The two afterwords essays are obviously by lovers of wilderness areas. I like wilderness areas but I really think North America, in particular the northern part of North America, is bigger than the state of Alaska. On the other hand, I find it rather difficult to envisage a wilderness area fitting into the following vision described on pages 151 and 152. "Protected wilderness, on the other hand, can remain forever as an increasingly attractive resource that will bring hundreds of thousands of people and, with them, millions of dollars to the state of Alaska." How a wilderness area can be invaded by hundreds of thousands of people with millions of dollars and emerge still a wilderness area in my ignorance escapes me, as does the scare statement on strontium 90 on page 153 which would seem to have been written before the test ban came into existence.

If the reader wonders what the reviewer really thinks about the problems discussed in the Sierra Club battlebook, let me make my personal position clear. I think the oil reserves, whatever they are, on the north slope of North America will be developed. As an environmentalist I am determined to do everything I can to make sure that the development takes place intelligently. Where there are gaps in our knowledge on how to bring that development into harmony with proper respect for the environment, we should do the research and do it well and do it fast. As for bringing the oil out, I am opposed to the use of tankers in the Arctic and I think Humble Oil, even on the partial data they have generated through the cruises of the Manhattan, share that view. I think the building of a trans-Alaskan pipeline through the seismically active zone is unwise with the present state of technology, because according to the information I have no one knows how to build a pipeline to withstand the degree of seismic activity known to exist. Nor do they know how to design terminal facilities at Valdez to withstand the seismic activity in that area. I think the oil should come out by pipeline and I hope routes for the pipeline will be developed that will be within the capability of foreseeable pipeline technology. I am satisfied myself that if we have the determination a pipeline both for oil and gas can be built through permafrost with acceptable environmental consequences, but I am also convinced that to achieve this goal we will have to be tough minded, determined and realize that constant vigilance, inspection and enforcement will be the price we have to pay for an environment we will be proud to hand on to our children. I would hope that concerned people will take this approach because I really think that the days of St. George and the dragon belong in history and not now.

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Freshwater Fishes of Northwestern Canada and Alaska

By J. D. McPhail and C. C. Lindsey. Fisheries Research Board of Canada Bulletin No. 173. Information Canada, Ottawa. 1970. 381 p., 26 text-figures, 59 drawings and 59 spot distribution maps, 5 colored plates. $8.50.

This book describes the freshwater fish fauna of the Bering and Arctic drainages of Alaska and Canada eastward to the coast of Hudson Bay north of 60° N.L. as well as the southwestern islands of the Canadian Arctic Archipelago and St. Lawrence Island in the Bering Sea. It is divided into sections entitled *Background information* which considers history, geology, zoogeography, classification, format, and identification, *Glossary, Key to Families, Species Accounts* which form the body of the text, *Collecting and Preserving Specimens, References* (14 pp.), and *Index*.

The most valuable contribution in the introduction is the discussion of geological history and zoogeography, fields the authors have been studying over a number of years. Dominating the origin and distribution of the fish fauna is the Wisconsin glaciation, the survival in and re-invasion from 3 major refugia around the periphery of the ice sheet. The authors are well acquainted with the Pleistocene geological literature. The publication in 1969 of Geological Survey of Canada map 1257A *Retreat of Wisconsin and Recent Ice in North America,* when the manuscript was completed, does not materially change their conclusions, although it would be desirable to incorporate this map in the next edition. By analysis of glaciation, distribution, and morphological variation, often at the infrasubspecific level, the authors have been able to deduce which refugia

and dispersal routes were used. Most species, 30, dispersed wholly or in part from the Mississippi refuge, 27 from the Bering refuge, and only 19 from the Pacific refuge. None are known to have survived in the Banks Island refugium, but it is little studied. It would have been interesting to see a map of species density, the result of the interaction of the fauna with geological processes and the present environment. Unfortunately, an overall ecological picture considering the major habitats was not included. This would have acquainted the reader with the environment and helped in zoogeographic interpretation. It would also have been interesting to learn whether fish distributions were correlated with isotherms, the northern limit of the tree line, or surficial geology.

Under Classification and Nomenclature, the authors state their point of view, one which others would do well to follow in regard to genera, — moderate lumping and the acceptance of scientific name changes reluctantly and only in the face of convincing published evidence. In regard to species they favour the criterion of reproductive isolation, but then go on to say:

> "Moreover, in our area, with its complex glacial history, there may be pairs of forms that do successfully interbreed in some lakes although remaining distinct in others. In all these instances, we believe that two forms that occur sympatrically in *any* locality without introgression (i.e. without successful exchange between the two gene pools) are most conveniently treated as two distinct species; intermediate populations arising by introgression can then be labelled as hybrids between these two species."

It does not appear to the reviewer that extensive genetic interchange can be styled reproductive isolation, although post-mating mechanisms have also to be considered. The existence of a minority of non-introgressing sympatric populations might be regarded as evidence that species isolation mechanisms are evolving, but the fact that the majority of sympatric populations are introgressing would indicate the present absence of complete species isolation mechanisms. Their definition tries to predict whether the two forms *will* become species rather than determining whether the two forms *are* species at the present moment.

Cunningly the authors seem to skirt rather than wade into the muskeg, and instead of applying their definition to these situations they employ "'*Coregonus artedii*' complex" or "'*Osmerus eperlanus*' complex." Actually, being advocates of Stark's dictum, "A question would better remain in the form of a question than in the form of an incorrect answer", they are being intellectually honest in admitting that the answers are not yet known. But one hopes they will continue their studies and settle the status of these forms for non-systematists.

Family accounts are followed by excellent illustrated keys to the species. There are fifty-nine species accounts. Eighteen other species and one subspecies which range close to but have not yet been found in the study area, are included in the keys but not in the species accounts.

Most of the information in the species accounts derives from the authors' own original observations and study, making a particularly valuable contribution to the knowledge of morphology, variation, taxonomy, and zoogeography of Arctic fishes. Less is known of the biology of Arctic populations and these sections are supplemented from extralimital literature. In the species accounts the authors display extensive study of material, careful reflection, and mature consideration of alternative hypotheses.

Unlike most works of its genre *Freshwater Fishes of Northwestern Canada and Alaska* provides pleasurable reading. The sentences are free flowing, occasionally lyrical, seldom telegraphic or needlessly technical. Quotes from field notes, ichthyological classics, explorer's accounts, anthropological sources, and personal communications embellish the text. A dry sense of humour pervades the book, so much so that one suspects the researchers of perversely choosing quotations from their colleagues, ". . . a mean pike will consume annually between three and four times its mean annual weight." The editors, not to be outdone, lost the photos the authors provided of themselves and substituted one of McPhail looking like a member of the Mafia and one of Lindsey looking like a plonk-happy trapper.

The editing of this bulletin attains the usual high standards of the Fisheries Research Board in clarity, grammar, and orthography (aside from usage of char for charr). The illustrations and maps are consistently placed on the left hand page opposite the species account. The convenience of this arrangement more than makes up for the slight wastage of space. The low gloss paper reduces page glare and permits good definition in the illustrations. The choice of type face is generally good but less bold subheadings in the species accounts might have been used. Hopefully

some of the colour plates will be replaced by ones of higher quality in the next edition. The photo of Twin Glacier Lake on the dust cover and the map on the endpapers combine with the typography and text-figures to give an overall pleasing effect.

Seldom are clarity, readability and scientific worth so combined as to please both the layman and specialist. It is clearly the finest handbook to appear on any Canadian fish fauna.

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Environmental Geology: Conservation, Land-use Planning and Resource Management

By Peter T. Flawn. Harper and Row, New York. 1970. 313 p. $14.50.

Environmental geology is the study of the relationship between man and his geological habitat and more specifically is concerned with the problems man has in using the earth and the reaction of the earth to this use. Flawn does not attempt detailed coverage of this whole subject but chooses to consider primarily those aspects that are related to the urban environment or to the exploitation by the industrial society of the earth's mineral resources.

The subject is presented in a logical manner. The first two chapters present the case for the study of environmental geology and illustrate in considerable detail the range of natural and man-initiated geological problems, such as earthquakes, landslides and subsidence, with which man must deal. In chapter 3, the reader is introduced to the engineering properties of rocks and soils and to those measurements which are considered significant to civil engineering. Chapters 4, 5 and 6 which consider the earth's resources, man as a geological agent, and conservation and management constitute the most valuable part of this book.

In chapter 4 the author describes the cost and benefit to society which results from man's use of the earth's resources and considers the economics involved in the extraction of both high value materials, such as minerals, and low value earth resources, such as water and construction materials. In chapter 5 the geological consequences of urbanization and industrialization, especially the problem of wastes and waste disposal are considered in great detail. The economic and ecological thinking which has determined past and present methods of disposing of gaseous, liquid and solid wastes and the methods which are being used successfully and unsuccessfully by various cities and industries are discussed. In chapter 6 the conservation and management of resources is considered. The legal framework within which this can be performed in the United States is discussed and several examples of the weighing of alternatives are presented. Recommendations are made as to how the environmental geologist can contribute to the best use of the available resources by advocating the sequential use of certain land areas, as for example, to recommend that sand and gravel resources, which may be in short supply, be extracted before urban development makes them unavailable and requires the opening of pits at higher cost in more remote areas. This type of planning can benefit both the urban and conservation interests. This argument and indeed the whole tone of the book can be summed up by the following quote:

> "The purpose of this argument is to demonstrate to the planner and to the environmentalist that he cannot ignore the need of an industrial society to dig into the earth for materials and that however much he would like to preserve vast areas of wilderness, parks, and unscarred suburban and agricultural terrain, all of the pits, mines, and quarries cannot be relegated to someone else's area. Mineral resources are "where you find them". They must be planned around, not planned for".

In chapter 7, Flawn makes a plea for the geologist to become involved in the affairs of the community and to work at "selling" the advantages of environmental geological reports to planning agencies and engineering departments. In addition to selling the value of the report the geologist must stand ready to assist in its interpretation to the problems at hand.

In the final chapter the author provides the example of Austin, Texas, where the principles outlined in the book are currently being used in long range city planning. One of the books few weaknesses occurs at this point in that the fold-out geologic map included with the book covers