SeaWorld/Busch Gardens
Raptors
4-8 Classroom Activities

Raptor Ratios

OBJECTIVE

The student will calculate ratios and interpret them. The student will calculate a measure of central tendency.

ACTION

1. Divide the class into groups of two.

2. Explain that each group will draw a specific raptor species from a bowl to research. The following information should be included in the students' research: range, habitat, diet, three adaptations, incubation, and a picture of the raptor species.

3. Instruct the student groups to calculate the ratio between the raptor's wingspan and body length using the following process. (Some measurements are metric.)

   Place the wingspan measurement in the numerator of a fraction and the body length measurement in the denominator. Next, determine the greatest common factor (try 2, 3 and 5 first) between the two numbers (wingspan and body length). Then divide the numerator and denominator by the greatest common factor to identify the ratio .

   Example: a 9 in. wingspan to a 6 in. body length: 9/6. The greatest common denominator is 3 because 3 is the largest number that will divide evenly into 6 and 9. 9/3= 3 and 6/3= 2. Therefore, the ratio is 3 to 2 or 3:2.

4. Instruct students to use the ratios for their raptor species to answer the second question listed on their raptor cards. The question will either ask the students to calculate a wingspan or body length based on the calculated raptor ratio. This is accomplished by placing the ratio into fraction form first. Remember the wingspan measurement should be in the numerator and the body length measurement should be in the denominator. Next, determine which piece of information is given in the question; (either the wingspan or the body length) and correlate that measurement in either the numerator or denominator of a second fraction. (If wingspan is given, then leave the denominator blank in the second fraction, if body length is given, then leave the numerator blank). Finally, determine the number one should multiply by to receive the given measurement in the second fraction and multiply ratio fraction by that number.

Example: Ratio of 3:2. Determine the wingspan of a raptor who has a body length of 10 cm. 3=x 2=10cm 3/2=x/10   Therefore (3)(10)/2 =x 3 times 10cm equals 30cm and 30cm divided by 2 equals 15 cm. x=15cm. To maintain a ratio of 3:2 for a raptor with a body length of 10 cm, the wingspan must be 15 cm.

5. Using a new set of ratio data (see box below), instruct students to rank the following species of raptors from greatest to least in terms of their wingspan/body length ratios (that is, raptors with the greatest wingspan to body length ratios will be listed first down to those with the smallest ratios). This can be accomplished by placing the ratio in fraction form and dividing the numerator by the denominator.

6. Next, students will measure their own body and calculate wingspan and body length as if they are a bird. Instruct students to calculate their human wingspan/body length ratios using a tape measure. The wingspan is calculated by having one of the students from each group stretch out their arms to the side. The second student will then measure the distance from the left hand's fingertips to the right hand's fingertips. (The students will alternate measuring so that both students in the group will determine their wingspan/body length ratios). Body length is calculated by measuring the distance from the feet to the top of the head. Finally, divide the wingspan by the body length for the ratio. The students should correlate their wingspans into the ranking chart completed in step 5.

7. Reveal the answers to the raptor ranking chart calculated in step 5 using the Teacher's Guide. Instruct students to present their raptor research to the class (demographic information, raptor species picture, and ratio calculations). The student groups may present their information as they appear on the raptor ranking chart. Answer the following qustions:
Where did the students' wingspan to body length ratios fall on the raptor ranking chart and why?
What was the mean wingspan/body length ratio for raptors and for humans?

BIRD RATIO DATA

Screech owl = 11:5
Barn owl = 9:4
Golden eagle = 2:1
Great horned owl = 10:3
Bald eagle = 5:2
Osprey = 7:2
Red-tailed hawk = 12:5
Burrowing owl = 11:4
Peregrine falcon = 23:9
Merlin = 21:11
Harrris hawk = 3:1
Northern goshawk = 7:5

MATERIALS

For each student group:
• Raptor Ratio Funsheet
• calculator
• tape measure
• library or internet Access
For class
• Raptor Ratio Answer Sheet
• large bowl

PREPARATION

Cut each raptor card out from the Raptor Ratio Funsheet and place them in a bowl.

Raptor Ratio Funsheet

1. screech owl (*Otus asio*)

Wingspan: 55 cm   Body length: 25 cm

What is the ratio between wingspan and body length for the screech owl?

_____ / _____

According to the screech owl's calculated ratio between wingspan and body length, what would the measured wingspan be for a screech owl that is 20 cm in body length?

_____ / _____ = x / 20 cm

Raptor Ratio Funsheet

2. golden eagle (*Aquila chrysaetos*)

Wingspan: 6 ft.   Body length: 3 ft.

What is the ratio between the wingspan and body length for the golden eagle?

_____ / _____

According to the golden eagle's calculated ratio between wingspan and body length, what would the measured body length be for a golden eagle that has a wingspan of 8 ft.?

_____ / _____ = 8 ft. / x

Raptor Ratio Funsheet

3. bald eagle (*Haliaeetus leucocephalus***)**

Wingspan: 200 cm   Body length: 80 cm

What is the ratio between the wingspan and body length for the bald eagle?

_____ / _____

According to the bald eagle's calculated ratio between wingspan and body length, what would the measured body length be for a bald eagle that has a wingspan of 205 cm?

_____ / _____ =   205 cm / x

Raptor Ratio Funsheet

4. red-tailed hawk (*Buteo jamaicensis***)**

Wingspan: 120 cm   Body length: 50 cm

What is the ratio between the wingspan and body length for the red-tailed hawk?

_____ / _____

According to the red-tailed hawk's calculated ratio between wingspan and body length, what would the measured wingspan be for a red-tailed hawk with a body length of 40 cm?

_____ / _____ =   x / 40 cm

Raptor Ratio Funsheet

5. peregrine falcon (*Falco peregrinus***)**

Wingspan: 115 cm   Body length: 45 cm

What is the ratio between the wingspan and body length for the peregrine falcon?

_____ / _____

According to the peregrine falcon's calculated ratio between wingspan and body length, what would the measured wingspan be for a peregrine falcon with a body length of 54 cm?

_____ / _____ =   x / 54 cm

Raptor Ratio Funsheet

6. barn owl (*Tyto alba***)**

Wingspan: 45 in.   Body length: 20 in.

What is the ratio between the wingspan and body length for the barn owl?

_____ / _____

According to the barn owl's calculated ratio between wingspan and body length, what would be the measured body length of a barn owl that has a wingspan of 36 in.?

_____ / _____ =   36 in. / x

Raptor Ratio Funsheet

7. great horned owl (*Bubo virginianus***)**

Wingspan: 60 in.   Body length: 18 in.

What is the ratio between the wingspan and body length for the great horned owl?

_____ / _____

According to the great horned owl's calculated ratio between wingspan and body length, what would be the measured wingspan of a great horned owl that is 27 in. in body length?

_____ / _____ = x / 27 cm

Raptor Ratio Funsheet

8. osprey (*Pandion haliaetus***)**

Wingspan: 70 in.   Body length: 20 in.

What is the ratio between the wingspan and body length for the osprey?

_____ / _____

According to the osprey's calculated ratio between wingspan and body length, what would be the measured wingspan of an osprey that is 26 in. in body length?

_____ / _____ = x / 26 in.

Raptor Ratio Funsheet

9. burrowing owl (*Athene cunicularia***)**

Wingspan: 55 cm   Body length: 20 cm

What is the ratio between the wingspan and body length for the burrowing owl?

_____ / _____

According to the burrowing owl's calculated ratio between wingspan and body length, what would be the measured wingspan for a burrowing owl that is 28 cm in body length?

_____ / _____ =   x / 28 cm

Raptor Ratio Funsheet

10. merlin (*Falco columbarius***)**

Wingspan: 63 cm   Body length: 33 cm

What is the ratio between the wingspan and body length for the merlin?

_____ / _____

According to the merlin's calculated ratio between wingspan and body length, what would be the measured body length for a merlin that has a wingspan of 42 cm?

_____ / _____ =   42 cm/ x

Raptor Ratio Funsheet

11. Harris hawk (*Parabuteo unicinctus***)**

Wingspan: 45 in.   Body length: 18 in.

What is the ratio between the wingspan and body length for the Harris hawk?

_____ / _____

According to the merlin's calculated ratio between wingspan and body length, what would be the measured wingspan for a Harris hawk that has a body length of 24 in.?

_____ / _____ = x / 24 in.

Raptor Ratio Funsheet

12. Northern goshawk (*Accipiter gentiles***)**

Wingspan: 42 in.s   Body length: 30 in.

What is the ratio between the wingspan and body length and for the Northern goshawk?

_____ / _____

According to the Northern goshawk's calculated ratio between wingspan and body length, what would be the measured body length for a northern goshawk that has a wingspan of 49 inches?

_____ / _____ = 49 in. / x

Raptor Ratios Answer Sheet

1. screech owl (*Otus asio***)**

Wingspan: 55 cm   Body length: 25 cm

What is the ratio between wingspan and body length for the screech owl? **11:5**
 The greatest common denominator between 55 and 25 is 5. Therefore, 55 divided by
 5 is 11 and 25 divided by 5 is 5.

According to the screech owl's calculated ratio between wingspan and body length, what
 would the measured wingspan be for a screech owl that is 20 cm in body length? **44 cm**
 (11/5=x/20   11 times 20 equals 220 divided by 5 equals 44)

Range: Southern Canada, United States and Mexico
Habitat: Wooded habitats
Diet: Small animals including mice, frogs, lizards, and birds.
Incubation: Up to 6 eggs are incubated for about 26 days in a tree hollow.
Three Adaptations Examples:
  A. When a screech owl spots danger, it will draw its body up to create a thin, narrow
      profile, and remain motionless to avoid detection.
  B. Owls have 14 neck vertebrae, allowing them to move their head 270 degrees.
  C. Screech owls are brown and black in color and camouflage well into wooded habitats.

2. golden eagle (*Aquila chrysaetos***)**

Wingspan: 6 ft.   Body length: 3 ft.

What is the ratio between wingspan and body length for the golden eagle? **2:1**
  6 divided by 3 equals 2; 3 divided by 3 equals 1.

According to the golden eagle's calculated ratio between wingspan and body length, what
 would the measured body length be for a golden eagle that has a wingspan of 8ft? **4 ft**
 (2/1=8/x 8 times 1 is 8 divided by 2 is 4 ft.)

Range: Western U.S. and across Canada and Alaska; winter in North America from
      south-central Alaska to central Mexico.
Habitat: Open country, desert grasslands.
Diet: Small and medium sized mammals, birds, and reptiles; occasionally carrion.
  Incubation: 35 to 45 days; 2 to 4 eggs; fledge 72 to 84 days.
Three Adaptations Examples:
  A. When golden eagles spot prey while soaring, they tuck their wings and swoop at
      speeds up to 200 mph. Some say it sounds like a small, low-flying airplane.
  B. These eagles prefer to attack upwind which increases their speed and ability to con-
      trol their speed and maneuverability.
  C. Golden eagles aren't typically found in the eastern portion of the United States
      because these eagles shy away from largely populated areas. They can be found in
      the rugged solitude of western U.S. where people are more spread out.

3. bald eagle (*Haliaeetus leucocephalus***)**

Wingspan: 200 cm   Body length: 80 cm

What is the ratio between the wingspan and body length for the bald eagle? **5:2**
   The greatest common denominator between 200 and 80 is 40. Therefore, 200 divided
   by 40 is 5 and 80 divided by 40 is 2.

According to the bald eagle's calculated ratio between wingspan and body length, what is
   the measured body length of a bald eagle that has a wingspan of 205 cm? **82 cm**
   (5/2=205/x is 205 times 2 equals 410 divided by 5 equals 82)

Range: North America from Alaska and Canada south into Florida and Baja, California.
Habitat: Live and nest near coastlines, rivers, lakes, wet prairies, and coastal pine lands.
   Diet: Prefer fish swimming close to the water's surface, small mammals, waterfowl,
   wading birds, dead animal matter (carrion).
Incubation: 31 to 45 days.
Three Adaptations Examples:
   A. The bald eagle can fly 20 to 40 mph in normal flight and can dive at speeds over
       100 mph.
   B. Bald eagles can actually swim! They use an overhand movement of the wings that
       is very much like the butterfly stroke.
   C. Bald eagles may use the same nest year after year, adding more twigs and branches
       each time. One nest was found that had been used for 34 years and weighed over
       two tons!

4. red-tailed hawk (*Buteo jamaicensis***)**

Wingspan: 120 cm   Body length: 50 cm

What is the ratio between the wingspan and body length for the red-tailed hawk? **12:5**
   The greatest common denominator between 120 and 50 is 10. Therefore, 120 divided
   by 10 is 12 and 50 divided by 10 is 5.

According to the red-tailed hawk's calculated ratio between wingspan and body length,
   what is the measured wingspan of a red-tailed hawk with a body length of 40 cm? **96 cm**
   (12/5=x/40 is 40 times 12 equals 480 divided by 5 equals 96)

Range: North America, from Alaska east to Nova Scotia.
Habitat: Open country, woodlands, prairie groves, mountains, plains, farmlands, savanna,
   and even along roadsides.
Diet: Small mammals; reptiles and amphibians; sometimes fish and invertebrates.
Incubation: 28 to 32 days, 1 to 4 eggs; 45 days fledgling.
Three Adaptations Examples:
   A. The red-tailed hawk's cry is a long rasping scream. It is used while soaring or
      perched as a sign of annoyance or anger, and is usually heard when an enemy or a
      rival hawk comes into its range. When the parents leave the nest, the young utter a
      loud klee-uk, repeated several times - this is a food cry.
   B. Red-tailed hawks are aggressive birds and vigorously defend their territory, especial-
      ly during the winter months when hunting is difficult.
   C. Red-tails' pair bond is strong, even outside the breeding season, and the female will
      defend her mate against aggressors.

5. Pperegrine falcon (*Falco peregrinus* **)**

Wingspan: 115 cm   Body length: 45 cm

What is the ratio between the wingspan and body length for the peregrine falcon? **23:9**
    The greatest common denominator between 115 and 45 is 5. Therefore, 115 divided
    by 5 is 13 and 45 divided by 5 is 9.

According to the peregrine falcon's calculated ratio between wingspan and body length, what
    would the measured wingspan be for a peregrine falcon with a body length of 54 cm? **138 cm**
    (23/9=x/54 cm 54 times 23 equals 1242 divided by 9 equals 138 cm)

Range: Worldwide range
Habitat: Semi-forested areas, savanna, and large metropolitan areas.
Diet: Other birds
Incubation: Four-seven weeks, clutch size between 3 and 4 eggs.
Three Adaptations Examples:
 A. The Peregrine falcon is thought to be the fastest bird. It has been clocked at 90 meters
    per second.
 B. Falcons do not usually kill with the talons, but rather with their "toothed" beak to bite
    prey.
 C. There is a size difference between the male and female Peregrine falcons. Females are
    larger and take larger prey species than the males. This is known as resource
    partitioning and it eliminates competition between males and females.

6. barn owl (*Tyto alba* **)**

Wingspan: 45 in.   Body length: 20 in.

What is the ratio between the wingspan and body length for the barn owl? **9:4**
    The greatest common denominator between 45 and 20 is 5. Therefore, 45 divided by
    5 is 9 and 20 divided by 5 is 4.

According to the barn owl's calculated ratio between wingspan and body length, what is
    the measured body length of a barn owl that has a wingspan of 36 in.? **16 in.**
    (9/4=36/x   36 times 4 equals 144 divided by 9 equals 16 in.)

Range: Nearly worldwide distribution, absent only from the high latitudes.
Habitat: Populated areas, wooded habitats.
    Diet: Small mammals (95%); occasionally small birds.
Incubation: 5 to 7 eggs; 32 to 34 day incubation; owlets fledge at 7.5 weeks.
Three Adaptations Examples:
  A. Barn owl pairs typically stay together as long as both members of the pair are alive.
      They do not create a nest; rather they deposit the eggs in manmade structures such
      as towers, barns, etc., often using the site year after year.
  B. Barn owls are able to consume twice as much food as other owls in comparison to
      their weight. They are able to cover 100 acres each night in search of food. One
      barn owl offspring is able to consume 25,000 mice a year.
  C. Barn owls hunt at night, and although they have very good vision, they rely mostly
      on their sense of hearing. Owl ears are located one higher than the other, increasing
      sound reception. During flight, the left ear captures sounds below while the right
      ear focuses on sounds from above.

7. great horned owl (_Bubo virginianus_**)**

Wingspan: 60 in.   Body length: 18 in.

What is the ratio between the wingspan and body length for the great horned owl? **10:3**
   The greatest common denominator between 60 and 18 is 6. Therefore, 60 divided by
   6 is 10 and 18 divided by 6 is 3.

According to the great horned owl's calculated ratio between wingspan and body length,
   what is the measured wingspan of a great horned owl that is 27 in. in body length? **90 in.**
   (10/3=x/27 10 times 27 equals 270 divided by 3 equals 90 in.)

Range: Throughout North America, Central America, and South America.
Habitat: Wooded and open areas.
Diet: Animal prey including amphibians, reptiles, birds, and mammals; rodents are an
   important food source; can even take prey as large as skunks.
Incubation: 2 to 3 eggs are incubated for 32 days.
Three Adaptations Examples:
   A. Less than 3% of all bird species are active at night, half of those are owls. Most owls
       have unique, comblike feathers that allow for silent flight. The leading edge is "fringed"
       so that the feathers, when moving, do not make noise when rubbing together.
   B. Owls have 14 neck vertebrae, allowing them to move their head 270 degrees.
   C. Although these birds have excellent eyesight, they are also capable of catching prey
       using only their sense of hearing. They have binocular vision and a hooked beak so
       as not to interfere with their vision. Owls' eyes look forward in a fixed position and
       cannot move from side to side, as the human eye can. In order to see peripherally,
       the owl must turn its entire head.

8. osprey (_Pandion haliaetus_**)**

Wingspan: 70 in.   Body length: 20 in.

What is the ratio between the wingspan and body length for the osprey? **7:2**
   The greatest common denominator between 70 and 20 is 10. Therefore, 70 divided
   by 10 is 7 and 20 divided by 10 is 2.

According to the osprey's calculated ratio between wingspan and body length, what
   would be the measured wingspan of an osprey that is 26 inches in body length? **91 in**.
   (7/2=x/26 26 times 7 equals 182 divided by 2 equals 91)

Range: All continents except Antarctica.
   Habitat: Lakes, ponds, rivers, reservoirs, estuaries, bays, lagoons.
Diet: Fish; occasionally small mammals, birds, amphibians, and reptiles.
Incubation: 5 weeks, 3 eggs; 10 weeks fledgling.
Three Adaptations Examples:
A. The black line running through the osprey's eye is thought to reduce glare from the
    sun, similar to the black lines football players wipe under their eyes.
B. The osprey is supremely adapted to this hunting style. The bottoms of its feet are
    extremely rough with barbs called spicules, and its outer toe can turn forward or
    backward, both of which help it grab and hold the fish. The osprey's flexible "wrist"
    helps it pull back into the air from the water, and its feathers are compact with an oily
    covering to resist becoming waterlogged.
C. The osprey typically hunts by watching for fish no more than .9m (3 ft) below the sur-

face, usually from an altitude of about 18.2m (60 ft). When it sees a likely fish, usually weighing less than .45kg (1lb.), the osprey plunges straight into the water, turning to a feet-first position before going impact.

9. burrowing owl (*Athene cunicularia*)

Wingspan: 55 cm   Body length: 20 cm

What is the ratio between the wingspan and body length for the burrowing owl? **11:4**
    The greatest common denominator between 55 and 20 is 5. Therefore, 55 divided by 5 is 11 and 20 divided by 5 is 4.

According to the burrowing owl's calculated ratio between wingspan and body length, what is the measured wingspan for a burrowing owl that is 28 cm in body length? **77 cm**
    (11/4= x/28 11 times 28 equals 308 divided by 4 equals 77 cm.)

Range: North America
Habitat: Open, dry grasslands, agricultural and desert habitats.
Diet: Large arthropods, mice, rats, gophers, and ground squirrels.
Incubation: Six to nine white eggs. Incubation is around 28-30 days.
Three Adaptations Examples:
  A. Burrowing owls live in abandoned burrows of small mammals or they can build their own burrows. The burrows help protect the owl against predators.
  B. Juvenile burrowing owls can imitate a rattlesnake like buzzing sound for protection against predators.
  C. Less than 3% of all bird species are active at night, half of those are owls. Most owls have unique, comb like feathers that allow for silent flight. The leading edge is "fringed" so that the feathers, when moving, do not make noise when rubbing together. It is rare for the prey to hear an owl swooping in.

10. merlin (*Falco columbarius*)

Wingspan: 63 cm   Body length: 33 cm

What is the ratio between the wingspan and body length for the merlin? **21:11**
    The greatest common denominator between 63 and 33 is 3. Therefore, 63 divided by 3 is 21 and 33 divided by 3 is 11.

According to the merlin's calculated ratio between wingspan and body length, what is the measured body length for a merlin that has a wingspan of 42 cm? **22 cm**
    (21/11=42/x   42 times 11 equals 462 divided by 21 equals 22 cm)

Range: Worldwide distribution
Habitat: Forested areas and scrublands.
Diet: Other birds
Incubation: Three to five eggs are incubated for 25 to 32 days.
Three Adaptations Examples:
  A. The Merlin uses its speed and small size to hunt its prey. The hunting flight of the Merlin is normally a low, direct flight over woods or grasslands.
  B. Merlins are very territorial and will defend their territories and nesting sites vigorously even against larger raptor species.
  C. Female merlins frequently utilize abandoned nests of other birds such as crows or magpies.

11. Harris hawk (*Parabuteo unicinctus***)**

Wingspan: 45 in.   Body length: 18 in.

What is the ratio between the wingspan and body length for the Harris hawk? **5:2**
   The greatest common denominator between 45 and 18 is 9. Therefore, 45 divided by
   9 is 5 and 18 divided by 9 is 2.

According to the merlin's calculated ratio between wingspan and body length, what is the
   measured wingspan for a Harris hawk that has a body length of 24 in.? **60 in**.

Range: Southwestern United States and south to southern Chile and central Argentina
   and Paraguay.
Habitat: Semi-arid habitats and grasslands.
Diet: Rabbits, rodents, snakes, lizards, and other birds.
Incubation: Two to four white eggs (sometimes speckled) are incubated for about 35
   days.
Three Adaptations Examples:
   A. Harris hawks have been known to display a "mantling" behavior over captured
       prey to hide it from other birds.
   B. Harris hawks hunt in family groups. Once prey is located, several hawks scare the
       prey out of hiding while another hawk is waiting to capture.
   C. Perch hunting is another method harris hawks use to catch prey. They will perch
       on low bushes, tall trees and utility poles. They have even been observed stacking
       on top one another to look for prey.

12. Northern goshawk (*Accipiter gentiles***)**

Wingspan: 42 in.   Body length: 30 in.

What is the ratio between the wingspan and body length and for the Northern goshawk?
   7:5
   The greatest common denominator between 42 and 30 is 6. Therefore, 42 divided by
   6 is 7 and 30 divided by 6 is 5.

According to the northern goshawk's calculated ratio between wingspan and body length,
   what is the measured body length for a Northern goshawk that has a wingspan of 49
   in.? **35 in.** (7/5=49/x   5 times 49 equals 245 dividied by 7 equals 35)

Range: Northern hemisphere
Habitat: Dense woodlands.
Diet: Small mammals and birds
Incubation: Two to five eggs are incubated for about a month.
Three Adaptations Examples:
   A. Goshawks have elongated feathers near their feet that functions as insulation
       against cold weather.
   B. Goshawks have extremely sharp talons for capturing prey.
   C. Goshawks are territorial and will defend their nest against any predators.

Raptor Ranking Chart

1.	osprey	3.5
2.	great horned owl	3.3
3.	Harris hawk	3.0
4.	burrowing owl	2.75
5.	peregrine falcon	2.6
6.	bald eagle	2.5
7.	red-tailed hawk	2.4
8.	barn owl	2.25
9.	screech owl	2.2
10.	golden eagle	2.0
11.	merlin	1.9
12.	Northern goshawk	1.4
13.	humans	~1.0

**Note: Ratios are approximations and does not necessarily reflect all members of a species.

Questions

Where did the students' wingspan to body length ratios fall on the raptor ranking chart and why? Humans generally have a wingspan equal to their body length and therefore ranked at the bottom of the chart. Humans may utilize wingspan for balance as opposed to flying. Flying requires more wingspan surface area to lift the body off the ground.

What was the mean wingspan/body length ratio for raptors and for humans? 5:2