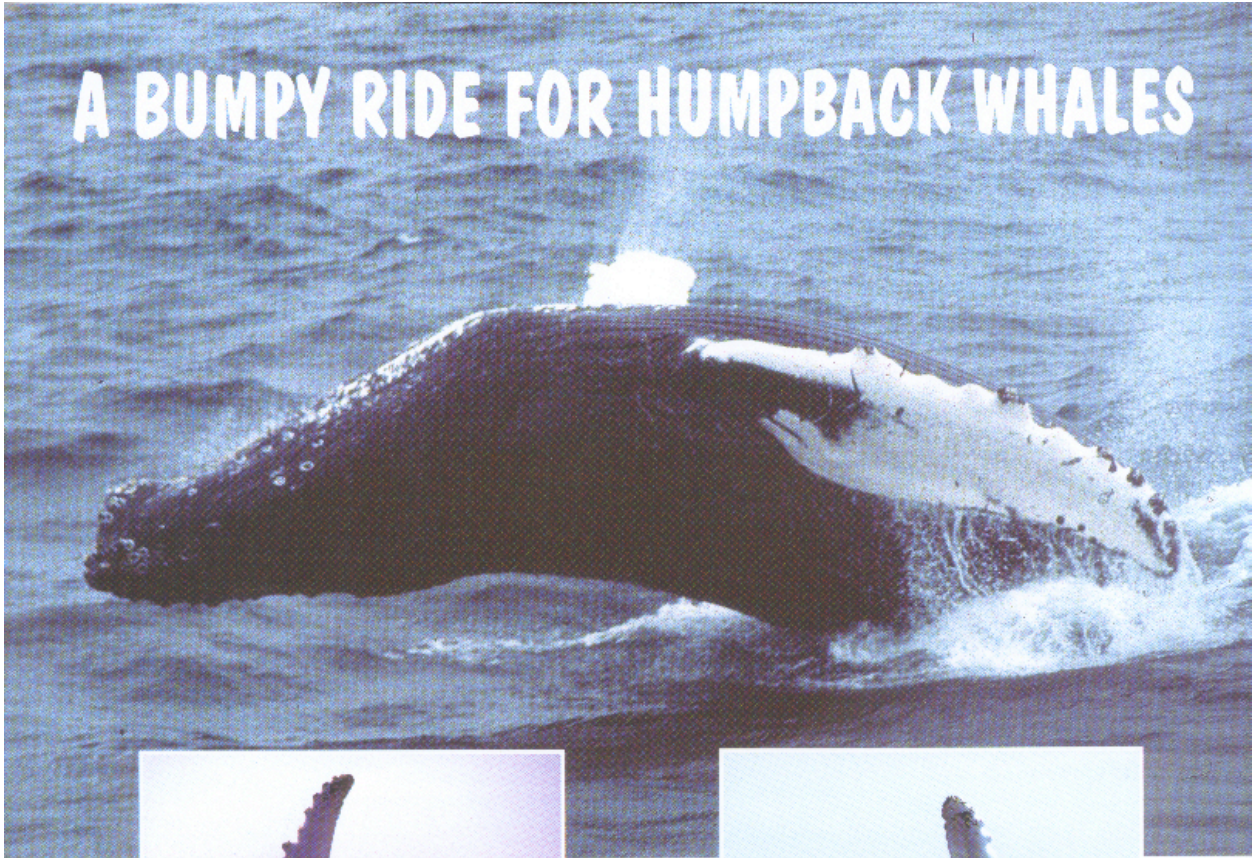


A BUMPY RIDE FOR HUMPBACK WHALES



The humpback whale (*Megaptera novaeangliae*) is the most acrobatic of the baleen whales. With great agility, the humpback whale can launch its 30 tonnes completely out of the water. Underwater manoeuvres are effected by movements of the whale's elongate pectoral flippers, which are roughly 1/3 the body length.

The flippers act like wings to generate lift forces that are used to induce a turn. Unlike commercial aircraft wings with a straight leading edge, the humpback flipper has prominent knobs, called tubercles, along the leading edge. The presence of these tubercles runs counter to generally accepted notions of aero- and hydro-dynamics for the design of wings and other lifting surfaces.

Wind tunnel studies of model humpback whale flippers, with and without tubercles, demonstrated enhanced capabilities due to the presence of tubercles. Without the tubercles, the flipper will stall and lose lift at 11° angle of attack, which is the angle between the wing and the on-coming airflow. The stall angle is delayed by approximately 40%

when the tubercles are present. In addition, lift increases on the flipper while drag decreases. Thus, the delay in stall effectively increases the operating envelope of the flipper.

From an ecological standpoint, the enhanced performance of the humpback flippers permits greater turning ability when foraging on elusive prey. As opposed to the other related rorquals, which swim straight ahead to engulf schools of prey, the humpback uses elaborate manoeuvring behaviours to catch its prey, including sharp U-turns and bubble-net feeding.

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TOP BREACHING WHALE (Ignacio B. Morento/Projecto Baleias/PRONTARI)