

varying equipments under harsh working conditions frequently affects the accuracy of the data, the discussion stresses the problems involved in averaging values and in quality control. For clarity where many data are available, they have been averaged by various sized areas. Other regions suffer a paucity of data. Where there are no data at all, the blank areas in the highly-coloured patterns give the charts a moth-eaten appearance.

In the horizontal contour charts, surface conditions are omitted; the shallowest contour is for 20 m. At this level one chart is presented for summer and one for winter conditions for each of the three variables, T, S, and O. For depth levels of 200 m. and below, data for all seasons are averaged together.

The smoothed contours of horizontal sections of temperature values are in whole degrees Celsius except for the 2,000 m. and 3,000 m. levels, where they are in 0.5°C. They are vividly coloured from blue to magenta in 2°C. intervals from 0 to 8°C. These irregular contours on an orthographic polar projection generally circle the antarctic continent, with increasing values to the north.

Corresponding projections of salinity sections are contoured in 0.2, 0.1 and 0.05‰, depending on the depth of the section. They are coloured at 0.4‰ intervals in yellow-brown tones which range from bright yellow to brown red.

The third variable on each plate portrays the dissolved oxygen content of the water. Values are contoured in 0.5 ml./l. for all levels and coloured in 1.0 ml./l. intervals. Six shades and tints of green, from a light yellow green to a dark brownish green are used.

In the discussion of the contoured sections, the observed distribution of the variables is explained by eddies or gyres in the circulation, but no chart shows these circulation patterns. It would also be helpful to present some information on ice, which greatly affects the other near-surface variables.

The companion report, *Sound Channels in Antarctic Waters*, includes a brief general description of sound channels; their controlling factors; and their presence and seasonality in the Antarctic. The last plate, number 19, presents 10 graphs of the vertical sound speed structure at designated latitudes along the 19°E. meridian for most of the months. Superimposed on each monthly series of speed profiles are coloured, dashed lines connecting the axes of the sound channels.

Sound channel depths in the Antarctic are interesting in that repeated sections exhibit wide seasonal variations. In some cases a sound channel is shown at two different depths. It makes one wonder how much variability is found in the original temperature and salinity data on which the sound speed was based.

The profiles are a little confusing because the sound speed is plotted as increasing to the left, but the scale implies an increase to the right. Furthermore, the axes of some sound channels are shown to fall along the surface. This is not the common usage of the term "axis", which is rather thought of as a depth of minimum sound speed occurring at some distance below the surface, permitting a channelling of sound by refraction from above, and below. Two polar projections showing geographical distribution of the speed of sound at the depth of the sound channel axis, for winter and summer, complete the plate.

References for the two parts, 23 and 9 respectively, afford ample guidance for further exploration of the subject.

This is an informative, useful and beautiful folio. It has fulfilled well its stated aim of data display and will be enjoyed by anyone interested in the Antarctic.

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FRESHWATER FISHES OF NORTH-WESTERN CANADA AND ALASKA. By J. D. MCPHAIL and C. C. LINDSEY. *Ottawa: Fisheries Research Board of Canada, Bulletin 173*. 1970. 6½ x 9¾ inches, 381 pages. \$8.50.

As an introduction, the authors have devoted the first section of this Bulletin to background information. They provide a history of publications on northern freshwater fishes, an outline of geological history, zoogeographical patterns, summary of dispersal routes, details on classification, nomenclature, the scope of the species descriptions, and methods of identifying fishes. The second and by far the greatest part of the Bulletin consists of keys for the identification of fish families and species and accounts of 59 species found in the area under consideration. This includes drainages on the North American mainland that are tributaries either to the Bering Sea, to the Arctic Ocean from Bering Strait, to Hudson Bay or to the west side of Hudson Bay north of 60°N. Also included are St. Lawrence Island in the Bering Sea and is-

lands of the Western Canadian Arctic Archipelago. All freshwater and anadromous species known from the area are illustrated and described. Species that only occasionally enter freshwater in the area or that occupy freshwaters adjacent to the area are included in the keys. The Bulletin concludes with a section on collecting and preserving aimed at encouraging the interested layman to contribute to our knowledge of the Ichthyofauna of this little known part of the world. A bibliography is provided.

Although first impressions might lead one to suppose the scope of this publication was too limited to be of much general interest, this is not so. The outline of geological history is mainly concerned with glaciation and the pattern of retreat of the ice following the last glacial period, the Wisconsin. Of most interest here in terms of the fish fauna are changes in drainage patterns and formation of post-glacial lakes. The zoogeographical section considers the probable dispersal of fish species from three refugia: the Pacific, the Bering and the Mississippi — in which they survived the last glacial maxima. The reconstruction of dispersal routes and origins of the freshwater fish fauna of Alaska and the Western Canadian Arctic is very plausible and the authors have obviously tried very hard to be objective. Considering the nature of the evidence and the scarcity of collections from the area they are to be congratulated for their ingenuity.

The keys provided in the book are simple and well illustrated. By using the methods of identifying fish section, and the glossary, anyone with a little patience should be able to identify any species of freshwater fish from the area under discussion. Even the key to the juvenile salmonids seems to be workable and these are particularly difficult to identify.

The species accounts are well rounded and as complete as possible. They are illustrated by beautiful and accurate line drawings, almost all done by Mrs. Jean Ramsey Maher. A distribution map shows localities from which the authors have examined specimens and a small inset map shows the known natural distribution of each species. Distinguishing characters are given. A description gives taxonomic details such as counts of gill rakers, fin rays, scales, vertebrae and pyloric caecae as well as notes on colour and sexual dimorphism. The distribution is described. Taxonomic notes give information on nomenclature and synonyms. Problems that have arisen possibly as a result of speciation in different refugia and subsequent intermingling of forms are aired where appropriate. A conservative approach is taken by consid-

ering the resultant forms as complexes, e.g. *Coregonus clupeaformis* complex, and *Osmerus eperlanus* complex. Postglacial dispersal is described and an account of the biology of the species gives information on habits, age and growth, diet, fecundity and any other information about the species in the area that is available. This is generally a comment on commercial or native exploitation of the species.

I have only one regret about the publication and that is that it did not cross Hudson Bay and include northern Quebec, Labrador and the eastern arctic in its scope. It would have required very little more effort to add the Atlantic refugia and include this area.

The coloured illustrations are disappointing and do not match up to the otherwise excellent quality of the Bulletin. I hope if the Fisheries Research Board is to continue using coloured plates a better quality of reproduction can be achieved. All in all this is a good book which should find its way onto the shelves of anyone with any interest in northern freshwater fishes.

G. Power

GEOLOGIC MAPS OF ANTARCTICA. BY CAMPBELL CRADDOCK *et al.* *Antarctic Map Folio Series, Folio 12.* New York: American Geographical Society, 1969-1970. 17 x 11 inches, 23 maps. \$12.00.

The publication of "Geologic Maps of Antarctica", which coincided with the SCAR/IUGS Symposium on Antarctic Geology and Solid Earth Geophysics in Oslo last August (1970), is a welcome event for both antarctic geologists and those interested in southern hemisphere paleogeography and biogeography. The organisation is such that the basic elements of the geology are clearly displayed for the casual viewer, and yet a closer examination reveals the most detailed and extensive compilation of antarctic geological data to date. Folio 12, which was begun in 1964, was accomplished through the co-operation of 25 geologists from eight countries.

The folio includes two groups of maps. The first comprises regional geologic maps, mostly at a scale of 1:1,000,000, which cover virtually all the areas of known rock outcrop on the continent. These were compiled by invited geologists with the fullest knowledge of each region. The second group comprises four maps of Antarctica compiled by Dr. Craddock from the regional maps and other sources. They show, at a scale of 1:10,000,000, fossil localities, sampling lo-