

WHY WHALES GREW BALEEN

THE EVOLUTION OF MARINE MAMMALS,
PLANETARY COOLING, AND THE SILICA CYCLE

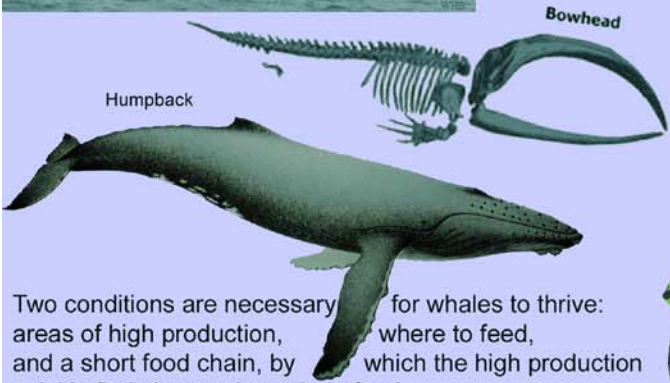


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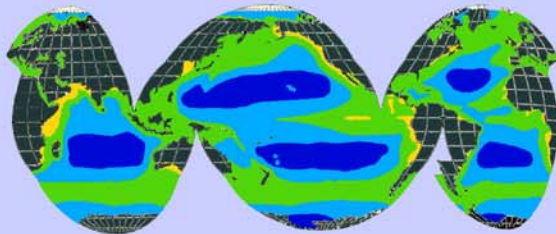
THE BLUE WHALE

Aqu. Pacific Long Beach



The blue whale is a baleen whale; that is, it uses a curtain of tough skin strips hanging from the roof of the mouth to filter the water for plankton, on which it lives. Other baleen whales are the familiar humpback whale (whose males sing) and the bowhead (whose head takes up almost one third of the body).

Two conditions are necessary for whales to thrive: areas of high production, where to feed, and a short food chain, by which the high production quickly finds its way into whale food.



areas of high production (yellow, green) occur around the rim of the oceans, in equatorial regions, and in the Southern Ocean.

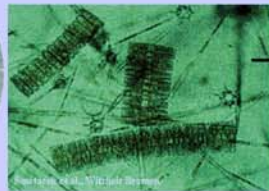


The number of transfers in the food pyramid determines how much edible material arrives at the top consumer.

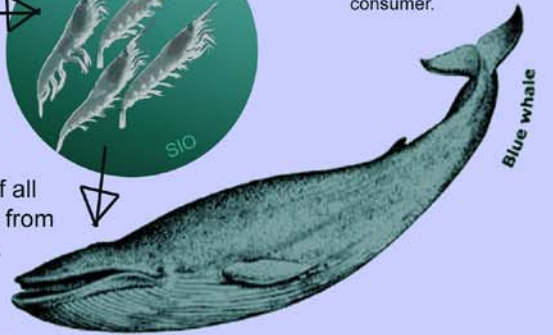
Other animals also benefit from the short food chain in the Antarctic seas: seals and penguins.



The "crabeater" seal has special teeth for straining krill from seawater. It is the most abundant type of seal on the planet. The Adelie (the most abundant penguin) feeds krill to its young.



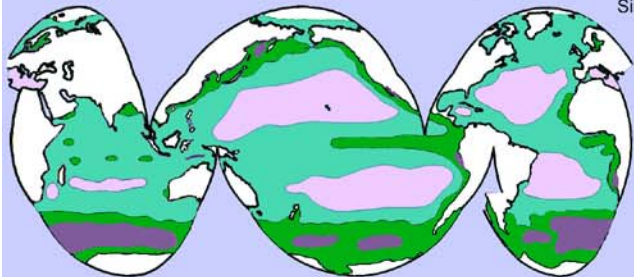
The shortest food chain of all is in the Southern Ocean: from diatoms to krill to whales.



WHAT MAKES THE SOUTHERN OCEAN SO SPECIAL?

It is the presence of abundant silicate. It collects as shells from diatoms and radiolarians on the seafloor around Antarctica. The strong current around Antarctica, driven by powerful winds, stirs the water to great depths. Thus, the silicate dissolving on the seafloor can then come back up into the sunlit zone to be used by diatoms.

Siliceous fossils: radiolarians and diatoms



few or no siliceous fossils
siliceous fossils common
very abundant
main constituent of the sediment

TO UNDERSTAND WHY WHALES GREW BALEEN WE MUST STUDY THE SILICA CYCLE, AND THE HISTORY OF DEEP MIXING IN THE OCEAN.

In the Southern Ocean, deep mixing depends on two things:
(1) strong winds around an icy continent
(2) an open Drake Passage to let the current go all around Antarctica.

Thus, the history of plate motions (for opening Drake Passage) and the history of planetary cooling (ice buildup on Antarctica) are the crucial ingredients of the answer to the question why whales grew baleen.