

Waiting to Inhale!

OBJECTIVE

Students will learn how long fur seals hold their breath when they dive.

TIME REQUIRED

10 minutes

BACKGROUND

INSTRUCTOR: This is an activity that should not be done at home or unsupervised. Instructors should take precautions to warn students that this activity should be done only at school.

Air-breathing mammals like pinnipeds (seals, eared seals and walrus) must be able to take in enough oxygen to survive while they are underwater diving for food. Most eared seals (fur seals and sea lions) dive to depths of 150-200 meters while other seals can dive to 1,000-1,200 meters. Fur seal dives are short for pinnipeds, averaging two to nine minutes. Because they have larger bodies, males can dive longer than females.

MATERIALS

- Worksheet 1 (grades 3-6)
- Table 1 (grades 5-6)
- Worksheet 2 (grades 5-6)
- Worksheet 3 (grades 5-6)
- Timer (clock with second hand, or stopwatch)
- Student basic 4 function calculators

PROCEDURE FOR GRADES 3-4

1. Ask what kinds of adaptations pinnipeds have for diving. Ask the students what they do when swimming (e.g. hold breath, open eyes underwater, use arms to propel, use legs to push).
2. Hand out Activity 5.2 Worksheet 1. Each student makes a prediction: how long can they hold their breath? Record the prediction on their worksheet.
3. Have students work in pairs. One student will hold his or her breath; the other student will record the length of time that the first student can hold his or her breath. Repeat three times, then switch.
4. Graph results as a class.
5. Compare predictions to their actual results

6. Discuss and write a conclusion sentence. "I conclude that I held my breath 10 seconds longer than I predicted..."
7. Show the students Table 1 (average and maximum dive duration of male northern fur seals) and talk about whether the students were able to hold their breath as long as fur seals hold their breath to dive.

PROCEDURE FOR GRADES 5-6

Follow steps 1-6 above.

8. Once all students have compared their predictions to their results, hand out Activity 5.2 Worksheet 2. Have students write down their average and maximum breath-hold durations and make a prediction about whether they can hold their breath longer than a fur seal.
9. Hand out Table 1 or show it on the overhead projector. Have students compare their individual breath-hold duration with male fur seal dive durations and write a conclusion based on their prediction. Have students calculate mean and median dive durations of the fur seal data.
10. The class will fill out Activity 5.2 Worksheet 3 as a group, either on the whiteboard or as an overhead projection. Students will have to convert their times to decimal minutes if they recorded them as minutes and seconds.
 - a. For times recorded as Minutes:Seconds (MM:SS), take the seconds (SS) and divide by 60, then add to the minutes (MM).
 - b. Example:
 - i. 89 seconds = 1 minute 29 seconds
 - ii. Divide seconds by 60: $29 \div 60 = 0.48$
 - iii. the amount would be written 1.48 minutes
11. Calculate a class average breath-holding duration (average of all the students) and maximum breath-holding duration (average of the students' individual maximum durations). Compare with the average and maximum dive duration of the fur seals.

DISCUSSION

- What was the class average for breath-holding?
- How did it compare to the average northern fur seal breath-holding?
- Why can fur seals hold their breath so much longer than humans?

Most mammals have hemoglobin, a molecule in red blood cells that carries oxygen. Seals and cetaceans also store oxygen in a molecule called myoglobin which is in the muscles. Seals also have a lot of blood compared to other mammals (about 12% of their body weight; a person has about 7% of their body weight composed of blood). So, seals have lots of hemoglobin and myoglobin to carry oxygen, which they use when they are diving.

EXTENSION

- Have the students look up dive durations of other animals (otters, whales, other seals) and compare them to their own breath-holding durations.
- If several classes do the same exercise, have them compare results. Bigger fur seals can dive longer and deeper because they have bigger bodies (and therefore more capacity to hold oxygen in their blood). Does this pattern hold with students, too?

RESOURCES

Video camera reveal marine mammals take a laid-back approach to deep diving

UC Santa Cruz Currents online, <http://www1ucsc.edu/currents/99-00/04-10/dive.html>

Marine Mammals–Marinebio.org

<http://marinebio.org/oceans/marine-mammals.asp>

ACTIVITY 5.2

WORKSHEET 5.2.1

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Student 1 name: _____

Student 2 name: _____

Prediction: How long can you hold your breath?

Student 1: _____

Student 2: _____

Data Table: Length of time holding breath (in seconds)

	Student 1	Student 2
	Name:	Name:
Trial 1		
Trial 2		
Trial 3		
Average		

Conclusion:

Student 1: _____

Student 2: _____

ACTIVITY 5.2

EXAMPLE 5.2.1

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Student 1 name: _____ Student 1

Student 2 name: _____ Student 2

Prediction: How long can you hold your breath?

Student 1: _____ Student 1 60 seconds

Student 2: _____ Student 2 75 seconds

Data Table: Length of time holding breath (in seconds)

	Name: Student 1	Name: Student 2
Trial 1	49	79
Trial 2	56	85
Trial 3	58	89
Average	54 seconds	84 seconds

Conclusion:

Student 1: I conclude that my prediction was very close to how long I could actually hold my breath.

Student 2: I conclude that I could hold my breath longer than I predicted.

ACTIVITY 5.2**TABLE 5.2.2****Waiting to inhale!****How long do male northern fur seals dive?**

Average and maximum dive durations for male northern fur seals. Dive durations are shown in two units: in minutes and seconds, and in decimal minutes. Decimal minutes are used by scientists for calculating mean and median durations.

Male #	Average dive duration (minutes:seconds)	Maximum dive duration (minutes:seconds)	Average dive duration (decimal minutes)	Maximum dive duration (decimal minutes)
1	3:40	6:17	3.67	6.28
2	5:25	8:14	5.42	8.23
3	5:39	8:59	5.65	8.99
4	3:34	5:10	3.56	5.17
5	2:56	5:16	2.94	5.26

ACTIVITY 5.2 **WORKSHEET 5.2.2** **Waiting to inhale!**

Comparing your results to northern fur seal dive durations.

What was your average breath-holding duration? _____

What was your maximum breath-holding duration? _____

Prediction 1: Do you think you can hold your breath longer than a fur seal? _____

Look at Table 5.2.2.

Calculate the mean and the median duration for the following:

	Mean duration (decimal minutes)	Median duration (decimal minutes)
Male fur seals — Average dive duration		
Male fur seals — Maximum dive duration		

Conclusion: _____

ACTIVITY 5.2

EXAMPLE 5.2.2

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Comparing your results to northern fur seal dive durations.

What was your average breath-holding duration? 54 seconds (0:54)

What was your maximum breath-holding duration? 58 seconds (0:58)

Prediction 1: Do you think you can hold your breath longer than a fur seal? NO

****SHOW THIS TABLE TO STUDENTS – available on separate page****

Table 5.2.2. How long do male northern fur seals dive?

Average and maximum dive durations for male northern fur seals. Dive durations are shown in two units: in minutes and seconds, and in decimal minutes. Decimal minutes are used for calculating mean and median durations.

Male #	Average dive duration (minutes:seconds)	Maximum dive duration (minutes:seconds)	Average dive duration (decimal minutes)	Maximum dive duration (decimal minutes)
1	3:40	6:17	3.67	6.28
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Calculate the mean and the median duration for the following:

	Mean duration (decimal minutes)	Median duration (decimal minutes)
Male fur seals — Average dive duration	4.25	3.67
Male fur seals — Maximum dive duration	6.79	6.28

Conclusion: My prediction that I could not hold my breath longer than a fur seal was correct.

My maximum breath- hold duration was 58 seconds and some male fur seals can hold their breath
over 8 minutes.

