Grade Level: 6-8
Time Estimate: 3-5 days

PERCENTAGES / INSTRUCTOR INFO

Summary

This lesson includes vocabulary, content, and problem solving activities to help students learn about fractions and percentages. Students will learn how to use fractions and calculate percentages using real OCEARCH™ data.

Part 1. Fractions and Factors
Part 2. Percentages
Part 3. Review

Goals & Objectives

The students will:

- learn how to write fractions;
- learn how to convert decimals and fractions to percentages;
- discover different uses for percentages;
- calculate percentages using real OCEARCH data.

// STANDARDS

This lesson aligns with the following Common Core Math Standards:
Grade 6: RP.A.3c, NS.B.3, NS.B.4
Grade 7: NS.A.3, EE.A.2

This lesson aligns with the following TEKS:
Grade 6 Science: 2A, 2C, 2D, 2E, 3A, 4A
Grade 7 Science: 2A, 2C, 2D, 2E, 3A, 4A
Grade 8 Science: 2A, 2C, 2D, 2E, 3A, 4A
Grade 6 Math: 1B, 1C, 1E, 1F, 2A, 2B, 2C, 2D, 3B, 11A, 11B, 11C, 11D, 12A, 12B, 13A, 13B
Grade 6 Math (Revised): 1A, 1B, 1C, 1D, 1E, 1F, 1G, 3D, 3E, 4G, 5B, 5C
Grade 7 Math: 1B, 2A, 2B, 2G, 3A, 13A, 13B, 13C, 13D, 14A, 14B, 15A, 15B
Grade 7 Math (Revised): 1A, 1B, 1C, 1D, 1E, 1F, 1G, 2, 3A, 3B, 4D
Grade 8 Math: 1A, 2C, 14A, 14B, 14C, 14D, 15A, 15B, 16A, 16B
Grade 8 Math (Revised): 1A, 1B, 1C, 1D, 1E, 1F, 1G

Helpful Tips

1) The content in this lesson is based on the conservation work of OCEARCH™ and the Global Shark Tracker™. Spend a few minutes getting familiar with the website and the tracker if you have not done so already. The Global Shark Tracker™ is also available as an app for iPhone and Android.
2) This lesson plan is designed to be adaptable to suit your specific needs. Use the entire lesson plan or just parts of it. This material can be expanded to be an entire unit or condensed for just one day in the classroom.
3) Vocabulary words will be underlined as they first appear in the lesson plan. A complete list of vocabulary words is included as well.
4) Answers to questions and prompts for discussions will appear in *italics*.
5) Optional activities and content (side notes) will appear in a box. Use these to enhance your lesson and adapt it to suit your needs!
6) Have questions for OCEARCH Expedition Leader, Chris Fischer? Email info@OCEARCH.org to schedule a Skype session and let your students/child talk directly to Chris and the OCEARCH crew!
7) Email all questions about this lesson to info@OCEARCH.org.

Vocabulary

Denominator – Bottom number of fraction; how many parts of the numerator it takes to equal a unit or whole; cannot be zero.
Factors – Numbers that when multiplied together produce a product.

Fraction – Number usually expressed in the form $\frac{a}{b}$ Number or ratio that describes part of a whole number. A fraction is not a whole number, but is composed of two parts: numerator and denominator.
Greatest Common Factor – Used to simplify fractions; the largest positive number that divides two or more numbers without a remainder. For example, the greatest common factor of 8 and 12 is 4.
Numerator – Top number of the fraction; represents a number of equal parts.
Percentage – A rate or proportion per hundred; denoted as %.
Ratios – Relationship between two numbers. A ratio describes how much of one thing there is compared to another thing, or how two numbers compare.

Vocabulary Game (15 – 30 minutes)

Try this fun game to practice and review vocabulary words!

Materials – For this game, students should make vocabulary cards with index cards or cut up paper. Write the word on one side and the definition on the other.

Select one student volunteer to be the game host then divide the rest of the students into two teams. Give the list of vocabulary words and definitions to the host for reference. Have every student spread out his/her cards on their desk word side up. The host announces the definition of one of the words and the students race to pick up the word that matches that definition. The first team with all students holding up the correct word wins a point! It is certainly fair for teammates to help each other out. Tell students to place each card word side down after it has been announced. Once all words have been announced, reverse the procedure and announce the word and students pick up the definition. For an added twist, make a rule where the teams play silently!

Grade Level: 6-8

Time Estimate: 5-15 mins

PERCENTAGES / PRE-LESSON ASSESSMENT

Use the following true/false and multiple choice questions as an introduction/warm-up to the lesson topics. You can do this in a verbal or written format, as a game, individually, or as a whole class! A handout is provided if you wish to hand the questions out in a quiz format.

The questions do not need to be graded. They are intended to give the students an idea of what they will be learning and to see what they already know.

1) True or False A fraction is a whole number.
Answer: *False*

2) True or False Percentage is a rate or proportion per hundred.
Answer: *True*

3) True or False The numerator is the bottom number of a fraction.
Answer: *False*

4) 3 out of 5 sharks are migrating north. What is the percentage of sharks migrating north?

a. 60%
b. 55%
c. 45%
d. 30%

Answer: *a*

5) Convert 0.65 to a percent.

a. 45%
b. 46%
c. 55%
d. 65%

Answer: *d*

Student handout on next page.

Name: _____ Date: _____

Percentages

Select the correct answer(s) to each of the following questions.

1) True or False A fraction is a whole number.

2) True or False Percentage is a rate or proportion per hundred.

3) True or False The numerator is the bottom number of a fraction.

4) 3 out of 5 sharks are migrating north. What is the percentage of sharks migrating north?

a. 60%

b. 55%

c. 45%

d. 30%

5) Convert 0.65 to a percent.

a. 45%

b. 46%

c. 55%

d. 65%

Grade Level: 6-8

PERCENTAGES / LESSON PLAN

INTRODUCTION **3-5 mins**

Researchers use percentages to explain data, which can often be complex. A percentage can give meaning to a number that otherwise might not have made much sense. For example, out of 500,000 people, 250,000 prefer oranges to apples. More simply put, out of 500,000 people, 50% prefer oranges to apples. Percentages can be calculated using fractions. So to start, students need a basic understanding of fractions and decimals.

Part 1. Fractions and Factors (15 – 20 minutes)

A fraction is a number or ratio that describes part of a whole number. A fraction is not a whole number and is composed of two parts: the numerator and the denominator. The numerator, or top number of the fraction, represents a number of equal parts, and the denominator, or bottom number, indicates how many of those parts make up a unit or a whole. Below are examples of fractions:

$$\frac{3}{5} \qquad \frac{5}{8} \qquad \frac{6}{9}$$

Example 1.1

Three out of ten great white sharks were recorded traveling back to Cape Cod, Massachusetts. How do you record this as a fraction?

Answer: $\frac{3}{10}$

3 is the number of specific sharks traveling to Cape Cod, and 10 is the total number of sharks in the group.

Factors are the numbers that when multiplied together produce a product. For example if you multiply 3 and 6, you get 18. The numbers 3 and 6 are factors of 18.

A single number can have many factors. For example, factors of 6 are: 1, 2, 3, and 6.
This is because:

1 x 6 = 6

Example 1.2.

2 x 3 = 6

What are the factors of 10?

Answer: *Factors of 10 are 1, 2, 5, and 10.*

1 x 10 = 10

2 x 5 = 10

Some fractions can be simplified, or reduced to the lowest terms, by dividing both the numerator and denominator by the greatest common factor. The greatest common factor is the largest positive number that divides two or more numbers without a remainder. For example, the greatest common factor of 8 and 12 is 4.

Example 1.3.

Reduce this fraction: $\frac{3}{6}$

This fraction can be reduced by dividing the numerator and denominator by 3 since 3 is the greatest common factor of the numbers 3 and 6. How do we know that?

Factors of 3: 1, 3

1 x 3 = 3 ◯

Factors of 6: 1, 2, 3, 6

1 x 6 = 6
2 x 3 = 6 ◯

Therefore, the greatest common factor of both 3 and 6 is 3!

Now divide both the numerator and denominator of $\frac{3}{6}$ by the greatest common factor, 3, to finish reducing the fraction.

$$\frac{3 \div 3}{6 \div 3} = \frac{1}{2}$$

Therefore, the answer is $\frac{1}{2}$!

Example 1.4. Reduce these fractions.

1) $\frac{4}{12} = \frac{1}{3}$ 2) $\frac{8}{16} = \frac{1}{2}$ 3) $\frac{75}{100} = \frac{3}{4}$ 4) $\frac{10}{15} = \frac{2}{3}$ 5) $\frac{21}{70} = \frac{3}{10}$

Part 2. Percentages (30 minutes)

A percentage is a rate or proportion per hundred and is denoted using the "percent sign" %. A percentage is typically a fraction of 100, but can represent any whole number. You can easily convert a fraction or decimal to a percentage and vice versa.

How do you convert decimals to percentages?

To convert a decimal to a percentage is quite easy! Because a percentage is fraction of 100, simply multiply the decimal by 100.

Example 2.1

Convert 0.48 to a percentage.

Answer: 0.48 x 100 = *48%*

Example 2.2
Convert the following decimals to percentages.

1) 0.19 = *19%* 2) 0.63 = *63%* 3) 0.5 = *50%* 4) 0.99 = *99%* 5) 0.7 = *70%*

How do you convert fractions to percentages?

To convert a fraction to a percentage, you must first divide the numerator by the denominator to get a decimal. Next, multiply the decimal by 100 to get a percentage.

Example 2.3

Convert this fraction to a percent: $\frac{3}{8}$

Answer: $3 \div 8 = 0.375$

$0.375 \times 100 = 37.5\%$

Example 2.4
Convert the following fractions to percentages.

1) $\frac{6}{8} = 75\%$ 2) $\frac{5}{10} = 50\%$ 3) $\frac{1}{3} = 33\%$ 4) $\frac{6}{16} = 37.5\%$ 5) $\frac{43}{50} = 86\%$

How do you convert a percentage back to a fraction?

Write the percentage as a fraction with 100 in the denominator. Then simplify the fraction using what you learned about greatest common factors.

Example 2.5
Convert 42% to a fraction.

Answer: $\frac{42 \div 2}{100 \div 2} = \frac{21}{50}$

Can you convert this fraction back to a percentage?

Answer: $\frac{21}{50} = 0.42$

$0.42 \times 100 = 42\%$

Example 2.6
Convert the following percentages to fractions.

1) $11\% = \frac{11}{100}$ 2) $26\% = \frac{13}{50}$ 3) $88\% = \frac{22}{25}$ 4) $2\% = \frac{1}{50}$ 5) $25\% = \frac{1}{4}$

What are the real life uses of percentages?

Do researchers actually use percentages and fractions in real life? The answer is yes! For example, OCEARCH researchers use both percentages and fractions to show the ratio of sharks that have reported in on the Global Shark Tracker versus sharks that have not reported in every week (Figure 1).

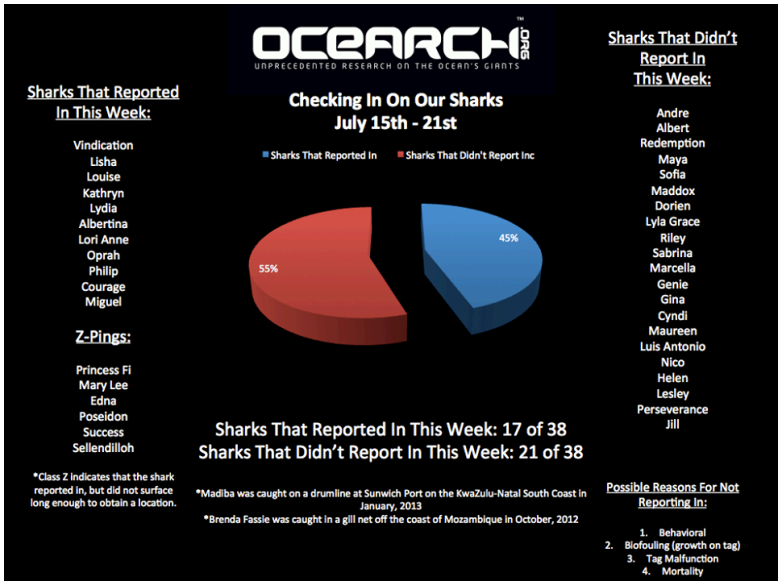

Figure 1. Pie chart showing sharks that reported in vs. sharks that did not report in over the span of a week.

Example 2.7

OCEARCH scientists had tagged a total of 38 great white sharks at the time this graph was made. During the week of July 15, 2013 through July 21, 2013, 17 out of the 38 tagged sharks reported in (Figure 1). How would you write this in fraction form?

Answer: $\frac{17}{38}$

$\frac{17}{38}$ *sharks reported in for the week.*

What percentage of sharks reported in for the week?

Answer: $\frac{17}{38} = 0.447$

$0.447 \times 100 =$ *44.7%*

44.7% of tagged sharks reported in during the week of July 15, 2013 through July 21, 2013.

Example 2.8

During the same week, 21 out of 38 sharks tagged did not report in (Figure 1). How would you write this in fraction form?

Answer: $\frac{21}{38}$

$\frac{21}{38}$ *sharks did not report in for the week.*

What percentage of sharks did not report in for the week?

Answer: $\frac{21}{38} = 0.55$

$0.55 \times 100 =$ *55%*

55% of tagged sharks did not report in.

Because percentage is a fraction of 100, the total percent of sharks that reported in versus did not report in must equal 100%.

$45\% + 55\% = 100\%$

Example 2.9

Out of the 17 sharks that reported in, 6 of them z-pinged (did not surface long enough to obtain a location). How would you write this in fraction form?

Answer: $\frac{6}{17}$

$\frac{6}{17}$ *sharks reported in via z-ping.*

What percentage of sharks reporting in did so via z-ping?

Answer: $\frac{6}{17} = 0.35$

0.35 x 100 = *35%*

35% of sharks reporting in z-pinged.

What percentage of sharks reporting in did so normally (no z-pinged)?

Answer: 100% - 35% = *65%*

Part 3. Review (10 minutes)

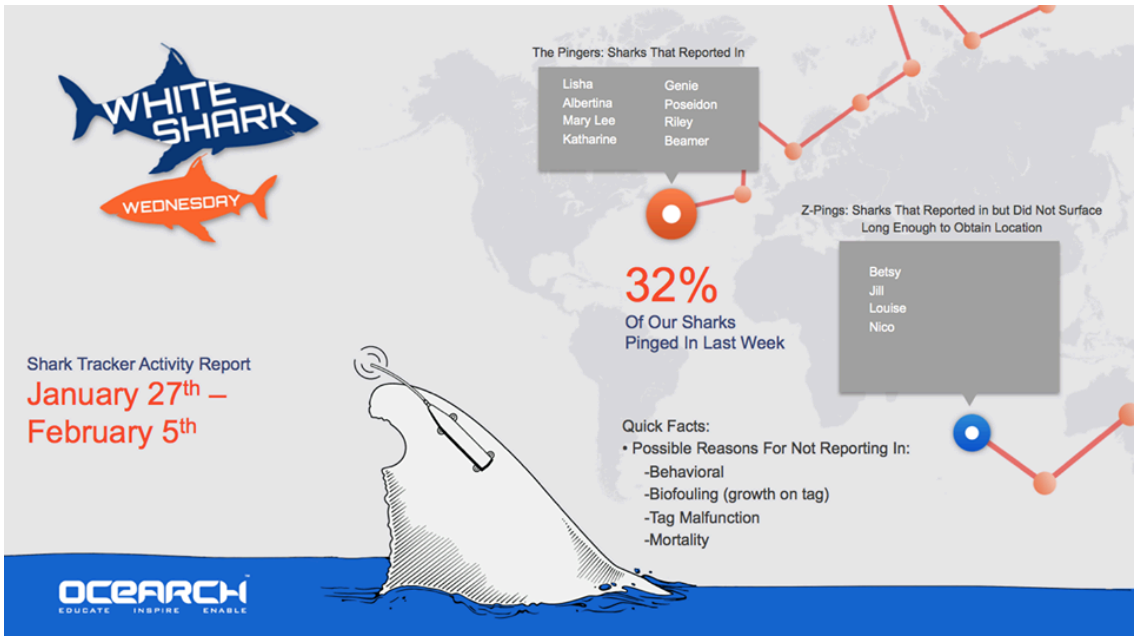

Figure 2. A White Shark Wednesday post showing sharks that have reported in over one week.

Example 3.1

Use Figure 2 and your knowledge of fractions and percentages to answer the following:

1. What percentage of sharks did not ping in?

68% of sharks did not ping in.

2. Of the sharks that reported in, what fraction of them z-pinged?

$\frac{1}{3}$ *of sharks reporting in z-pinged.*

3. Write the fraction of sharks that z-pinged as a percentage.

33% of sharks reporting in z-pinged.

4. What can scientists learn from using fractions and percentages?

5. When would you use fractions and percentages in everyday life?

Percentages

ACTIVITY 1. Practice Problems

(45 minutes – 60 minutes or take home)

Students should solve the following practice problems. Student worksheet provided below.

1. If a 910 kg great white shark eats 30 kg of food in a single feeding, it does not have to eat for another 2 weeks. What percentage of her body weight could sustain her for 2 weeks?

Answer: $\frac{30\ kg}{910\ kg}$ = 0.033

0.033 x 100 = *3.33%*

2. Great white sharks have body temperatures slightly above that of the surrounding water. The stomach of great white sharks is generally between 7-14°C (13-25°F) above water temperature to help the shark digest food more rapidly. However, the stomach temperature immediately drops after feeding. If 25 of out the 38 sharks tagged had stomach temperatures below 7°C (13°F), what percent of sharks recently fed?

Answer: $\frac{25}{38}$ x 100 = *65.8%*

3. A shark's liver is extremely large and makes up 25% of the animal's total body weight. If a great white shark weighs 600 kg, how much does the liver weigh?

Answer: 600 kg x 0.25 = *150 kg*

4. Sharks can consume on average 3% of its body weight in food per day. If a great white shark weighs 980 kg, how much food should it eat in one day?

Answer: 980 x 0.03 = *29.4 kg*

5. Assume a shark consumes 5% of its body weight in one week. If a great white shark consumes 65% seal, 33% tuna, and 2% mackerel, how many kilograms of each food type did the shark eat during the week? Assume the shark weighs 1,150 kg.

Answer:
You must first figure out how many kilograms total the shark consumes in one week:

$$1150 \text{ kg} \times 0.05 = 57.5 \text{ kg}.$$

Now, figure out how many kg of each prey type the shark consumed from the total consumed.

Seal:
65% = 65 ÷ 100 = 0.65
57.5 kg x 0.65 = 37.38 kg

Tuna:
33% = 33 ÷ 100 = 0.33
57.5 x 0.33 = 18.98 kg

Mackeral:
2% = 2 ÷ 100 = 0.02
57.5 x 0.02 = 1.15 kg

Total = 37.375 kg + 18.975 kg + 1.15 kg = *57.5 kg*

6. If a great white shark weighs 1,264 kg and eats a fur seal in South Africa that weighs 300 kg, what percent of its body weight did it eat?

Answer: $\frac{300}{1{,}264} = 0.237 \times 100 =$ *23.7%*

8. Stomachs are naturally acidic, with a pH ranging between 1.5 and 2.5. An increase in pH is a sign the shark has recently fed. This is due to the amount of seawater the shark swallows along with its prey which dilutes the stomach acid. If 8 out of 38 great white sharks tagged had stomach pH of 8.0, what percentage of sharks recently fed?

Answer: $\frac{8}{38}$ x 100 = *21%*

Activity 1. Practice Problems

Name: _____

Date: _____

Instructions

Use your new found knowledge of fractions, decimals, and percentages to calculate the answers to the following word problems.

1. If a 910 kg great white shark eats 30 kg of food in a single feeding, it does not have to eat for another 2 weeks. What percentage of her body weight could sustain her for 2 weeks?

2. Great white sharks have body temperatures slightly above that of the surrounding water. The stomach of great white sharks is generally between 7-14°C (13-25°F) above water temperature to help the shark digest food more rapidly. However, the stomach temperature immediately drops after feeding. If 25 of out the 38 sharks tagged had stomach temperatures below 7°C (13°F), what percent of sharks recently fed?

3. A shark's liver is extremely large and makes up 25% of the animal's total body weight. If a great white shark weighs 600 kg, how much does the liver weigh?

4. Sharks can consume on average 3% of its body weight in food per day. If a great white shark weighs 980 kg, how much

5. Assume a shark consumes 5% of its body weight in one week. If a great white shark consumes 65% seal, 33% tuna, and 2% mackerel, how many kilograms of each food type did the shark eat during the week? Assume the shark weighs 1,150 kg.

6. If a great white shark weighs 1,264 kg and eats a Cape fur seal in South Africa that weighs 300 kg, what percent of its body weight did it eat?

8. Stomachs are naturally acidic, with a pH ranging between 1.5 and 2.5. An increase in pH is a sign the shark has recently fed. This is due to the amount of seawater the shark swallows along with its prey which dilutes the stomach acid. If 8 out of 38 great white sharks tagged had stomach pH of 8.0, what percentage of sharks recently fed?

Percentages

ACTIVITY 2. Percentages in Real Science

(30 – 45 minutes or take home)

Introduction

Students will learn how to calculate percentages using the Global Shark Tracker™ at http://www.ocearch.org. Students will calculate the percent of males vs. females tagged, mature vs. immature tagged, the percent of sharks that surfaced in the last 72 hours, and the percent of great white sharks tagged along the coast of the United States vs. Africa. With this data, the students will then draw conclusions about the life of a great white shark.

*The Global Shark Tracker shows several different species of sharks. Only use data for great white sharks.

Note: New sharks are being tagged all the time. Therefore, the total number of sharks will continuously change. Also, make note that a number of the tagged great white sharks are now deceased from various causes. Make sure to have the students subtract out these sharks as they do the assignment. The information is provided in each of the sharks' profiles. Students should collect the data on their own.

Materials

- Computer with internet connection
- Writing utensil
- Calculator
- Worksheet (provided below)

Instructions

1. Visit the OCEARCH website at http://www.ocearch.org. This will take you to the Global Shark Tracker™. Here, you will be able to see where the sharks are in near-real time and filter sharks by name, gender, stage of life, etc. Play around with the tracker to familiarize yourself with how it works.
2. The orange and blue dots are where the sharks have "pinged in" – meaning their dorsal fins broke the surface of the water long enough for its location to be transmitted to a nearby satellite.
    - **Orange** means the shark pinged less than 30 days ago.
    - **Blue** means the shark pinged more than 30 days ago.
3. Only use tagged great white sharks for this assignment. By clicking on the pings you see basic see information on the shark. "View More" will pull up the sharks profile and allow you to determine the species. Remember some of the sharks are deceased. The information for the deceased sharks is provided in their profiles, so remember to look for them and subtract them from your data as needed.

4. Using tallies in the table below (or you can make your own), go through each individual shark profile and record whether it is male or female, mature of immature, if it pinged in the last 72 hours, and if it was tagged in the United States or South Africa. *Tip: Record the names of the sharks you collect data for on a scrap piece of paper. That way you can eliminate those who are deceased and be able to keep track of how many sharks are in your data set.*
5. Complete the table by adding the totals for each category and then calculating the percentage of sharks in each category out of the total number of sharks in the data set.

Example

NOTE: These answers will change over time because data is being collected in real-time.

Date: July 2013	**Number of Sharks**	**Percentage**
Total Number of Great White Sharks Tagged	38	100%
Males	12	31.6%
Females	26	68.4%
Immature	25	65.8%
Mature	13	34.2%
Pinged in last 72 hours	7	18.4%
Sharks tagged along east coast of United States	6	15.8%
Sharks tagged along coast of Africa	32	84.2%

Double check your answers! Numbers should equal the total number of sharks in your data set.

Males vs. Females: 12 + 26 = 38
Immature vs. Mature: 25 + 13 = 38
Sharks tagged in United States waters vs. African waters: 6 + 32 = 38

Double check your percentages. Percentages should equal 100%.

Males vs. Females: 31.6 + 68.4 = 100%

Immature vs. Mature: 65.8 + 34.2 = 100%
Sharks tagged in United States waters vs. African waters: 15.8 + 84.2 = 100%

Discussion

What inferences can you make with your data?

For example, are there more females or males? Are most of the sharks mature of immature? What percentage of the sharks have pinged in the last 72 hours? Why do you think this might be? *There is no wrong answer! The lives of great white sharks are a mystery to humans. OCEARCH scientists are asking these very same questions.*

Activity 2. Shark Percentages

Name: _____

Date: _____

Introduction

Sharks are apex predators (animals who, as adults, have no natural predators in their ecosystem) and therefore play a crucial role in maintaining balance in the ocean's ecosystems.
The scientists working with OCEARCH have made significant leaps forward in understanding shark movements in the ocean. The OCEARCH Global Shark Tracker allows YOU to observe the navigational pattern of sharks that have been tagged with satellite tracking technology all for the purpose of shark conservation!
The sharks are tagged with a SPOT (Smart Position and Temperature Tag) tag, which is attached to the dorsal fin (the fin on the shark's back). A tagged shark "pings" in when the shark's dorsal fin breaks the surface and there is a satellite overhead. The longer the shark's fin is above water, the more accurate the ping is.
Your job is to collect data from the Global Shark Tracker and use it to calculate percentages. What you find may help you understand the mystery of the great white shark.

Instructions

1. Visit the OCEARCH website at http://www.ocearch.org. This will take you to the Global Shark Tracker™. Here, you will be able to see where the sharks are in near-real time and filter sharks by name, gender, stage of life, etc. Play around with the tracker to familiarize yourself with how it works.
2. The orange and blue dots on the map are where the sharks have "pinged" in.
    - **Orange** means the shark pinged within the last 72 hours.
    - **Blue** means the shark pinged more than 30 days ago.
3. OCEARCH currently tags several different species of sharks: great whites, bull, mako, and blue. Only use great white sharks for this assignment and remember some of the sharks are deceased (they were caught in a gill net and are no longer alive). The information for the deceased sharks is provided in their profiles, so remember to look for them and subtract them from your data as needed.
4. Using tallies in the table below (or you can make your own), go through each individual shark profile and record whether it is male or female, mature of immature, if it pinged in the last 72 hours, and if it was tagged in the United States or South Africa. *Tip: Record the names of the sharks you collect data for on a scrap piece of paper. That way you can eliminate those who are deceased and be able to keep track of how many sharks are in your data set.*
5. Complete the following table by adding the totals for each category and then calculating the percentage of sharks in each category out of the total number of sharks in the data set.

Activity 2. Shark Percentages

Name: _____

Date: _____

Date:	**Number of Sharks**	**Percentage**
Total Number of Great White Sharks Tagged		
Males		
Females		
Immature		
Mature		
Pinged in last 72 hours		
Sharks tagged along east coast of United States		
Sharks tagged along coast of Africa		

6. Double check your answers! Numbers should equal the total number of sharks in your data set.

Males vs. Females: _____ + _____ = _____

Immature vs. Mature: _____ + _____ = _____

Sharks tagged in United States waters vs. African waters: _____ + _____ = _____

7. Double check your percentages. Percentages should equal 100%.

Males vs. Females: _____ + _____ = 100%

Immature vs. Mature: _____ + _____ = 100%

Sharks tagged in United States waters vs. African waters: _____ + _____ = 100%

Activity 2. Shark Percentages

Name: _____

Date: _____

Conclusion Questions

Remember, when you are explaining your findings there is no wrong answer! The lives of great white sharks are a mystery to humans. OCEARCH scientists are asking these very same questions for the same reasons.

1. Are there more female or male sharks in your data set? Why might this be?

2. Are most of the sharks mature or immature? Why might this be?

3. What percentage of sharks have pinged in the last 72 hours? Why might this be?

4. Are there more sharks tagged in the United States or South Africa? Why might this be?