

SWIMMING AND DIVING

4. Blowhole

Objective: To demonstrate how whales breathe.

Level: K-3

Background: Like all other mammals, whales have lungs and breathe air, and so must come to the surface to breathe. Instead of a nose, a whale has either one or two blowholes on the top of its head that serve as nostrils. The dorsal location of the blowhole allows the whale to breathe without having to lift its head out of the water. The blowhole is surrounded by a set of powerful muscles that close off the hole and prevent water from entering when the whale dives. A system of nerves and muscles automatically keeps the blowhole from opening under water. The toothed whales have only one blowhole while baleen whales have two.

Breathing frequencies vary depending on species, physical activity and family groupings. Right, Blue and Humpback whales surface every four to seven minutes. Most species take a series of breaths separated by 10 to 30 seconds before diving again. When baleen whales feed, they generally go down for 10 to 15 minutes, then resurface and breathe or "blow" about once a minute. Their limit under water is about 40 minutes. At rest, whales do not breathe as quickly as they do immediately after returning from a dive. Family relationships can also influence breathing: Killer Whale pods tend to breathe in the same rhythm, with all animals surfacing at approximately the same time.

When whales surface they let out their breath and spout a column of air and water vapour several metres into the air. This is called *blow*. Whales do not exhale water although it sometimes looks that way. Blow is created primarily through three mechanisms:

- water resting in the cup of the blowhole is vaporized as the whale exhales;
- the whale's warm breath condenses in a cooler ambient temperature;
- air released under pressure condenses.

When swimming fast, many cetaceans will jump clear of the water to breathe. If a fast-moving whale were to raise just its blowhole to the surface, it would meet maximum water turbulence and drag, and so expend a great amount of energy. Jumping out of the water allows the whale to maintain speed without expending too much energy.

The four-metre-wide tail flukes of the Fin Whale can generate up to 200 horsepower. With this kind of power and a streamlined body it is easy to understand how whales can swim so fast. A 20-metre Blue Whale is able to keep up a speed of 37 km/hr (20 knots) for 10 minutes and 26 to 28 km/hr (14 to 15 knots) for over two hours. Killer Whales can travel at speeds up to 45 km/hr (24 knots) and the Dall's Porpoise, the fastest of all cetaceans, can reach 50 km/hr (27 knots).

Procedure:

- 1) Have the students close their eyes, take a deep breath and imagine they are underwater. What is the first thing they do when they surface to breathe, inhale or exhale?
- 2) Have them make a large blowhole with both hands over their head, take a deep breath and close their hands tight. Have them hold their breath for 10 to 15 seconds, open their hands and exhale, then inhale quickly and close their hands tightly, and repeat.
- 3) Notice the different sounds they make as they inhale and exhale. Most whales make a tremendous sound as they surface and breathe. They must inhale quickly because their blowhole is only out of the water for a short time.