

Laboratory at Barrow. Duties as Head of the New York Botanical Garden prevented the complete working-up of the data until after his retirement in 1972.

The book includes an introduction, a definition of what is meant by Arctic Alaska, a discussion of the arctic environment, the phytogeographic and physiographic provinces in the area, the floristic elements that are present, remarks on how the relative abundance of the species was designated, and a gazeteer of collecting localities. The bulk of the text, however, is devoted to an annotated catalogue in which each species is accompanied by a list of specimens examined, published reports and comments on relative abundance, ecology and geographic distribution. Whenever possible, Steere has added a dot map of the North American distribution of the species. These maps, in most cases, have been previously published but many have been modified by the addition of further dots, usually of additional sites from northern Alaska. Informative nomenclature notes have been added where pertinent. Keys and illustrations are not included but, where needed, discussion and/or references are given to enable the reader to find this information.

The moss flora of Arctic Alaska totals 415 species but may reach 500 with further study. This is astonishingly high as the area "has a substantially larger moss flora, in numbers of species, than most areas of North America of comparable size in much more favorable climates, and with a greater range of physiographic and floristic zones". This unusual situation is partially due to the fact that much of the area was unglaciated during the Wisconsinan thus allowing the survival of a number of species that have disjunct populations in Arctic Alaska and in the eastern United States. It is also due to the close proximity of Asia and the resultant presence of a number of amphi-Beringian species.

Strong features of this book are the bringing together of published information on the mosses of northern Alaska plus the incorporation of the author's large personal collections and observations and those of others who have worked in the area. Also commendable is the extent to which the author has sought out and incorporated constructive criticism from numerous outstanding bryologists.

This book is highly recommended. It should be in the reference library of all who are seriously working on the flora of the arctic.

Charles D. Bird  
Dept. of Biology  
The Univ. of Calgary  
Calgary

AN ARCTIC ATLAS: Background Information for Developing Marine Oilspill Countermeasures; *Fenco Consultants Ltd., Calgary, and F. F. Slaney and Company Ltd., Calgary; Research and Development Division, Environmental Emergency Branch, Environmental Protection Service, Ottawa; 1978; 481 pp.; No price listed.*

The purpose of this atlas is, as stated in the introduction, to present, under one cover, a multidisciplinary overview of information which has relevance to marine oil spills in the Canadian Arctic and in the Labrador Sea. It was prepared by Fenco Consultants and F.F. Slaney for the Environmental Protection Service of the federal government as a project of the Arctic Marine Oil Spill Program. It is indicated that only a limited number of these atlases have been printed thus far, which is perhaps not surprising considering its size.

An effort has been made to present information over the Canadian Arctic from the Beaufort Sea to the west coast of Greenland, and south to the Labrador Sea. Hudson Bay is not treated. A loose-leaf atlas format stresses map presentation with some explanatory material inserted. Subjects covered are geology and petroleum development, meteorology and oceanography, ice, biology, and social. For overview presentation the maps are at scale 1:15,282,000 while more detailed regional information is mapped at a scale of 1:2,817,000.

In the section on geology and petroleum development, 22 sheets chart the bathymetry over the area mentioned above. The data for the smoothed display is largely from Canadian Hydrographic Service sources though, surprisingly, data from the National Office of Lands and Mapping, Hungarian People's Republic, Budapest, are used in the Foxe Basin area. Six pages are devoted to describing and mapping the shoreline features, and outlining implications of oil impingement upon them. Seventeen maps show the present extent of oil and gas lease and permit blocks. An overview of geological basins stressing those with high potential for petroleum discovery occupies one page. Three pages are devoted to descriptions of well drilling techniques, offshore structures, and present shipping routes. As a section I feel it is done rather well. Some items, such as permafrost occurrence, and sea-bed characteristics are missing.

After mapping meteorological stations the meteorological section charts values of mean air temperature and mean total precipitation for the months of January and July. Thirteen pages of graphs follow showing monthly values of mean daily minimum temperature, mean daily maximum temperature, monthly extreme maximum and extreme minimum temperature

ever recorded at that station. Graphs for all stations also show mean monthly rainfall, mean monthly snowfall, mean number of days of measurable precipitation and the maximum 24-hr precipitation recorded, by months. For the months of July to October graphs are given of monthly values of daily mean air temperatures recorded by ships in each of 33 marine areas. The number of observations is given for each grid point for each month so that some estimate of the reliability of the temperatures can be made. Twenty-one pages of wind data follow. For meteorological stations seasonal wind roses indicate percent calm, percent frequency of winds from eight directions, the mean wind speed from each direction and brief description of terrain around the station. For each marine area mentioned for temperature display, tables are given of seasonal values of percent frequency of winds from eight directions, and calm, and percent frequency of wind speeds from each direction falling in one of six speed classes. The numbers of observations available are included. These tables contain rather more information than the wind roses but are, of course, not as graphic. Wind data summaries are hard to present in a manner both useful and concise but the attempt here is fairly successful. To round out the meteorology, brief notes on storm tracks, hours of daylight, and windchill values are furnished along with monthly values of the frequency with which visibility at meteorological stations is less than 0.8 kilometres.

Oceanography begins with seven pages of graphs of the monthly mean values of the sea surface temperatures in Marsden Square quadrants. Standard deviations are furnished where the number of observations is sufficient to allow their calculation. The remainder of the oceanographic section concerns water currents. Three pages are devoted to introduction and a schematic depiction of mean flow patterns. Then follow 17 charts showing actual surface current measurements. Useful data is pitifully small, a natural result of minuscule current studies, uncoordinated in space or time. I trust this will be one of the first parts of the atlas to be improved, the information content now being very low. In contrast to all other areas the Beaufort Sea charts look impressive until one notices that the currents there are largely hypothetical. The eleven pages of sub-surface water current data that follow are even more pitiful than the surface current material. I congratulate the compilers on refraining from use of the currents derived by the "dynamic" method from density cross sections, for my personal opinion is that many of these may be suspect. In any event the current observations presented stress the

importance of tidal currents which may be very important in the short run.

The section on ice is the largest in the atlas. A two-page introduction to the subject leads into 116 pages of ice coverage of arctic waters. For the months of December to April overview or small scale maps are sufficient, the area of interest being southwest of Greenland and offshore Labrador. For the months of May through November sectional maps show monthly ice coverage in one of six divisions ranging from open water to ten tenths coverage. Shear zones are indicated. While isopleths are very much smoothed, and the whole presents a rather static picture to my mind at least these pages represent ice coverage in the area. What is missing of course is indication of ice type, thickness and so on for which data are not available. An effort is made to remedy this major deficiency by illustrating multi-year ice coverage in May and September of average and unfavourable ice years. Ten pages of material depicting iceberg distribution off Labrador by seasons are good. Three pages are devoted to iceberg distribution north of 61°N in the Davis Strait and Baffin Bay area. I was surprised at how unsymmetrical and incomplete the table showing iceberg counts in the different areas from 1964-1977 seemed, even allowing for the well-known variability in iceberg numbers.

The biological section starts with four pages of introduction and usage. The following 23 sectional charts of fisheries and marine productivity reveal the paucity of information available from most areas. Noteworthy in these charts are the isolated pockets of higher values of productivity in the central and western Arctic and the importance of the Lancaster Sound area and other parts of the eastern arctic. Eskimos lived where the sea life was, and their concentration reflected the marine resources. Twenty-one charts of sea-bird distributions again reveal the importance of the Mackenzie Delta, and the Lancaster Sound areas. The same picture is seen in the 22 regional charts of the distribution of marine mammals, polar bears and arctic foxes. I suggest that much of the material in this section forms an important synthesis of biological aspects of the area. I trust, as with other parts of the atlas, it will soon be possible to strengthen the section with more data input.

In the section called "Social", 22 pages are devoted to mapping aerodromes and listing details at each. Dewline stations and aerodromes in western Greenland are included. Forty pages are devoted to mapping and describing communities and their details throughout the area, including again west Greenland. Twenty-six pages are devoted to

delineating game and marine sanctuaries and sites of ecological importance. Why are no archaeological sites included?

The text concludes by listing references used, separated by subject.

To sum up I think that, considering financial and time constraints, this atlas meets the needs for which it was designed in good fashion. It is massive, almost 500 pages. In these it covers subjects of interest to its intended users very well. Most deficiencies exist because the basic data are simply not there. Worst in this regard I would judge ocean currents and biology details. These are areas in which marked improvement may be expected in subsequent editions of the atlas.

As to the other subjects, meteorology is treated a little cursorily but detailed treatises are newly available from the Atmospheric Environment Service. In oceanography, perhaps more on tides would help in interpreting water current displays and might

be useful where shoreline contamination is being considered. The sea ice coverage synthesis is a major effort but detailed thickness information, such as that contained in Swithinbank's ice atlas, is missing. Presumably oil activity and perhaps social sections will need continuous updating. The overall production of the atlas is good, although some parts, by the uneven density of information furnished, show signs of the haste with which the atlas was compiled.

All in all this first edition has been a noble beginning. It has met requirements of its somewhat limited clientele well. In biological and sea ice coverage its syntheses are firsts. It has no real competition except for large-scale efforts like the Atlas of Canada or specialist tracts of much more limited coverage. I hope this atlas will go through many editions and will not, like so many government projects, wither on the vine as policies and priorities veer hither and yon.

*E. R. Walker*