

THE OTTAWA NATURALIST.

VOL. X.

OTTAWA, JULY, 1896.

No. 4.

HOW WHALES BREATHE.

By PROFESSOR EDWARD E. PRINCE,

Dominion Commissioner of Fisheries, Ottawa.

No sight is more common, on a sea-voyage, than the spectacle of a whale "blowing." Many people imagine that the creature spouts forth a column of water, and most artists so depict it, forgetful of the fact that the blow-hole or spiracle, being really the nostril, is used for respiration, and that all cetaceans or whales are air-breathing creatures. It is true that fishes, which are cold-blooded, inhale water, for they breathe by means of gills; but whales have warm blood and have no gills, and indeed, are not fishes at all. Like ourselves they have a pair of lungs, and are compelled to rise to the surface of the water in order to breathe. If detained under water too long they are drowned like any other air-breathing animal. Some of the largest species remain submerged for thirty or forty minutes and on rising to the surface spout eight or nine times and then descend again. The sperm-whale spouts sixty or seventy times at brief intervals of three to ten seconds and then dives below. Whale hunters say that, when hunted, a whale will remain below for an hour. The white column thrown up at each "spout" of the whale, is really the hot damp breath mingled with a little mucus and water. In the cold atmospheric stratum just above the waves the breath is condensed and falls like a shower of fine

rain or spray, and the colder the weather the more marked and visible is this phenomenon. When a large whale raises its snout sufficiently far out of the water the column is thrown up precisely like a jet of steam forcibly escaping from a boiler. This jet may be ten or twelve feet high in the case of an Arctic whale or a huge Finner ; but in the porpoise, one of the smallest of the whales, the jet is an insignificant puff only six or eight inches in height. Sometimes the creature breathes before the blow-hole is clear of the waves and a low fountain like a boiling jet is then formed, but if the blow-hole is level with the surface of the sea a small quantity of water is carried up with the rushing column of hot vapour. The cloud of ejected vapour, in very still weather, hangs for a considerable time and moves slowly over the water until it dissipates and fades away. Its appearance when seen from the level of the sea, as the late Professor H. N. Moseley recorded, "is very different from that which it has when seen from the deck of a ship ; it appears so much higher and shoots up into the air like a fountain discharged from a very fine rose." Whereas the great Arctic whale (or Right whale) possesses two blow-holes side by side, and throws up two lofty jets of vapour, the Beluga or white porpoise, and the small porpoise or sea-pig, exhibits a single crescent-shaped aperture, and like the huge sperm-whale ejects a single puff or column ; but in the last-named whale the spout curves over in front of the head, and forms an arch of white vapour. Two blow-holes occur in the Hump-backs, but in the Beaked Whales (*Hyperoodon*) which are allied to the toothed sperm-whale, there is a single cruciform aperture.

Great force being required to expand the spacious chest of these huge monsters, the muscles used in the breathing operation are very powerful and this is especially true of the muscular diaphragm. The elasticity of the lungs, due to the enormous development of "yellow fibres," and the pressure on

the surface of the body, by reason of the external water, renders the emptying of the lungs very easy, and the out-rush is not only swift and powerful enough to clear the complicated nasal passages, but to throw up the vapoury breath to a considerable height ; as we have seen.

I have on many occasions been privileged not only to examine the carcasses of these gigantic creatures after capture, but to see them at close quarters when enjoying themselves in active life. On the Pacific coast, while cruising up the great inlets, and between the numerous islands, along the British Columbia sea-board, I frequently found myself in the midst of a school of whales, numbering in some cases at least twenty. The sea was as calm as a lake, and in the cool still atmosphere, the great clouds of vapour shot up at intervals all around, while the monsters glided with slow gracefulness after the shoals of minute animals on which they were feeding. At times one, in a fit of playfulness, would cause a great commotion, and with his flippers and tail throw up a storm of spray and foam ; but the school as a whole moved leisurely and noiselessly like dark shadows rising and sinking in the water. On certain occasions, when engaged in fishery investigations on the Scottish coast I found myself in close proximity to schools of gigantic Rorquals. They rose around our fishing yawl on all sides, and constantly threw up columns of white vapour accompanied by a deep bass snort or sigh like the gasp of the piston in a Cornish engine. When one of these mighty creatures, fifty or sixty feet in length, spouted within a few yards of us, the vibration made our vessel tremble, and one can understand the feelings of the novice on board ship who, in the long night watch, saw clouds of vapour and heard terrific sighs and snorts, and asked appealingly " How soon will I be off this perilous duty with those great guns afiring off so close to me ? "

This process, by which whales breathe, may be likened to

sneezing, the ejection of the breath out of the nostrils being so powerful and spasmodic. It is easy to understand that in air-breathing creatures, which are born and live their whole life in the water, special provision was necessary to prevent the entrance of water into the windpipe and air passages, more especially as water must be taken in along with their food. Most of this water is thrown out again from the mouth, but the solid particles of food are retained and swallowed.

If we examine the breathing apparatus say in a small porpoise, we find that the trachea or windpipe is very short, and of wide calibre. At the top; the epiglottis projects like a conical funnel, and can be raised until it is pushed into the opening of the nasal chamber in the roof of the mouth. But a whole series of complex structures intervenes between the outer valved blow-hole, on the summit of the head, and the epiglottis or top of the windpipe. Five of these structures may be noticed in the porpoise, viz.: first; the valve of the crescentiform spiracle; second, the spiracular tube; third, a double enlarged chamber, really the two smelling sacs, but not used for purposes of smell; fourth, the sub-spiracular passage; fifth, the final opening into the mouth which is provided with a strong circular band of muscle. The purpose of the tubes, chambers, and valves is to afford passage to the air, entering, and driven out of the trachea and lungs, while at the same time preventing the entrance of water. Were water to gain access to the windpipe it might choke and kill the whale. We adopt in our churches in Canada an analogous arrangement in order to allow of the admission and exit of the congregation, while, as far as possible, preventing the entrance of cold air. Thus the storm-porch with its tight-fitting doors leads into a vestibule, which in some churches, leads into one or two curtained recesses, these finally opening, by baize-covered doors, into the body of the church.

The sense of smell, like that of hearing, is in the whales

either very defective or practically absent. The olfactory nerves, in fact, degenerate in all Cetaceans except the great baleen whales, the nasal chambers and passages being modified, as we have seen, for the peculiar respiration characteristic of these aquatic mammals.

Pennant in his "British Zoology" remarks that whales "like land animals, breathe by means of lungs, being destitute of gills. This obliges them to rise frequently to the surface of the water to respire, to sleep on the surface, as well as to perform several other functions." In the eyes of the law whales are still regarded as fish, and along with the sturgeon are, in Britain, named "Royal fish," and belong to the sovereign, in accordance with an old Act of Edward the Second, which runs "Item habet varectum maris per totum regnum Ballenas et Sturgiones captos etc.," so that when accidentally stranded or captured on British shores, "the king and queen divided the spoil," as Pennant quaintly adds: "the king asserting his right to the head, her majesty to the tail." Nor was the Queen's share to be altogether despised if Frederick Marten's opinion is to be trusted. "The flesh of the whale is coarse and leathery" he wrote, about three hundred years ago, "but somewhat resembles that of the ox . . . the flesh of the tail is softer." It is not the object of these notes, however, to determine the culinary excellencies of the whale, but to refer simply to certain striking features in the respiration of these gigantic creatures.



Prince, Edward Ernest. 1896. "How Whales Breathe." *The Ottawa naturalist* 10(4), 73–77.

View This Item Online: <https://www.biodiversitylibrary.org/item/89746>

Permalink: <https://www.biodiversitylibrary.org/partpdf/369930>

Holding Institution

Harvard University, Museum of Comparative Zoology, Ernst Mayr Library

Sponsored by

Harvard University, Museum of Comparative Zoology, Ernst Mayr Library

Copyright & Reuse

Copyright Status: Public domain. The BHL considers that this work is no longer under copyright protection.

This document was created from content at the **Biodiversity Heritage Library**, the world's largest open access digital library for biodiversity literature and archives. Visit BHL at <https://www.biodiversitylibrary.org>.