LESSON 1

DISCOVERING THE OCEAN
Of Fish and Ships and People

1 A bountiful sea?

2 A new planet

3 Discovery of the world ocean

4 Early oceanography and the Challenger Expedition

5 Post-Challenger expeditions

6 Scripps: Evolution of a marine research center

Fig. 1.01. Pelagic jellyfish include some of the largest and most ancient forms of animal life in the sea.

Lobster, scallop and tuna are among the more expensive items on the seafood menu, and for good reasons.

We like to eat these things, and there are many of us, and not so many of them any more. In fact, with regard to fish suitable for fine dining, there are now roughly ten times fewer in the sea than only a few decades ago (1). Many other animals of the sea once or recently heavily exploited are similarly diminished, including for example sea turtles and large whales. Jellyfish, however, remain in sufficient abundance (Fig. 1.01). Their nutritional value, in relation to weight, is low. Nevertheless, they are already finding their way into seafood restaurants, thus confirming a long-term trend away from catching highly prized predators such as tuna and swordfish toward netting plankton eaters and invertebrates (2).

For millennia, the relationship between people and the sea has been largely determined by human fondness for seafood. Fishermen had the most intimate knowledge of winds and currents and of the changes that come with the seasons. Also, of course, they knew where to go to find fish and crabs and oysters. Their prey was found in view of the land. Later on, with bigger vessels, fishing moved out into the open ocean away from visual contact with the coast. Fishermen discovered new riches – enormous aggregations of cod, schools of herring. In high northern latitudes, whales have long been part of marine hunting cultures. Not so long ago, in the 19th century, whaling was an important business in many coastal communities throughout the world. In New England, shore whaling off Nantucket and Long Island made a start around 1690. The business grew into a worldwide enterprise in the early 1800s, centered at New Bedford, where more than 400 whalers were registered at the Custom House in 1857 (3). Yankee whalers knew the sea and the habits of whales (4). They were the sages

of the sea well before oceanography emerged as a branch of the Earth sciences. Their knowledge was closely tied to purpose, a link that has largely persisted into modern ocean sciences. The main lesson of the story of whale hunting, often retold, is that the sea's resources are not inexhaustible, and that over-exploitation will not engender restraint, but will only stop after collapse of the resource or from outside intervention (in this case, the discovery of petroleum).

As we have learned more about the ocean, motivated by the needs of fisheries, navies and shipping, and also by curiosity, a new planet has entered our awareness, one where the ocean is the dominating feature of conditions on Earth. Winds from the sea bring the rain that determines where plants and animals on land shall thrive. Their patterns of distribution in turn determine the life-style of humans dependent on agriculture.

Awareness that our planet has an enormous ocean, with island continents, starts with the discovery of the world ocean around AD 1500. Knowledge that the deep ocean is cold and that its salt is the same everywhere are achievements of the 19th century. Since then, the science of the sea has expanded rapidly. The general pattern of this expansion, as seen in the large oceanographic institutes around the world, is nicely reflected in the history of Scripps Institution of Oceanography ("Scripps" for short), one of the largest and oldest of the genre. As it happens, Scripps is just over one hundred years old: it was founded in 1903.

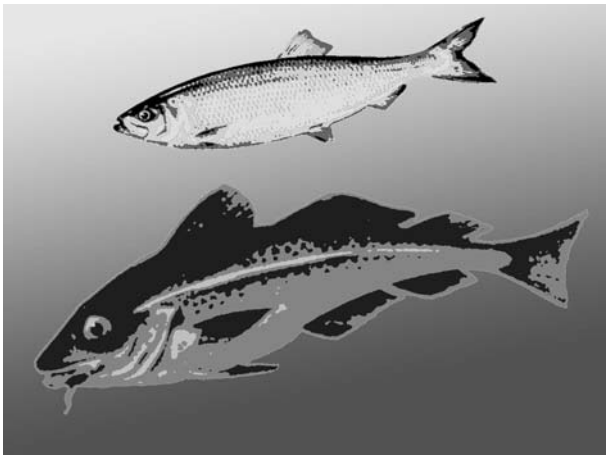

Fig. 1.02. For centuries, herring and cod have supported major fisheries of the North Atlantic.

Notes and references

1. P. Ward, R.A. Myers, 2005. *Shifts in open-ocean fish communities coinciding with the commencement of commercial fishing*. Ecology 86 (4) 835-847. B. Worm, M. Sandow, A. Oschlies, H.K. Lotze, R.A. Myers, 2005. *Global pattern of predator diversity in the open oceans*. Science 309, 1365-1369.

2. The trend has a name: *Fishing down marine food webs*. D. Pauly, V. Christensen, J. Dalsgaard, R. Froese, F. Torres, 1998. Science 279 (5352) 860-663.

3. Encyclopaedia Britannica 1974, Macropaedia 19, "Whaling."

4. J. R. Spears, 1908. *The Story of the New England Whalers.* Macmillan, New York, 418pp.; C. W. Ashley, 1942. *The Yankee Whaler*. Halcyon House, Garden City, N.Y., 156pp. J. T. Jenkins, 1921. *A History of the Whale Fisheries*. Whitherby, London, 336pp.; E. K. Chatterton, 1926. *Whales and Whaling.* William Farguer Payson, New York, 248 pp.; P. Budker, 1959. *Whales and Whaling.* Macmillan, New York, 182pp. For a lively account of the whale hunt in the 19th century, see H. Melville, 1851. *Moby-Dick.* Harper and Brothers, New York, and also N. Philbrick, *In the Heart of the Sea. The Tragedy of the Whaleship Essex.* Penguin Putnam, New York, 302pp. An early example of the modern scientific approach to the natural history of whales is by K.S. Norris (editor) 1966. *Whales, Dolphins, and Porpoises.* University of California Press, Berkeley and Los Angeles, 789pp. A scholarly and poetic description of life in the sea from the point of view of a sperm whale is in V.B. Scheffer, 1969. *The Year of the Whale.* Charles Scribner's Sons, New York.

Images

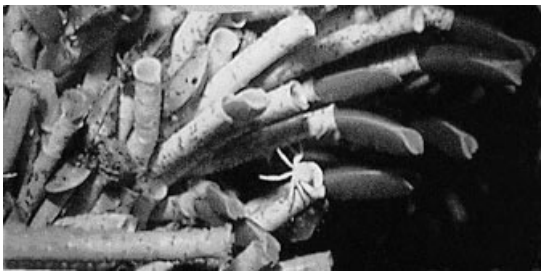

Fig. 1.03. Gutless tube worms processing sulfurous emissions from a hot vent, with the help of symbiotic bacteria living within their bodies. Note the small crab.

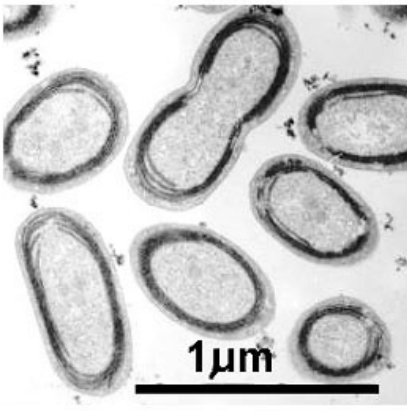

Fig. 1.04. The smallest and the most abundant: cyanobacteria of the genus *Prochlorococcus*.

Fig. 1.05. Captain James Cook, explorer of the Pacific and discoverer of Australia and the Southern Ocean.

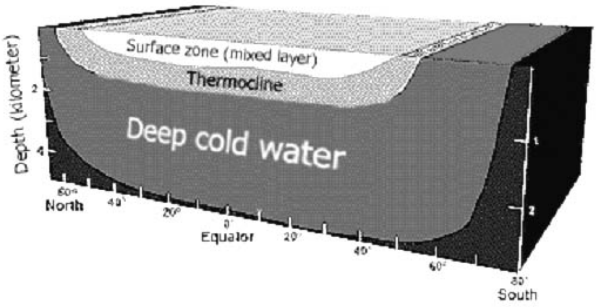

Fig. 1.06. The ocean is filled with cold water. A thin warm layer covers it, except in high latitudes. Cold and warm water are separated by a transition zone, the “thermocline.”

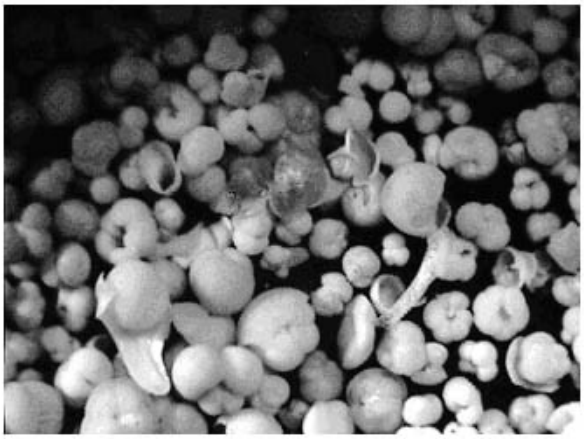

Fig. 1.07. Foraminiferal shells extracted from deepsea sediments. The size is that of sand grains. The shells within the sediment are a means by which the ocean remembers its history.

Fig. 1.08. Creatures (sea cucumber, octopod) brought up by the dredge on the *Challenger*, showing there is life at great depth.

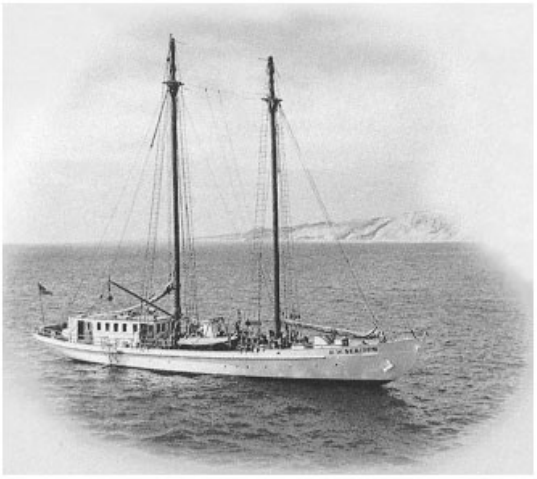

Fig. 1.09. Research vessel *E. W. Scripps* off the pier at Scripps Institution of Oceanography, ca. 1940.

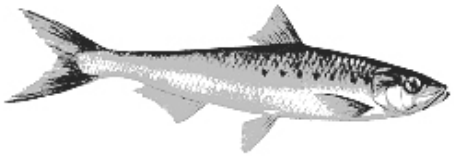

Fig. 1.10. California sardine, *Sardinops sagax*

Fig. 1.11. Helmsman's tool

Figure sources (where based on sources in the literature, on the web or in museum exhibits: figures are considerably modified and adapted for present purposes, using Adobe Photoshop; drawings and photographs by the author are marked "orig."):
1, E. Haeckel; 2, H. Murayama, and Brehm's Tierleben; 3, Alvin photo, R. Hessler, SIO; 4, microphoto courtesy S.W. Chisholm, MIT; 5, Murray and Hort, 1912; 6, NOAA; 7, microphoto P.A. Anderson, SIO; 8, Challenger Reports; 9, SIO archives; 10, H. Murayama; 11, Bergen Maritime Museum (orig.). **References**: Ernst Haeckel, 1904. *Kunstformen der Natur*. Leipzig. Reprinted 2006, Prestel Verlag, Műnchen; H. Murayama in J.O. La Gorce (ed.) 1939, *The Book of Fishes*. National Geographic Society, Washington, D.C., 367pp.; Brehm's Tierleben: two sources were used, *viz.* P. Rietschel et al. (eds.) *Das Tierreich nach Brehm.* Buch und Bild (Bertelsmann), Hamburg, no date (ca. 1955), and R. Barth (ed.) *Brehm's Tierleben,* Verlag Zimmer and Herzog 1953, Berchtesgaden [both are edited extracts from *Brehm's Tierleben,* specifically the 2nd ed., the ten-volume zoological opus of Alfred E. Brehm, 1829-1884, director of the Berlin Zoo; and the thirteen-volume 4th ed. edited by Otto zur Strassen (1911-1920)]; J. Murray and J. Hjort, 1912. *The Depths of the Ocean.* Macmillan, London, 821pp.; NOAA, National Oceanic and Atmospheric Administration, U.S. Department of Commerce; Challenger Expedition: image reprinted by H.S. Bailey (1953) as cited in H.W. Menard (ed.) *Ocean Science, Readings from Scientific American.* W.H. Freeman, San Francisco, 1977.