle who successfully escaped lions to pass on to its offspring?
20	The booklet says "This went on for many years...." What exactly is going on for many years? Why did it take a long time for the size of most members of the species to change?

NATURAL SELECTION AND SALMON

In every animal species except man, most animals die before they are old enough to reproduce.

Animals that live to reproduce probably have characteristics that are well suited to the environments they live in. They pass these characteristics on to their offspring.

Animals that are not as well adapted die, and their characteristics are not passed on.

Natural selection is the process by which some animals live to reproduce and others die before reproducing.

On the next page are characteristics of five imaginary salmon. All started life in a quiet stream that fed a river flowing into the Pacific Ocean. As you fill in the chart, think how natural selection would work: which animals would die and which ones would live to reproduce?

Natural Selection: Salmon

There is variation among the offspring of any parents.	SOME CHARACTERISTICS OF SALMON A 1. After fertilization, egg developed well. 2. Fish had streamlined body. 3. Had good sense of smell. 4. Muscles in tail did not develop well. 5. Had urge to return upstream after years in the ocean.	SOME CHARACTERISTICS OF SALMON B 1. After fertilization, egg developed well. 2. Fish very fat. 3. Had poor sense of smell. 4. Muscles all developed well. 5. Had no urge to return upstream.
In order to survive to reproduce, animals must be well adapted to their environments. a. Put a X under the fish that will survive to reproduce. b. Explain why you think the other ones will not survive.		
In every species except man, a few offspring survive to reproduce; many more die before reproducing. What characteristics might the salmon that live to reproduce pass on to their offspring?		

SOME CHARACTERISTICS OF SALMON C	SOME CHARACTERISTICS OF SALMON D	SALMON E: MAKE UP SOME CHARACTERISTICS OF THIS OFFSPRING
1. After fertilization, egg developed well. 2. Fish had streamlined body. 3. Had good sense of smell. 4. Muscles all developed well. 5. Had urge to return upstream after years in ocean.	1. After fertilization, egg developed well. 2. Fish had streamlined body. 3. Had good sense of smell. 4. Muscles all developed well. 5. Had urge to return upstream but at different time of year from other members of its species.	1. 2. 3. 4. 5. 6.

NATURAL SELECTION AND HERRING GULLS

In the spring, herring gulls fly to rocky coasts and islands where they settle for the spring and summer. There they mate and each pair of gulls lays three eggs. By the end of the summer, only one bird has survived from every six or seven eggs laid.

Why do so many birds die? Are some birds more likely to survive and reproduce than others? The answers to these questions help us understand how natural selection is working all of the time in the herring gull species.

Natural Selection: Herring Gull

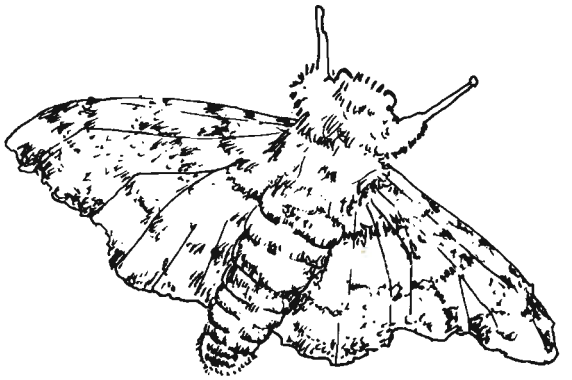
Certain periods in the first few months of the chicks' lives are the most critical for them. More gulls die during these periods than at other times. IN THE BOXES BELOW, LIST THE POSSIBLE CAUSES OF DEATH IN EACH PERIOD. It will help you to think about things the parents have to do as well as things the chicks have to do in each period.

First Critical Period right after the egg is laid	**Second Critical Period** when the egg is hatching and the time right after that	**Third Critical Period** toward the end of three months when the chick is becoming independent

What are some of the characteristics you think a herring gull that survived to reproduce would pass on to its offspring?

Some herring gulls survive themselves but they do not produce offspring. What characteristics might make it difficult for the gull to produce or raise offspring?

THE PEPPERED MOTH



The story of the Peppered Moth shows how natural selection caused at least one characteristic of an animal species to change when an environment changed. One hundred years ago, most of the members of this species were white with black, pepper-like spots. Some, however, were dark. Today, most of the members of the species are dark. This is the story of how the change occured.

In England, there are many birch trees. A hundred years ago they had white bark, spotted with patches of darker mosses. When the white peppered moths sat upon the trunks of trees with their wings spread, they were very difficult to see. The members of the species that were dark all over were quite easy to spot.

Several species of birds feed upon moths. You can imagine which variety of the peppered moths they found most easily! Both dark and light moths were eaten, but many more of the dark moths were eaten.

Gradually, in the cities of England, factories were built. These factories burned coal to run their machinery, and from the smokestacks poured tons and tons of soot. The soot settled upon the countryside, causing the bark of the birch trees to look black instead of white.

In areas where there were factories, the dark moths had an advantage over the light moths. With wings spread, the light moths were easily seen by the birds, but the darker ones were difficult to see. So more of the darker ones survived to reproduce. And their offspring, since they inherit the characteristics of their parents, were more likely to be the dark color also. That is why today, in most places in England, there are more dark moths than white ones with peppered spots.

The only places where the light moths still make up the larger part of the population are the places where there are no large factories nearby. Here, the trees are still white, and it is an advantage for the moths to be white with peppered spots.

I. Other Activities and Questions

These can be used as independent assignments or homework questions throughout the herring gull study.

1. Gulls' wings are well suited for long-distance flying, for gliding, for hovering over one spot. The birds have special glands in their heads that separate salt from the water so they can spend a long time over oceans without going near fresh water. They have excellent eyesight. Their feet are suited for both land and water. Knowing these things, what do you think a gull's life might be like? What else would you like to know to help you answer that question?

2. Draw a picture of a bird with a short, strong beak, short wings, and feet with three toes. What do you think the life of this bird might be like?

3. The herring gull filmstrip was made from pictures taken by Louis Darling, the author of The Gull's Way. Look through the pictures in the book. What additional information can you find about gulls from these pictures?

4. Have available the book Look at a Gull, by Dare Wright. The photographs in this book are beautiful and the writing usually accurate. The children might write a new script for the book, not using the first person but describing the pictures as a scientist might.

5. Imagine a male gull that had a very strong urge to fight. It did not just threaten other gulls, but actually fought with them. Do you think this bird would be of benefit to the species? Why or why not?

Can you think of any reason why this gull, as powerful as he is, might not reproduce? Think about other urges that the gull must have in order to reproduce, and what things in the outside environment might arouse those urges.

> I think it highly probable that a ruthless fighter, an individual with an unusually strong fighting urge, would reduce its own chances of reproduction by not responding readily enough to the female's releases, and attack instead of courting her. As a matter of fact, such individuals are known to bird fanciers. Especially among song-birds, there are some males that become so extremely pugnacious that it is impossible to pair them; they invariably attack any other bird that comes in their vicinity.*

6. The following pages can be dittoed for a special project on communication.

*The Herring Gull's World, by Niko Tinbergen, (c) 1960. Revised Edition by Niko Tinbergen, Basic Books, Inc., New York, 1961; reprinted with permission of Basic Books, Inc.

THE SOUNDS GULLS MAKE

What sounds do gulls make? Are all the sounds the same? Do sounds mean different things? Are sounds used for the same reason time after time?

These are a few questions you can ask about the sounds any animal makes. Men are studying animal sounds to try to find the answers to these and other questions.

To answer the questions, scientists not only have to listen to the sounds, they have to watch the animal and see when it makes the sound. Does it make the same sound every time it is in the same situation?

Then they can figure out if the sound has meaning to other animals. Are there other animals around when the sound is made? If there are, what do the other animals do? Do they do the same thing every time the sound is made?

And then there are other questions scientists ask. Animals seem to be born able to make sounds. But are they born knowing <u>when</u> to make the sounds, in what situations? Or do they learn these things?

Read the following statement and answer the questions. The story is told by Dr. Niko Tinbergen, a man who has spent many years studying gulls.

> The alarm-call of the parents causes the young to have the desire to hide. However, the parent cannot tell them where the predator is, nor where to hide. This was made clear to me when I was taking photographs from a hide in a Herring Gull colony. The hide had been standing at the same spot for so many days that it had been accepted by all gulls, old and young, as part of the scenery. The parents used its roof as a look-out post, the chicks hid in it in case of danger. One day I made a careless movement while sitting in the hide, which was seen by one of the parents. It promptly called the alarm, and walked away from the hide. The young, aroused by the alarm-call, ran for shelter. My hide being their particular shelter, they all entered the lion's den and crouched at my feet.
>
> Tinbergen, Social Behaviour of Animals, p. 49

Tinbergen says that the adult gull gave the call of alarm. How do you think Tinbergen knew it was an alarm call?

What other situations might cause an adult gull to make the same sound?

If you could put words into the adult gull's mouth, what would you have it say in the situation Tinbergen describes?

Do you think the chicks are born with an urge to hide when an alarm call is given, or do you think they learn it? Explain your answer.

Sometime when you are sitting outside, listen to the birds (watch them, if you can) and try to think of what the sounds they are using might mean. Or, if you have a pet dog or cat, watch it and see what special sounds it has.