SCIENCE·3D

SHARKS!

In this packet, sample student answers are provided in red and notes to teachers are in blue.

In this **Science Mission**, students will use data to explore how changes in temperature influence the amount of energy and food that sharks need. Then, they will count sharks from drone imagery to determine how shark migrations might be influenced by water temperature and the energy that sharks need. Finally, they will use this understanding to predict how sharks might be influenced by changes in their environment.

Activity 1: Energy and Temperature

The data collected in the table below is from sharks swimming in a tank. For these sharks, scientists measured how fast they were swimming and how much energy they were using. We can measure shark energy by measuring their oxygen use. The more oxygen they use, the more energy they use.

1. What body part in sharks collects oxygen from the water? Gills

2. What delivers the oxygen to the rest of the body? Blood

Table 1: Average amount of oxygen used in an hour by sharks swimming in a tank at two different temperatures

Shark number	Oxygen use at 21°C (70°F)	Oxygen use at 29°C (84°F)
1	150	290
2	140	300
3	125	325

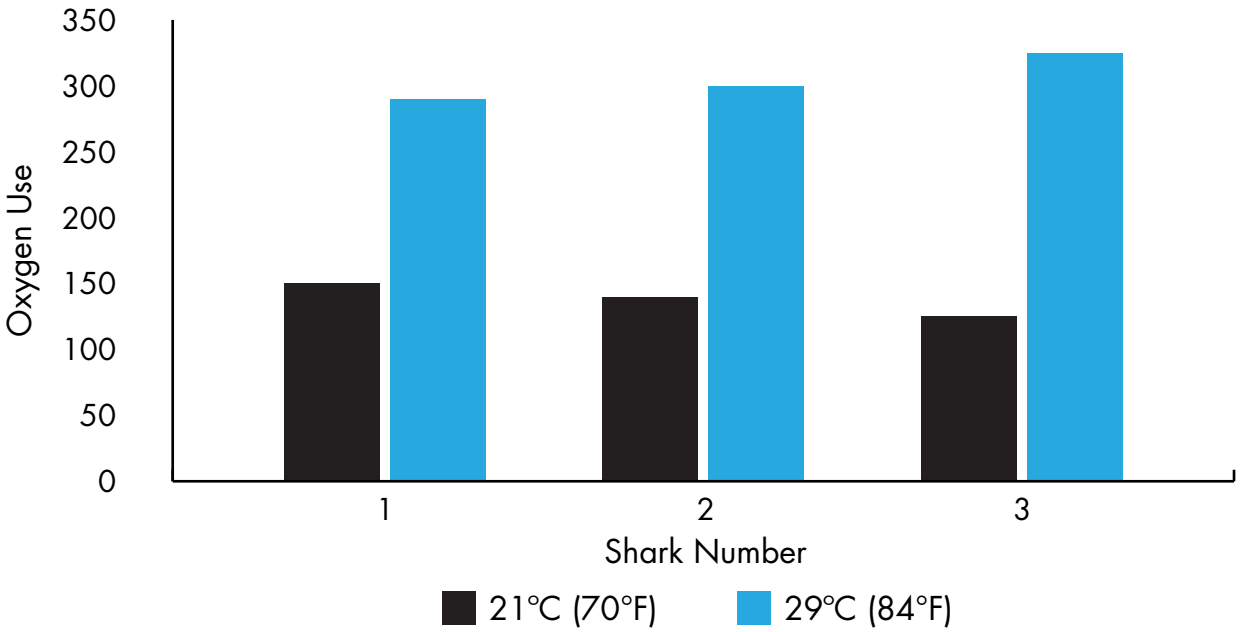


Figure 1. Oxygen used by three sharks when swimming at 21˚C and 29˚C

3. **Describe** how the amount of energy sharks use changes with temperature. Remember, the more oxygen they use, the more energy they use. Use Table 1 and Figure 1 to support your answer.

   Sharks use more energy at higher temperatures. All three sharks used a lot more energy at 29 degrees than at 21 degrees.

4. **Predict** what would happen to the amount of energy and prey sharks in the wild would need if water temperatures increased. Support your prediction with evidence from the data in Table 1 and Figure 1.

   I think sharks would need more energy if the temperatures went up. This is because sharks used more oxygen and energy when they were in warm waters in the experiment. The pattern should be the same in the wild. If sharks need more energy, they will need to eat more food to get that additional energy.

Activity 2: The Great Blacktip Migration

Animals migrate to find the right environmental conditions at the right times of year. They may need to move to new places if it gets too hot or too cold. They may have to move to find a safe place to have their offspring. They may have to move to find food.

What about blacktip sharks? When do they migrate? Does water temperature affect how many sharks are migrating? Use the data in the graph below to answer these questions.

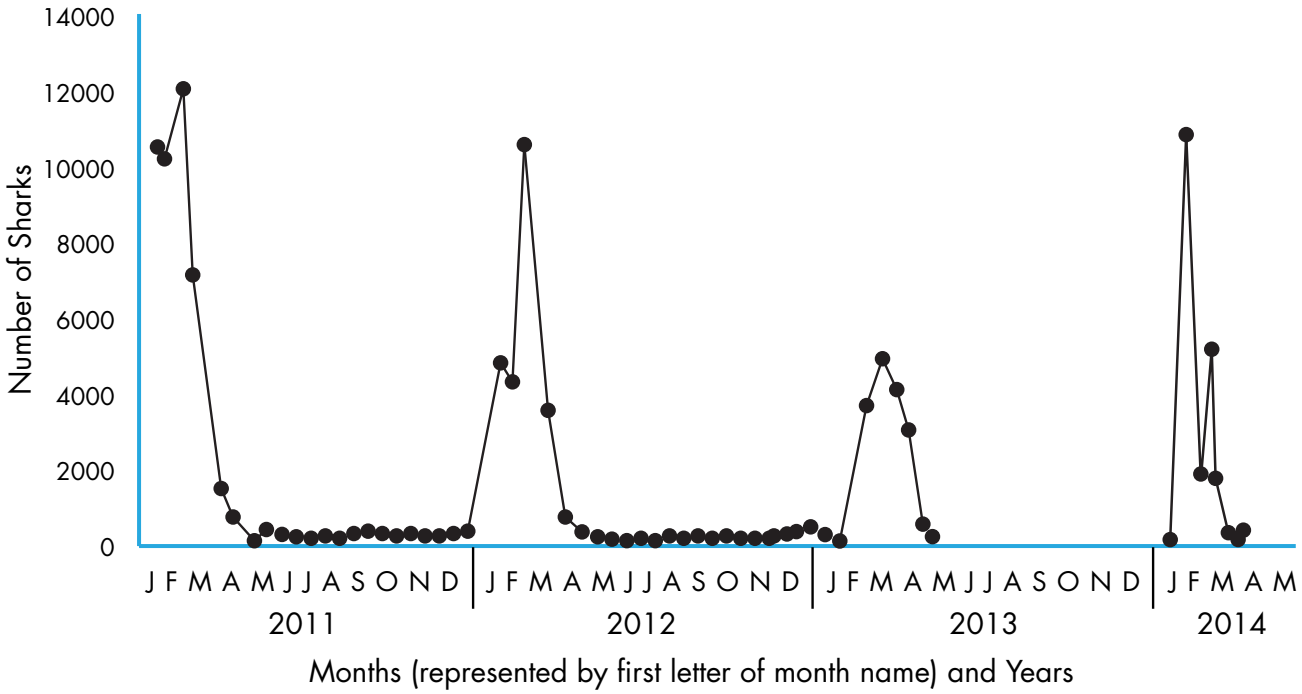


Figure 2. Number of blacktip sharks per month from 2011 - 2014

1. **Describe** how shark numbers change during the year off the coast of Palm Beach, Florida.

Shark numbers are low during most of the year. In February, March, and April there are many more sharks than in the other months.

2. **Compare** and **contrast** the patterns in the four years that were studied.

The basic patterns are the same with many sharks in February to April. Compared to other years, there were many less sharks in 2013, even at the peak.

3. How might you explain the patterns in shark numbers in the waters of Palm Beach? How would you test your idea?

Accept reasonable answers. Examples of how students might explain the patterns: The patterns are to avoid cold water up north or find warmer water to the south. Sharks move to avoid predators or find prey. They may move to find places to have their offspring. Examples of how students might test their ideas include: I would measure water temperature and compare this to the number of sharks. I would count the number of predators in areas where blacktip sharks are going and where they are leaving. I would find out when and where the sharks have babies. I would collect information on where sharks find their food.

Activity 3: Temperature and the Shark Migration

Could temperature influence the number of sharks in the waters of Palm Beach? Data from the shark counts and water temperature measurements can help us find out. On the next few pages are pictures taken from a drone. They do not show the entire migration, but rather one part of the population. That means we must multiply this number of sharks by the number of frames with the same count.

Each picture was taken at a different day with a different water temperature.

1. Count the number of sharks in each picture and record your counts in Table 2. To help with counting, consider making a mark on each shark after you count it.

2. Multiply the number you counted by the number in the column labeled "multiply by" to get an estimate for the number of migrating blacktip sharks. Enter this number in Table 2.

22°C (71°F) - 40 sharks in view

23°C (73°F) - 40 sharks in view

24°C (75°F) - 38 sharks in view

25°C (77°F) - 15 sharks in view

26°C (79°F) - 10 sharks in view

27°C (81°F) - 1 shark in view

28°C (82°F) - 2 sharks in view

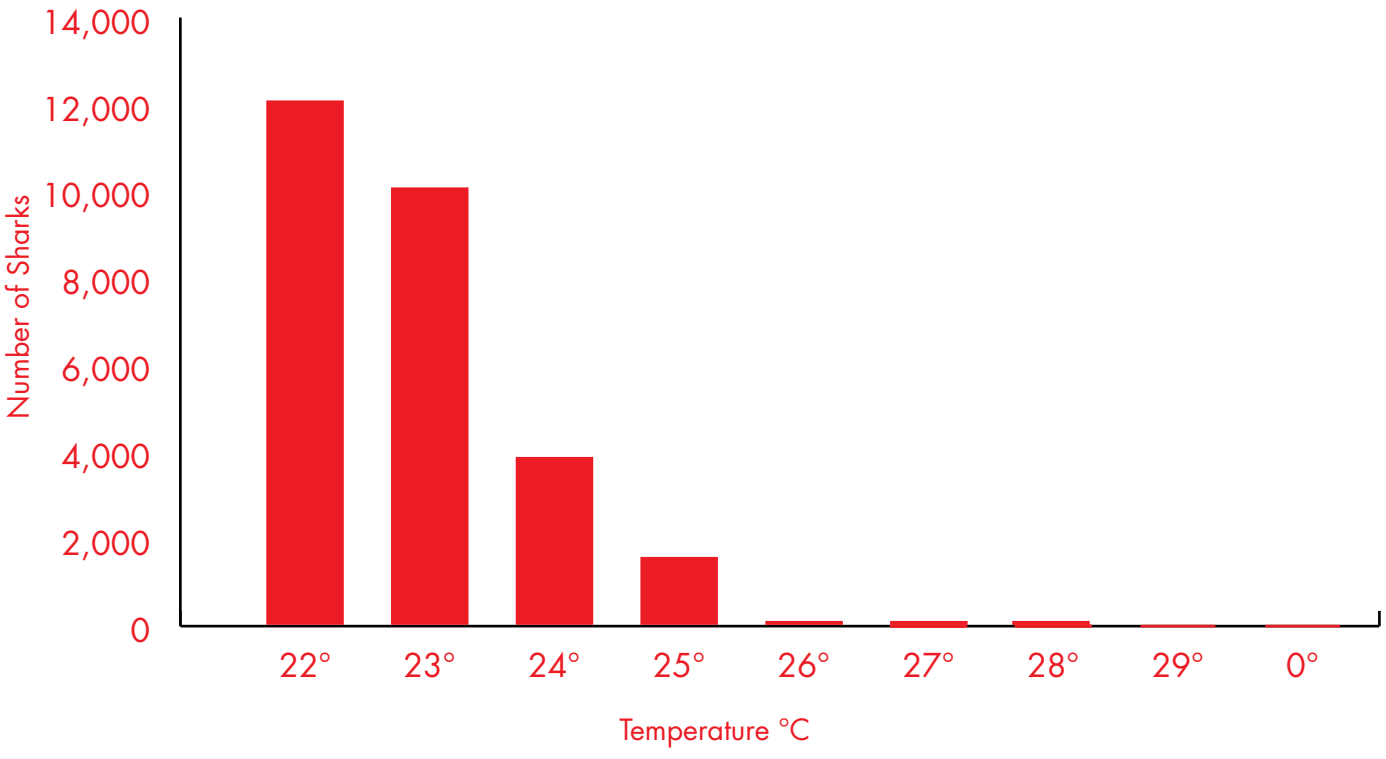
29°C (84°F) - 0 sharks in view

30°C (86°F) - 0 sharks in view

Table 2. Relationship between water temperature and shark counts during the migration

Temperature	Count	Multiply by	Estimated shark count
22°C (71°F)	40	300	12,000
23°C (73°F)	40	250	10,000
24°C (75°F)	38	100	3,800
25°C (77°F)	15	100	1,500
26°C (79°F)	10	1	10
27°C (81°F)	1	1	1
28°C (82°F)	2	1	2
29°C (84°F)	0	1	0
30°C (86°F)	0	1	0

3. **Create** a bar graph of the data in Table 2. Label the axes of your graph and include a title.



4. **Describe** the relationship between water temperature and the number of sharks observed.

   There are fewer sharks as the water temperature increases. (Negative relationship).

5. Do you think that water temperature influences shark numbers? Support your argument using the data in your graph.

   I think that temperature does influence the number of sharks. The greatest number of sharks are present when water temperatures are around 22 degrees. There are almost no sharks once the temperature is above 25 degrees. It is possible that students might say that they think another factor is more important, like prey or predators, but the data in the graph doesn't support this.