

ECHOLOCATION AND COMMUNICATION

8. Predator - prey

Objective: Students will understand how whales use echolocation to find their food.

Level: K-3

Background: Although many whales have good underwater vision, the water of the North Pacific is often murky and dark, especially at depths below 20 metres. Whales compensate for this inability to see underwater by using another method of *seeing* called echolocation, or sonar. Sound travels four times faster in water than in air, and much farther. Whales send out powerful clicks or pings that they produce in air sacs in their foreheads. Many species have a fat deposit in the forehead called the melon. These whales change the shape of their melon to direct or focus the outgoing sonar waves. The melon transmits these sound waves while their oil-filled lower jaws receive and carry the returning sounds to the inner ear. As the whale approaches its target, it sweeps its head back and forth and saturates the area with clicks. When the signal returns to the whale, it computes the location, distance, direction of movement, speed, shape and texture of the object. Many of the sounds used in echolocation are high-pitched and inaudible to the human ear.

Sound travels through a medium in the form of waves. The number of wavelengths (the distance from one wave crest to the next) that pass a given point in one second (frequency) is measured in Hertz (Hz), or cycles per second. Dolphins generally do not send out signals much below 0.5 kHz. In echolocation, higher frequencies are sent out to gain information about nearby smaller objects. A low frequency signal is used for distant or large objects; in water, lower frequencies travel farther than high frequencies.

Toothed whales (Odontocetes) use a highly sophisticated form of sonar. The sound waves travel through the water and bounce off surrounding objects. A Sperm Whale's sonar consists of a series of clicks that sound like loose change banging in an empty clothes dryer. A single click is made up of one to nine separate pulses, each pulse lasting slightly more than 24 thousandths of a second. Baleen whales (Mysticetes) have a primitive echolocation system and scientists still debate whether they use it to sense their surroundings.

Materials: blindfolds

Procedure:

- 1) Divide the class into two groups. The students in each group hold hands to form a circle and the boundary of the game.
- 2) Select one student from each group to be the whale, and two students to be the fishes, and have them stand in the middle of the circle.
- 3) Blindfold the whale. The whale calls "whale" to locate the fish. Each time the student that is the whale calls "whale", the fish must respond with "fish" to imitate the returning echo of the whale's sonar. If the whale calls "whale, whale, whale" the fish must reply "fish, fish, fish". The object of the game is for the whale to find the two fish by following the sound of their voices. The students in the middle can move only within the boundaries of the circle.
- 4) When the whale touches a fish, the fish is considered eaten. When both fish are eaten, select a new whale and two new fish. Try to involve each member of the class. (It is important that the fish always respond to the whale's call).