ARCTIC
VOL. 46, NO. 2 (JUNE 1993) P. 175-177

Maxwell John Dunbar

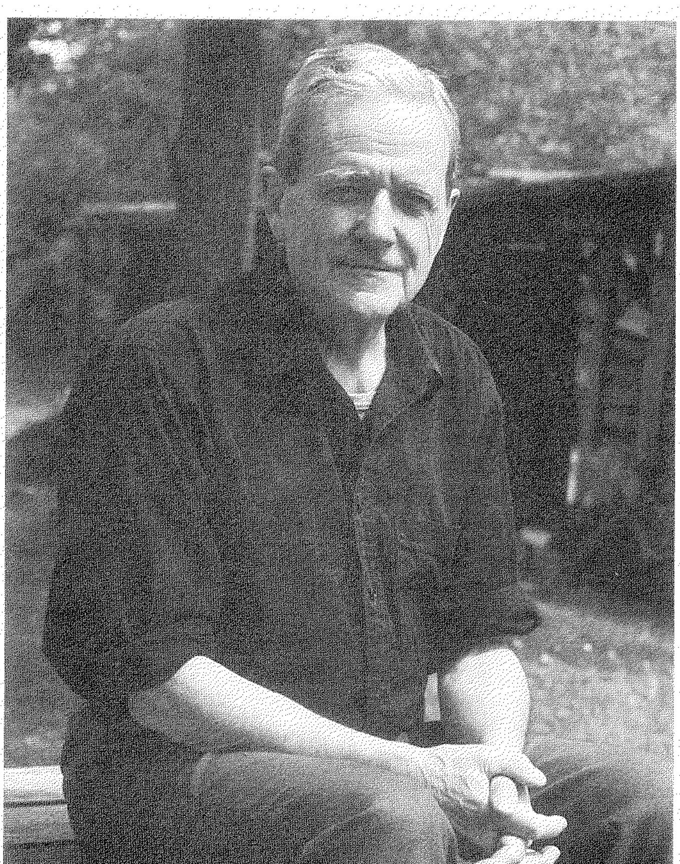
At the Annual Festival of the University of Copenhagen on 21 November 1991, the Canadian biologist and oceanographer Maxwell John Dunbar, professor at McGill University, Montreal, was awarded an honorary doctorate of science. He was accorded this mark of honour on the grounds of both his extensive work in arctic marine biology and his long-term association with Greenland and Denmark.

Max Dunbar was born in 1914 in Edinburgh and is still very much the Scot. He studied zoology at Oxford University, where he completed his training in 1939, following an interim period at Yale University. After several expeditions to the Arctic, he received his doctorate from McGill University in 1941.

As early as 1935 and 1936 Dunbar went to West Greenland as a member of expeditions from Oxford University. Later he was appointed Canadian consul to Greenland during the Second World War, stationed at Godthåb/Nuuk. He learned Danish almost to perfection, and he was very popular in the Danish community, where his social gifts made him quickly accepted. In addition to his official duties, he continued his scientific research on the study of the plankton of Godthåb Fjord.

After the war Dunbar maintained his ties with Danish friends and colleagues and visited Denmark almost every other year. In 1952-53 he was on a sabbatical year at the Plankton Laboratory of the Danish Fisheries and Marine Research Organization.

He was appointed to the Faculty of McGill University in 1946, from which he retired in 1982, but he has continued his scientific work. He has a record of some 180 publications, including books, and as a university teacher he trained a large number of doctoral students. He has taken part in or led a number of international meetings and congresses and played a part in international research undertakings.

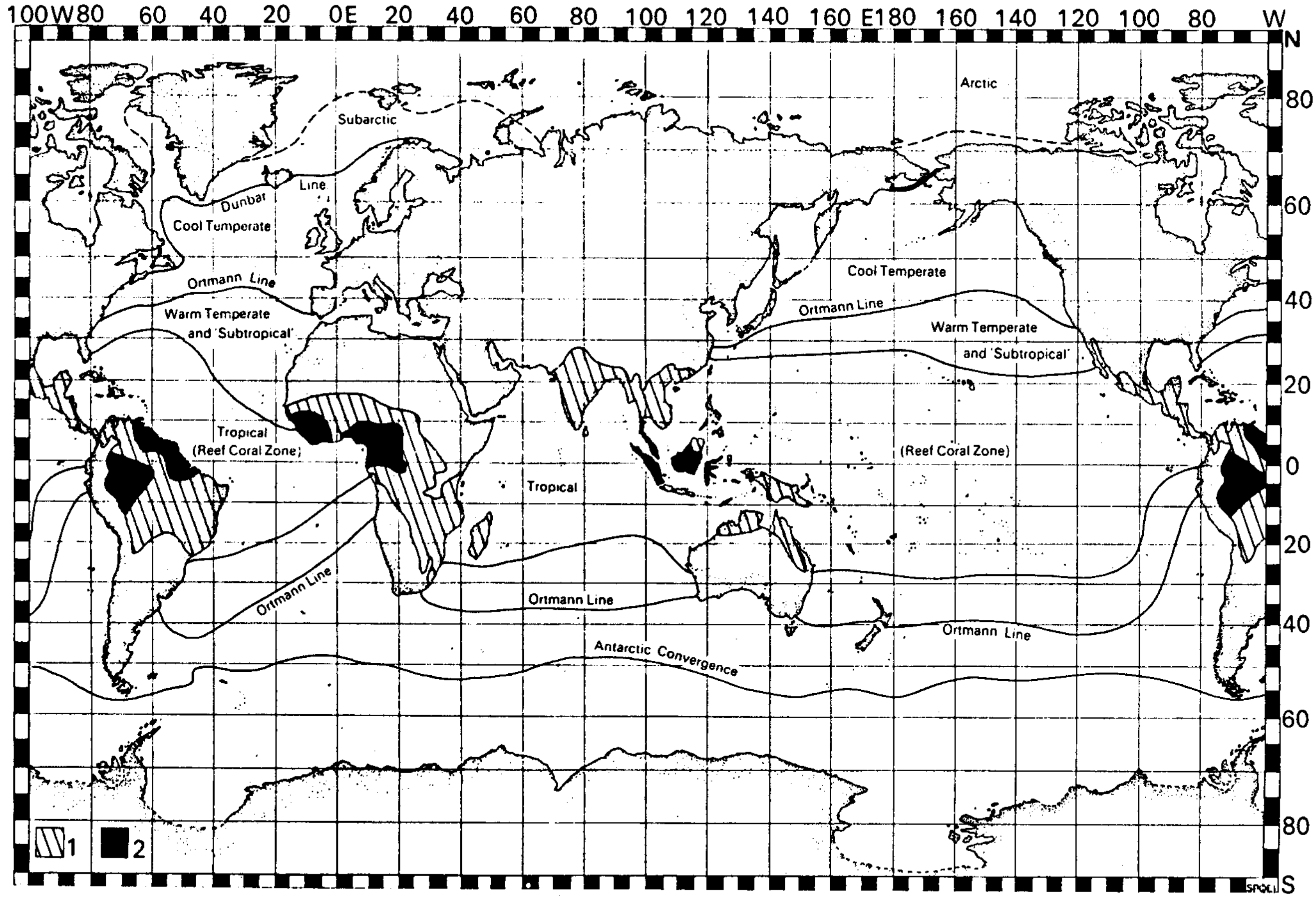


Max Dunbar, 1992. Photo by Dougal Dunbar.

Dunbar's scientific activities have been extensive and far reaching. Certain selected areas of his research are highlighted below. His earliest research was in zoology, involving different zooplanktonic groups, especially those Crustacean groups of importance in the food chain. He soon moved into ecological-hydrographic studies, investigating the so-called "brown zone" at the face of a glacier in the Disko Bay region of West Greenland in 1936. When glaciers extend into deep water, the surface water flowing away from the glacier face can be replaced by upwelling water coloured brown by mud from the bottom and in which there is a large plankton population that attracts seabirds in search of food. There followed extensive oceanographic and biogeographic studies, resulting in a monograph, *Eastern Arctic Waters* (1951), in which the physical oceanographic conditions in the Eastern Canadian Arctic and West Greenland regions are described. In order to continue research in Canadian arctic waters, the research vessel *Calanus* was built in 1948, modeled on Scandinavian lines — the first research vessel to be built in Canada specifically designed for the arctic regions.

The geographical studies expanded by degrees to the global scale, as can be seen in the accompanying map. In the northern regions there is a distinction between an arctic and a subarctic zone, as seems relevant in a zoogeographic context. Dunbar defines the arctic zone as consisting exclusively of arctic water from the upper 200 m of the Arctic Ocean, while the subarctic zone is defined by the mixture of arctic and non-arctic water (Atlantic and Pacific). To the south the subarctic zone is bounded by a zone without admixture of arctic water, the north temperate or boreal zone. The map shows these zones clearly, especially in the North Atlantic region. From a practical point of view the boundary between the arctic and subarctic zones corresponds approximately to the 0°C isotherm on the annual average at the surface, while the boundary between the subarctic and boreal zones can be characterized approximately by the 5°C annual average temperature at the surface. But one should not be too restricted by these limits, which are only approximate and vary greatly from year to year. They are, in fact, indicative of significant differences in biological productivity. In the last analysis, all of our scientific concepts are conventional definitions that are valid to the extent that they are useful and, in this case, have shown themselves appropriate to define the areas of distribution of many species of animals.

A tongue of subarctic water flows northward through Bering Strait from the North Pacific in the direction of the Atlantic, which makes it probable that in a warmer period there was a faunal dispersal from the Pacific to the Atlantic. Dunbar considers that a dispersal of plankton could have taken place during geologic time and that the faunal discontinuity we now find between the Pacific and the Atlantic is due to climatic cooling that occurred since Tertiary times, when the climate was warmer than it is today. He holds that there was a general fauna dispersal from the direction of the Pacific to the Atlantic and, in contrast to the opinion of many other researchers, that



The marine biogeographic zones. From Dunbar, 1979, "The relation between the oceans," redrawn from Ortman, 1896, "Grundzüge der marinen Tiergeographie," Jena: G. Fischer.

there has been a dispersal from the Arctic to the Atlantic oceans, and not the other way around.

Long-term oscillations in air and sea temperatures became an important part of Dunbar's research, prompted by the classic 1939 study of Adolf S. Jensen on climatic changes in arctic and subarctic regions during recent decades and their biological effects. Bringing together a large corpus of historical and scientific data, he reached back to a warm period from the 6th to the 12th centuries, followed by a later cold period from 1430 to 1850, the so-called "little ice-age," and the recent warm period in the 20th century, with temperature maxima in the 1930s and 1950s-60s, where the most remarkable biological effect was the abundance of Atlantic cod in West Greenland from about 1920 to 1970 (Dunbar and Thomson, 1979; Dunbar, 1982).

One of the international research projects that Dunbar participated in was the large oceanographic research program MIZEX (Marginal Ice Zone Experiment), centred on the whole ice-edge zone in the Greenland Sea between Greenland and Svalbard in the years 1983-87, for which he organized the biological program. It is well known that when one approaches the ice edge in a ship there appears a rich life of birds, whales, seals and plankton. The basis for this is the primary production of phytoplankton in the open water and of ice algae within the lower levels of the ice itself. The ice algae, which are adapted to the lower light intensities under the ice, are the basis for a special food chain beneath the ice of algal-feeding Crustacea (copepods and amphipods), which are eaten by the polar cod, which are preyed upon by birds and seals; the top level of the food chain consists of polar bears (and human beings). This project of physical and biological oceanography was a collaboration among researchers from ten countries. The collection of the data and material involved several research vessels, observation aircraft and anchored buoys.

In a totally different field, that of the theory of cognition or research methods, Dunbar argued against the principle of parsimony, also called "Occam's Razor," after the English philosopher William of Occam (*ca.* 1285-1349). This principle states that one must never assume more things or entities (hypotheses) than are necessary, but Dunbar turns sharply against the principle in an article with the drastic title of "The blunting of Occam's Razor, or to hell with parsimony" (Dunbar, 1980), in which he shows, with examples from the history of science, that many valuable ideas might never have been advanced if the principle of parsimony had stifled the imagination. That principle is in line with the inductive method, by which one argues from the particular to the general (as opposed to the deductive method, by which the argument goes from the general to the particular). The English philosopher Francis Bacon (1561-1626) was one of the first to argue for induction as the method of science.

Two examples given by Dunbar are: 1) In 1859 Darwin published his selection theory. Later in his autobiography he claimed to have worked according to "proper Baconian principles" and had collected facts without regard to any theory, but it is known that he had conceived the idea of natural

Calanus in the Button Islands, Northwest Territories, 1949.

selection earlier in his career. 2) In geology, theories concerning changes in the distribution of continents were put forward in the 19th century, and in 1912 Alfred Wegener, a German explorer of Greenland, published his theory of continental drift, based partly on the configuration of the continents. Wegener's theory was abandoned because of lack of evidence, but it has now won general recognition in the modern plate-tectonics theory of the 1960s.

In scientific theory of recent years the idea of levels of organization has generally come to be accepted, with the physical sciences as the foundation, followed by the biological sciences and finally the human sciences. Each level of organization has its own concepts and methods that cannot be transferred to the others, even though higher levels must be based upon the lower. This makes the principle of parsimony impossible, especially for the higher levels, since it is not directly possible to build further on the basis of experience from the lower. As an example, Dunbar names ecology, which when a young, independent science was considered to be no more than physiology transferred to the natural world, to Nature. But while physiology concerns the functions of individual organisms, ecology is much more complicated in that it includes the relation of plants and animals in food chains interacting with the physical environment. Both induction from lower levels to higher and deduction from the higher to the lower are impossible.

In a recent publication (Dunbar, 1991), Occam's Razor is attacked again in a discussion of an extension of Darwin's selection theory. Classic Darwinism deals with selection at individual and species levels, that is, selection between individuals of the same species or between species. Dunbar widens Darwin's theory by bringing in the question of selection at the ecosystem level, a concept not thought of in Darwin's time. The smallest entity for natural selection must be the organism plus its environment, which develops within a system of similar units; from there it is not far to the concept of the ecosystem as a unit of evolution. Since environmental changes, for instance climatic changes, are effective at the species level, their effects must be even more direct on ecosystems. Paleoecology (historical ecology) is thought to be just as fruitful in research in the evolution of ecosystems as is paleontology (the study of fossils) for the study of classical evolution.

This profile does not cover all of Dunbar's field of work, but probably the most important, at the same time showing the extent of his scientific range from descriptive zoology through ecology, oceanography, zoogeography, to the theory of science. In this latter area he is, in his critique of the logic of induction as a scientific method, on a par with other theorists of our time, such as the Austrian-English philosopher K.R. Popper.

REFERENCES

DUNBAR, M.J. 1951. Eastern arctic waters. Fisheries Research Board of Canada Bulletin 88:1-31.

______ . 1979. The relation between the oceans. In: Van der Spoel, S., and Pierrot-Bults, A.C., eds. Zoogeography and diversity of plankton. Utrecht: Bunge Scientific Publishers. 112-125.

______ . 1980. The blunting of Occam's Razor, or to hell with parsimony. Canadian Journal of Zoology 58(2):123-128.

______ . 1982. Twentieth century climatic change in the Northwest Atlantic and subarctic region. NAFO, Scientific Council Studies 5:7-15.

______ . 1991. Polar marine ecosystem evolution. In: Herman, Y., ed. The arctic seas: Climatology, oceanography, geology, and biology. New York: Van Nostrand Reinhold. 115-122.

DUNBAR, M.J., and THOMSON, D.H. 1979. West Greenland salmon and climatic change. Meddelelser om Grønland 202(4):1-19.

Erik L.B. Smidt
Gronnevej 253, 9
2830 Virum
Denmark