Lab 11: Animal Behavior: Why Do Great White Sharks Travel Over Long Distances?

Introduction

Shark populations worldwide are declining in areas where they were once common. As a result, the International Union for Conservation of Nature (IUCN), has classified many species of shark as threatened with extinction. One species of shark that is currently on the IUCN "Vulnerable" list is the great white shark (*Carcharodon carcharias*). The great white shark is found in coastal surface waters of all the major oceans. It can grow up to 6 m (20 ft.) in length and weigh nearly 2,268 kg (5,000 lb). The great white shark reaches sexual maturity at around 15 years of age and can live for over 30 years. Great white sharks are apex predators (see the figure to the right). An apex predator is an animal that, as an adult, has no natural predators in its ecosystem and resides at the top of the food chain. These sharks prey on marine mammals, fish, and seabirds.

A great white shark

Great white shark conservation has become a global priority in recent years. However, our limited understanding of their behavior has hindered the development of effective conservation strategies for this species. For example, little is known about where and when great white sharks mate, where they give birth, and where they spend their time as juveniles. We also know that some great white sharks travel long distances, such as from Baja California to Hawaii or from South Africa to Australia, but we do not know why they make these journeys. There are, however, a number of potential explanations that have been suggested by scientists. For example, great white sharks might travel long distances because they need to do one or more of the following:

- Find and establish a territory (an area that they defend that contains a mating site and sufficient food resources for them and their young) once they reach sexual maturity or after losing a territory to other great white sharks.
- Migrate between a foraging site and a mating site on an annual or seasonal basis.
- Forage for food—slowly traveling over long distances allows the sharks to find, capture, and consume new sources of food along the way without expending a great deal of energy.
- Find a foraging site with other sharks in it and cooperate with them to capture prey and minimize the amount of energy required to capture and consume food.
- Follow their prey as the prey migrates on an annual or seasonal basis.
- Move between several different foraging areas because they quickly deplete their food source in a given area and must move onto new foraging areas to survive.

All of these potential explanations are plausible because they can help a great white shark survive longer or reproduce more. It is difficult, however, to determine which of these potential explanations is the most valid or acceptable because we know so little about the life history and long-range movements of the great white shark. Most research on this species has been carried

out at specific aggregation sites (such as the one near Dyer Island in South Africa). Although this type of research has enabled scientists to learn a lot about the feeding behaviors and short-range movements of the great white shark, we know very little about how they act in other places. A group called OCEARCH (*www.ocearch.org*), however, is trying to facilitate more research on their life history and long-range movements so people can develop better conservation strategies to help protect the great white shark.

This group of researchers has been catching and tagging great white sharks to document where they go over time. To tag and track a great white shark, OCEARCH places a SPOT tag on the shark's dorsal fin. These tags emit a signal that is picked up by global positioning satellites. Unfortunately, the signal can only be detected when the shark's dorsal fin breaks the surface of the water and a satellite is directly overhead. Researchers at OCEARCH call these signals "pings." The time span between pings can vary a great deal (from once an hour to once in a three-week period) because of individual shark behavior and the orbit of a satellite. OCEARCH has created the Global Shark Tracker database (*www.ocearch.org*) to share the real-time data they collect (see the figure on the opposite page). This database allows users to see the current location of all the sharks that the OCEARCH researchers have tagged. It also allows users to track the movement of each shark over time. Users can also search for sharks by name, sex (male or female), and stage of life (mature or immature).

Your Task
Use the OCEARCH Global Shark Tracker database to identify patterns in the long-range movements of the great white shark, and then develop an explanation for those patterns. The guiding question of this investigation is: **Why do great white sharks travel over long distances?**

Materials
You will use an online database called Global Shark Tracker to conduct your investigation. You can access the database by going to the following website: *www.ocearch.org*.

Getting Started
Your first step in this investigation is to learn more about what is already known about the great white shark. To do this, check the following websites:

- Animal Diversity Web (*http://animaldiversity.ummz.umich.edu/accounts/Carcharodon_carcharias*)
- MarineBio (*http://marinebio.org/species.asp?id=38*)
- The Smithsonian National Museum of Natural History Ocean Portal (*http://ocean.si.edu/great-white-shark*)

You can then use the OCEARCH Global Shark Tracker database to identify patterns in the long-range movement of great white sharks. To accomplish this task, it is important for you to determine what type of data you will need to collect and how you will analyze it.
To determine *what type of data you will need to collect,* think about the following questions:

- What data will you need to determine if there are patterns in the long-range movements of great white sharks?
- What data will you need to determine if there are sex-related, age-related, or geographic region–related differences in the long-range movements of great white sharks?

To determine *how you will analyze your data,* think about the following questions:

- How can you identify a pattern in the ways great white sharks move over long distances?
- How can you determine if there are patterns in the way great white sharks move over long distances based on sex, age, or geographic region?
- What type of table or graph could you create to help make sense of your data?

Once you have identified patterns in the ways great white sharks move over long distances, you will then need to develop an explanation for those patterns. You can develop one of your own or see if one of the explanations outlined in the "Introduction" section of this investigation is consistent with the patterns you identified. These explanations stem from what scientists know about the behavior of other animals and reflect some of the theories that scientists currently use to explain animal behavior.

Report

Once you have completed your research, you will need to prepare an investigation report that consists of four sections (be sure to have section headings):

1. Introduction: Give some background information on the topic. Explain what question were you trying to answer and include a hypothesis. (Background info, research question and hypothesis)
2. Procedure: What did you do during your investigation and why did you conduct your investigation in this way? (How you collected and analyzed data)
3. Data: Include a data table and/or graph to show your results. Be sure to include a title for your table or graph with labels for the variables.
4. Conclusion: What is your argument? (Claim - Evidence - Reasoning)

Your report should answer these questions in two pages or less. The report must be typed, and any diagrams, figures, or tables should be embedded into the document. Type your report on Google Docs (12 point font, double-spaced) and share it with your teacher. Your report will be graded based on the rubric in the class syllabus.