

Each team will use their data to compare the behavior patterns within the group and between adults and offspring. Teams will share the tasks of observing and recording data. Individual observers are responsible for recording behavior of their focal bird. Data will then be graphed and conclusions about the behavior trended. Finally, researchers will compare their hypothesis with their conclusion and see if their scientific guess held true for the "slice of life" they observed.

STEP ONE - BACKGROUND FACTS

Research begins with background information. HawkQuest has assembled a list of important raptor questions and answers that will help each research team better understand the raptors and the nest environments. Facts can be reviewed as a team or as a class discussion. See how much your students know about raptors!

When do raptors nest and start to raise a family?

Different species nest at different times of the year. For instance, owls can begin rearing a family as early as February. Eagles begin rearing a family around March.

How can you tell female raptors from male raptors?

Female raptors are 10% to 50% larger than the males, depending on the species. Size differences are more pronounced in larger species like the Great Horned Owl and the Bald Eagle. Unlike songbirds, coloring between female and male raptors is the same, with the exception of the American Kestrel. Kestrel males have blue-gray wings, reddish-brown tails with broad black tips and spots visible along the trailing edge of the wings. Females, by contrast, have reddish brown on their wings and back as well as on their tail which also has thin dark brown bars.

How many eggs will raptors lay?

Raptors often lay 3 to 4 eggs in years when food supply is abundant. Barn Owls can lay up to 15 in one year. When food supply is low, raptors may lay one or no eggs. Below is a chart of some of the common species that use the Xcel Energy nesting boxes, with average clutch sizes and incubation days.

SPECIES	AVERAGE CLUTCH SIZE
Peregrine Falcon	3-4 creamy white eggs
Bald Eagle	1-3 bluish white eggs
Osprey	2-4 whitish eggs with red-brown spots
Great Horned Owl	1-4 white eggs

What food will the raptors eat?

All raptors are carnivores. The type of meat they eat depends on the habitat they frequent. For example, Bald Eagles living near water will consume fish. Bald Eagles wintering in the Colorado prairie will eat prairie dogs. Peregrine Falcons prefer to catch and eat birds, including ducks and geese. Great Horned Owls who don't have a highly developed sense of smell eat everything from skunks. rabbits, mice, voles, snakes and even house cats.

Why do raptors regurgitate pellets?

Raptors swallow small prey whole or they rip and tear pieces of meat with their beaks to swallow whole. Raptors, especially owls, cannot digest all the bones, teeth, fur, feathers and insect casings that they eat. Nature has designed them to regurgitate (cough up) these remains in a compact pellet. Pellets are often regurgitated before the raptor can eat its next meal.

Do raptors make their own nests?

Some raptors, like eagles, do make their own nests. However, owls rarely make nests. They prefer to occupy nests built by other animals, including squirrels and crows. They also occupy structures and nests built by humans.

How long does it take for a bird to fledge, or leave the nest?

SPECIES	AVERAGE FLEDGE DAY AFTER HATCHING
Peregrine Falcon	30-42 days
Bald Eagle	10-12 weeks
Osprey	49-56 days
Great Horned Owl	35 days

STEP TWO - ETHOGRAMS

An **ethogram** is a catalog of a chosen animal's behavior, i.e., feeding, playing, grooming. Each researcher will use HawkQuest's sample ethograms to track the social and non-social behaviors of their focal animal (photocopy ethogram on the next page). An ethogram contains behaviors that the researcher will focus on, codes to simplify recording, and agreed on definitions of each behavior determined by the research team. By observing the raptors for a few minutes, each team can record any additional behaviors not listed on the ethograms.

I. SOCIAL BEHAVIORS ETHOGRAM

Social behaviors are any behaviors the birds use when they interact with each other. Have the students review the ethogram on the next page. Become familiar with the different behaviors they might see. Add any social behaviors found in the research that are not listed here. Have the students circle any social behaviors listed below that the research team wants to track.

BEHAVIOR	CODE	DEFINITION
Preening Each Other	PO	Use beak to fix or clean another bird's feathers
Play	PL	Engage in amusement with another bird
Fight	FT	Engage in aggressive behavior to hurt or dominate another bird
Feed Other Birds	FO	Place food in another bird's mouth
Receive Food from Others	RF	Food placed in mouth by other birds
Nuzzle	NZ	Rub head on another bird
Touch Other	TO	Use beak or talon to gently touch
Intimidation Display	ID	Fluff up to scare another bird
Bite	BT	Use beak to nip another bird
_____	_____	_____
_____	_____	_____
_____	_____	_____

NOTE: Codes will be used to quickly record behaviors (shorthand) and as a legend to graph trends.

II. NON-SOCIAL BEHAVIORS ETHOGRAM

Non-social behaviors are solitary behaviors, behaviors the raptor engages in by itself. Review the ethogram below. Become familiar with the different behaviors you might see. Add any non-social behaviors that you found in your research that are not listed here. Circle any non-social behaviors listed below that your research team wants to track.

BEHAVIOR	CODE	DEFINITION
Self Preen	SP	Use beak to clean and fix feathers
Eat	ET	Swallow food
Scratch	SC	Use talons to relieve itching
Sleep	SL	Inert, eyes closed
Flap	FL	Move wings up and down
Walk/Hop	WH	Locomote with legs
Roust	RO	Rearrange feathers by fluffing up and shaking
Manipulate Object	MO	Use beak or talons to move object
Inactive	IA	Eyes open, no movement, at rest
Yawn	YN	Open beak in reaction to sleepiness
Regurgitate Pellet	RP	Cough up indigestible bits of food, i.e., fur and bones, in a compact, oval pellet.
Open Beak	OB	Open beak to receive food
_____	_____	_____
_____	_____	_____
_____	_____	_____

NOTE: Codes will be used to quickly record behaviors (shorthand) and as a legend to graph trends.

STEP THREE - FORMING A HYPOTHESIS

Answer the questions below as a team.

Which social behaviors do you think will occur most frequently in:
the group?
the adults?
the babies?

Which non-social behaviors do you think will occur most frequently in:
the group?
the adults?
the babies?

Of all the behaviors, which do you think will occur most often?

STEP FOUR - RECORDING DATA

Each team will need a stopwatch or access to a clock with a seconds hand to record the data. Each observer will observe their focal animal at 30 second intervals for five minutes. This will result in ten data samplings of each animal present in the nesting box. At each sampling, one researcher will observe their focal bird and communicate observed behaviors that will be recorded by a fellow team member on the chart on the next page. The recorder can use the behavior codes on the ethograms for shorthand, rapid recording. One researcher will be the timekeeper who announces when the sampling will begin and announces every 30 seconds interval with "NEXT." The timekeeper will also signal the end of the five-minute observation. The rest of the research members, if any, will keep a running record of interesting or unusual behaviors to round out their observations. At the end of five minutes, team members will rotate their positions until all raptors in the group have been sampled.

NOTE: Try a test run to make sure all members of the research team are familiar with the rotating rolls of observation and recording data. Have ethograms with codes in front of researchers for easy reference.

Date: _____ Observation Time: (Begin -- _____)
 (End -- _____)

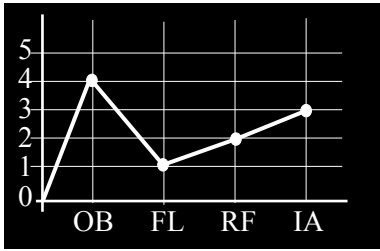
Nature Researcher	Focal Animal	30 sec	1 min	1 min 30 sec	2 min	2 min 30 sec	3 min	3 min 30 sec	4 min	4 min 30 sec	5 min
Example	Owlet A	O B	O B	F L	R F	R F	O B	O B	I A	I A	I A
# 1	Adult A										
# 2	Adult B										
# 3	Baby A										
#4	Baby B										
#5	Baby C										

STEP FIVE - ANALYZING DATA

Have the students gather your raw data, using the following table to enter the sample totals. Use the codes from the ethograms that describe the behaviors that are observed.

Code											
Behavior Description											
Adult A											
Adult B											
Baby A											
Baby B											
Baby C											
Example Codes	O B	F L	R F	I A							
Owlet A	4	1	2	3							

Graph results, i.e., Total Number of Occurrences versus Behaviors of each raptor in the group.



Researchers can also graph social versus non-social behaviors as defined by the ethograms or compare activities of babies versus parents.

STEP SIX - CONCLUSIONS

Answer the questions below as a team.

Which social behaviors occurred most frequently in:
 the group?
 the adults?
 the babies, if any?

Which non-social behaviors occurred most frequently in:
 the group?
 the adults?
 the babies, if any?

Of all the behaviors, which occurred most often?

ADDITIONAL MATH FOR THOSE WHO LIKE TO CRUNCH NUMBERS DIVISION AND PERCENTAGES

The more time field biologists spend observing animal behavior, the more accurate trend data is recorded. If time permits, have each research team fill out several data collection sheets of the observed group. This will increase the total opportunities to record and produce more accurate percentages of behavior trending.

Each research team must determine the total number of behavior opportunities. For example, each researcher had 10 (30-second) time periods in five minutes in which to observe each behavior or 10 opportunities to observe each behavior. Use a calculator and divide the individual total occurrences by the TOTAL OPPORTUNITIES to get the percentage of time each behavior occurred.

FOR EXAMPLE: If the sum total of all opportunities is 10 and the bird was observed eating a total of 5 times (total occurrences) then the bird ate $5/10 = .5$ or 50% of the time during the sampling period. If the team chose to sample more than 5 minutes per raptor, let's say 20 minutes, then the total opportunities would be 40 (30 second periods). If the bird was observed eating a total of 10 times (total occurrences) during this time, then the bird ate $10/40$ or 25%.

Research teams can use the table below to figure the percentages.

BEHAVIOR CODE	Total Occurrences of this Behavior	Divide by	Sum Total of Opportunities	Equals	Percentage of Time the Behavior Occurred
Example IA	3	/	10	=	33.333%
1.					
2.					
3.					
4.					
5.					
6.					
7.					
8.					
9.					

Graph % of each behavior recorded for individual raptors and/or the group.

STEP SEVEN - ONE MORE HYPOTHESIS and perhaps another experiment . . .

As with most scientific experiments, conclusions often lead to new hypotheses. Does the research team think the behaviors that occurred most frequently would be different at different times of the day or at different stages in the nesting and rearing of young?



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