

Communicating About Numbers



Objectives

Students communicate mathematical ideas and visually represent ideas by constructing charts, graphs, and scale drawings.

Materials

- Ocean Animals information cards on pages 3-5
- graph paper
- pencils

Background

There are various ways we can communicate mathematical concepts. We can write number sentences and formulas, we can verbalize information, we can create engineering drawings, and we can visually portray information in graphs. In this activity students will explore graphing and scale drawings.

For the in-class part of this activity, students may work individually or in learning groups. The first part of the activity is a take-home, parent-participation component.

ANSWERS

4. *Communicating maximum adult sizes:*
Students may create various bar graphs. The top graph here is one example.

5. For animal populations, swimming speed, and diving depth, students may suggest and create various types of bar graphs.

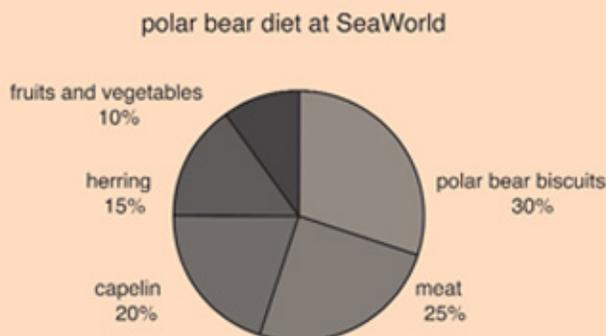
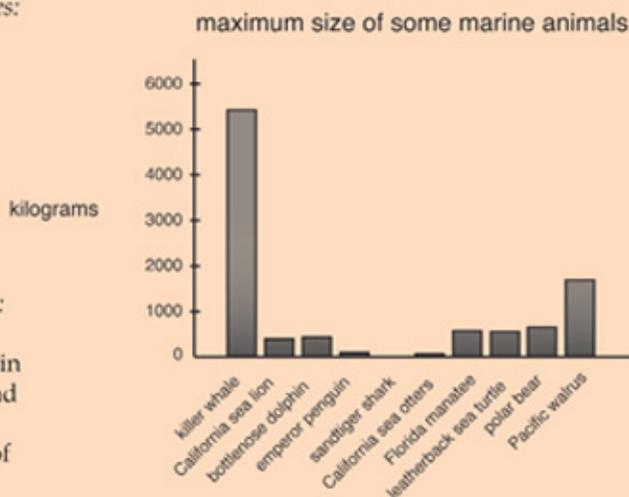
6. *Determining the range of food intake:*
Using a Florida manatee as an example, Florida manatees range in size from 363 to 544 kilograms, and they eat 4% to 9% of their body weight per day. On the low side of the range, we can calculate:
 $363 \text{ kilograms} \times 0.04$
 $= 14.5 \text{ kilograms of food per day}$

On the high side of the range we can calculate:

$$544 \text{ kilograms} \times 0.09 \\ = 49.0 \text{ kilograms of food per day}$$

Percent food intake is a more accurate picture of how much an individual animal eats, given that the adult size of animals varies. Larger animals of the same species generally eat more than small animals.

7. Students create pie charts such as the graph at right.



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Action

1. Ask students to think of ways we can communicate about mathematical concepts. Discuss formulas, number sentences, graphs, engineering and architectural drawings, and other ways students suggest.
2. Ask students to go home and peruse newspapers and magazines to find information that is expressed in terms of numbers. They may encounter articles that discuss the environment, weather reports, etc. Ask students to discuss what they find with their parents and family. How were numbers used to help communicate? How did the author communicate about the numbers? Students bring to class a copy of an article they discussed with their family and report to the class.
3. Distribute a set of Ocean Animals information cards to each group of students. Choose one card to go over together, pointing out that the card gives specific numerical information including size, food intake, population, swimming speed, and diving depth. Note the units of each of the measurements.
4. Ask students to think of ways to communicate how they can compare the maximum adult sizes of each of the animals. (They should suggest a bar graph.) Ask students to create graphs that communicate the maximum adult sizes of each animal species. Remind them to define their units of measure and to label both axes.
5. Ask student to suggest ways to graph animal populations, swimming speed, and diving depth for the same animals. Have them create graphs.
6. Discuss the animals' food intake. Note that the animal information cards list food intake as a percent of body weight. Choose one animal and have the students determine the range of amount of daily food intake. Why is giving a percent of body weight a better way to communicate this information than by giving a range?
7. Have students create pie charts depicting various animals' diets at SeaWorld.
8. Next, students gain experience making scale drawings. Have each learning group choose one animal from the Ocean Animals information cards and trace it onto graph paper. They will use their tracing to create an enlarged drawing in proportion to the size of the original. First, each group decides whether their new drawing will reflect a proportion of 2:1, 3:1, or 4:1. Help them plot key points on their graph paper and create their drawings. Ask students how they would plan to construct a life-size scale drawing of their animal.

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Ocean Animals

When we describe ocean animals we often use numbers; numbers describe how big an animal is, how fast it swims, or how much it eats. Numbers can also describe an animal's population or life span. These cards use numbers to describe several ocean animals.

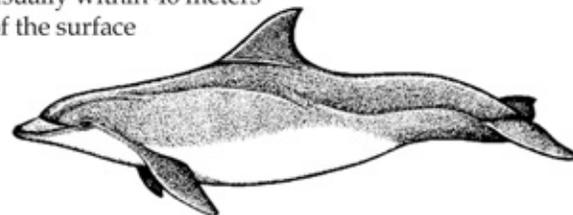
Some of the activities in this Teacher's Guide require the use of the information in these cards. Here are some other ideas for ways to use these cards in your classroom:

- Use the facts on the cards to help you prepare lessons and lead discussions in class.
- Copy and cut apart the cards. Distribute a different card to each cooperative learning group or to each student. Visit the school library to learn more about the animals.
- Encourage students to use the information on these cards to develop their own story problems to share with their classmates.

bottlenose dolphin

Tursiops truncatus

adult size:	2.5 to 3.7 meters and 190 to 454 kilograms, females slightly smaller than males
food intake:	4% to 6% of body weight per day
typical diet at SeaWorld:	60% smelt, 20% herring, 15% squid, 5% mackerel
typical life span:	20 to 30 years
population:	unknown, not endangered
swimming speed:	usually 5 to 11 kilometers per hour, as fast as 35 kilometers per hour
diving depth:	usually within 46 meters of the surface



killer whale

Orcinus orca

adult size:	males 5.8 to 6.7 meters and 3,628 to 5,442 kilograms, females 4.9 to 5.8 meters and 1,361 to 3,628 kilograms
food intake:	about 3% to 4% of body weight per day
typical diet at SeaWorld:	50% herring, 30% smelt, 10% squid, 10% mackerel
typical life span:	probably 25 to 35 years
population:	unknown, not endangered
swimming speed:	usually 3 to 10 kilometers per hour, but as fast as 48 kilometers per hour
diving depth:	usually within 60 meters of the surface



blue whale

Balaenoptera musculus

adult size:	about 21 meters and 64,000 kilograms
food intake:	about 4% of body weight per day during a feeding season that lasts about 120 days
typical life span:	possibly 30 to 90 years
population:	about 11,000
swimming speed:	to 18 to 22 kilometers per hour
diving depth:	unknown



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California sea lion

Zalophus californianus

adult size: males 2.25 meters and 200 to 400 kilograms, females 1.5 to 2 meters and 50 to 110 kilograms

food intake: about 5% to 8% of body weight per day

typical diet at SeaWorld: 40% herring, 20% mackerel, 20% smelt, 20% squid

typical life span: 15 to 25 years

population: about 200,000

swimming speed: as fast as 19 kilometers per hour, usually slower

diving depth: usually within 74 meters of the surface



Pacific walrus

Odobenus rosmarus divergens

adult size: males 2.7 to 3.6 meters and 800 to 1,700 kilograms, females 2.3 to 3.1 meters and 400 to 1,250 kilograms

food intake: 4% to 6% of body weight per day

typical diet at SeaWorld: 45% herring, 15% clams, 15% capelin, 10% mackerel, 10% sardines, 5% squid

typical life span: about 16 to 30 years

population: about 200,000

swimming speed: usually about 7 kilometers per hour, as fast as 35 kilometers per hour in short bursts

diving depth: usually within 80 meters of the surface



Florida manatee

Trichechus manatus latirostris

adult size: about 3 meters and 363 to 544 kilograms (Females are usually larger than males.)

food intake: 4% to 9% of body weight per day

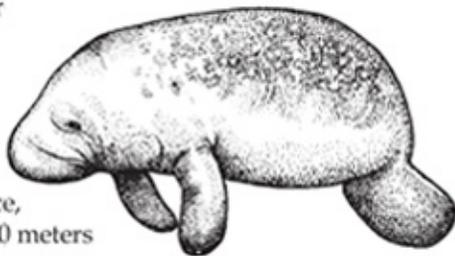
typical diet at SeaWorld: 61% romaine lettuce, 21% other types of lettuce, 10% spinach, 7% cabbage, 1% carrots and apples

typical life span: probably 50 to 60 years

population: probably less than 3,000

swimming speed: usually 3 to 10 kilometers per hour, as fast as 24 kilometers per hour in short bursts

diving depth: usually within 3 meters of the surface, as deep as 10 meters



California sea otter

Enhydra lutris nereis

adult size: males about 1.5 meters and 29 kilograms, females about 1.2 meters and 20 kilograms

food intake: 20% to 30% of body weight per day

typical diet at SeaWorld: 55% clams, 30% shrimp, 10% crab, 5% sea urchins

typical life span: about 15 to 20 years

population: probably less than 2,000

swimming speed: about 9 kilometers per hour under water and 12.5 kilometers per hour at the surface

diving depth: usually within about 20 meters of the surface



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emperor penguin

Aptenodytes forsteri

adult size: about 1.1 meter and 27 to 41 kilograms
food intake: on average, about 4% of body weight per day
typical diet at SeaWorld: 80% herring, 20% capelin
typical life span: about 15 to 20 years
population: about 436,200 mature adults
swimming speed: usually 10 kilometers per hour or less
diving depth: mostly within 21 meters of the surface, as deep as 534 meters



polar bear

Ursus maritimus

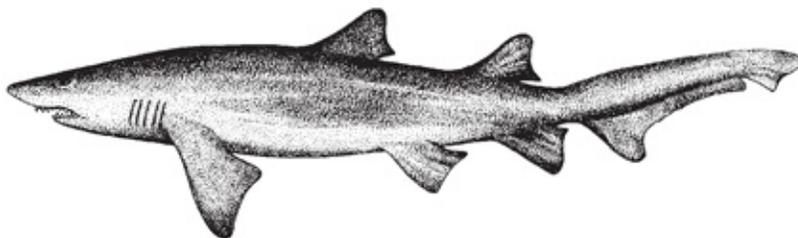
adult size: males 2.5 to 3 meters and 350 to 650 kilograms, females 2.0 to 2.5 meters and 150 to 250 kilograms
food intake: about 2% of body weight per day
typical diet at SeaWorld: 30% polar bear biscuits, 25% meat, 20% capelin, 15% herring, 10% fruits and vegetables
typical life span: probably 15 to 30 years
population: 21,000 to 28,000
swimming speed: as fast as 10 kilometers per hour, usually slower
diving depth: usually within 4.5 meters of the surface



sandtiger shark

Carcharias taurus

adult size: 2.2 to 3.2 meters and about 140 kilograms
food intake: 1% to 10% of body weight per week
typical diet at SeaWorld: 50% blue runner, 40% mackerel, 10% squid
typical life span: unknown
population: unknown
swimming speed: unknown
average depth: to 191 meters



leatherback sea turtle

Dermochelys coriacea

adult size: 1.2 to 1.9 meters and 200 to 506 kilograms (the largest of the sea turtles)
food intake: unknown
typical life span: possibly to 80 years
population: less than 115,000 females (Only mature females are counted, when they come ashore to lay eggs.)
swimming speed: 1.5 to 9.3 kilometers per hour
diving depth: 305 meters in routine dives, as deep as 1,190 meters

