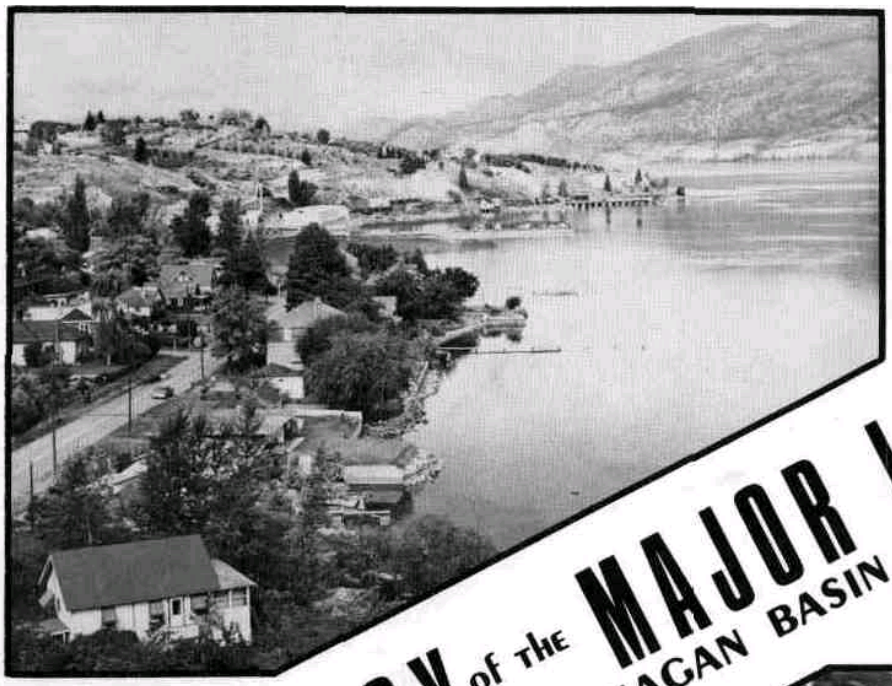
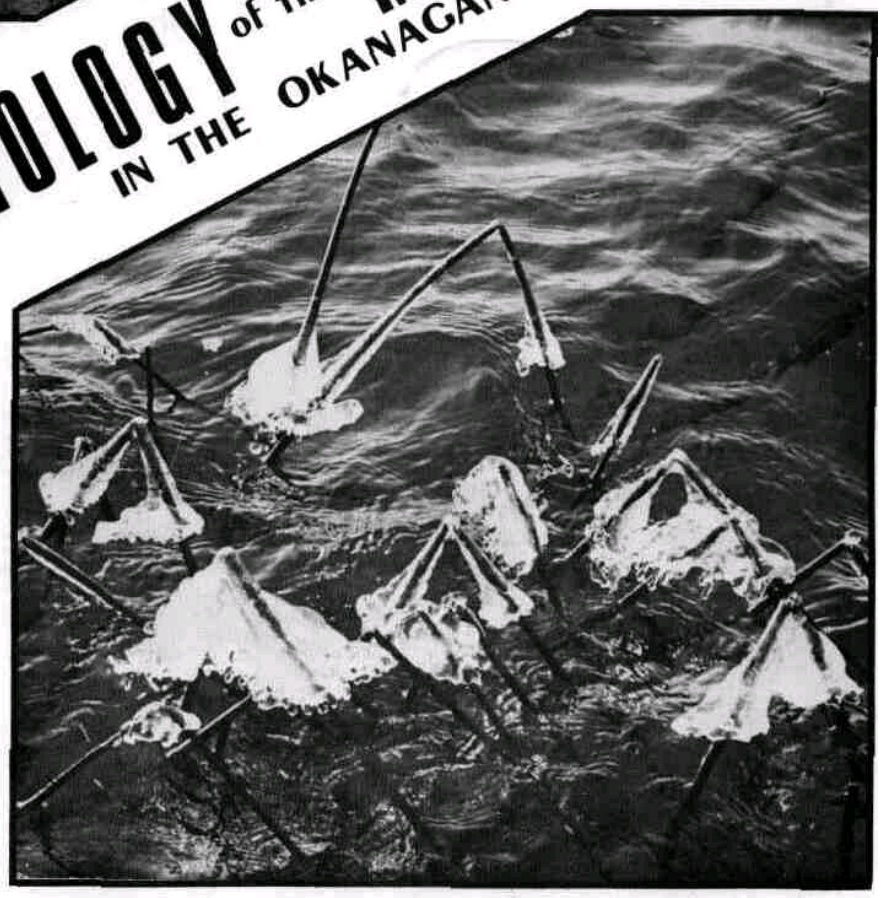
CANADA- BRITISH COLUMBIA OKANAGAN BASIN AGREEMENT

TECHNICAL SUPPLEMENT V



LIMNOLOGY of the MAJOR LAKES IN THE OKANAGAN BASIN



"the closer you look...."

MARCH 1974

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CANADA-BRITISH COLUMBIA OKANAGAN BASIN AGREEMENT

TECHNICAL SUPPLEMENT V

TO THE

FINAL REPORT

THE LIMNOLOGY

OF THE

MAJOR OKANAGAN BASIN LAKES

PUBLISHED BY

OFFICE OF THE STUDY DIRECTOR

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THE CONTRIBUTION OF THE FOLLOWING PEOPLE IN
THE PREPARATION OF THIS TECHNICAL SUPPLEMENT

COMPILATION

Morley E. Pinsent
B.C. Fish & Wildlife Branch
Department of Recreation & Conservation
Victoria, B.C.

John G. Stockner
Pacific Environment Institute
Department of the Environment, Canada
North Vancouver, B.C.

CONTRIBUTING AUTHORS

T.G. Northcote, Gordon Halsey and S. MacDonald
(Mainstem fisheries)
B.C. Fish and Wildlife Branch, Victoria, B.C.

B. St. John (Limnogeological Studies)
C.C.I.W., I.W.D., Environment Canada

J. Blanton and H.Y.F. Ng, (Physical Limnology)
C.C.I.W., I.W.D., Environment Canada

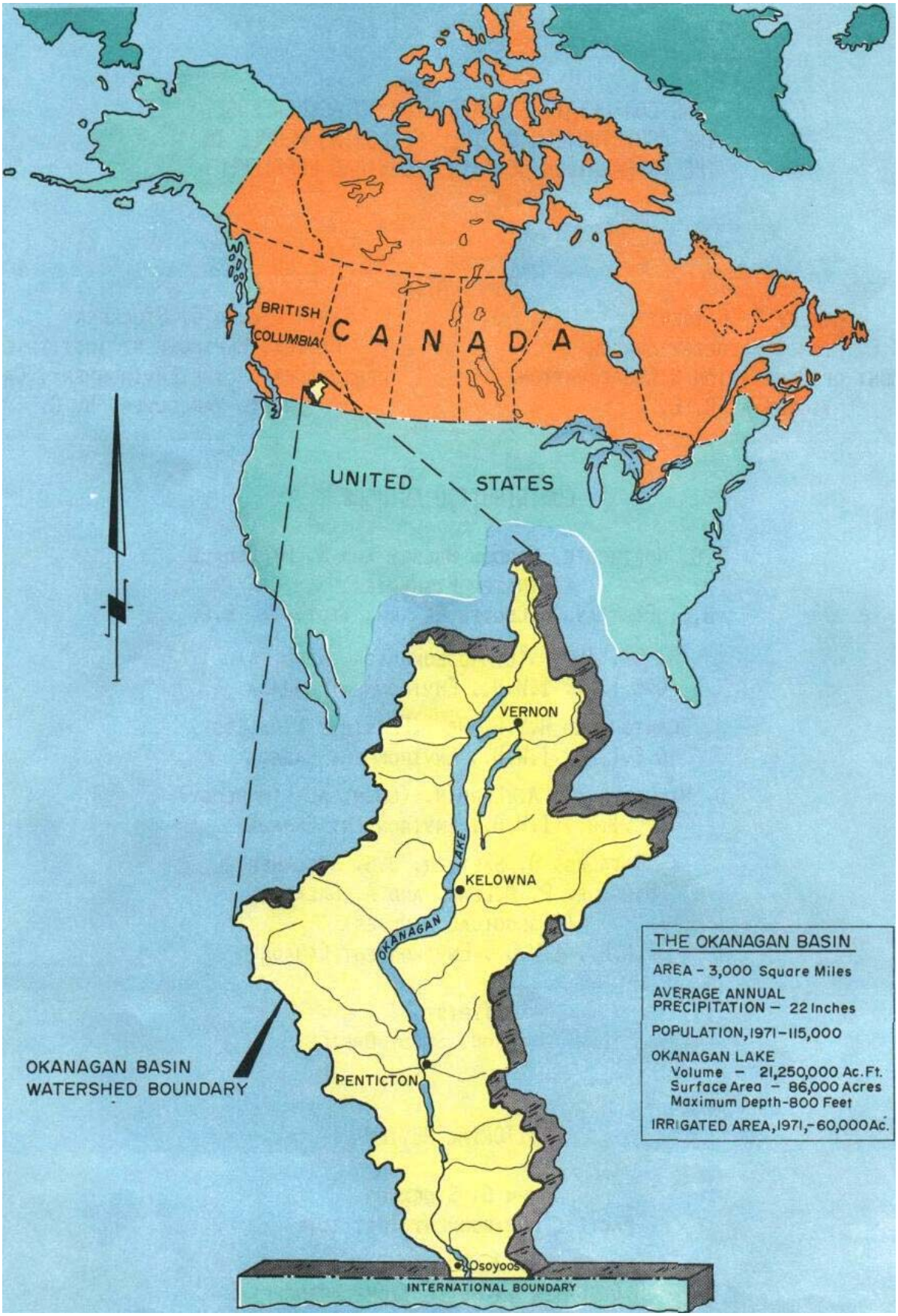
D. Williams and A. Lerman, (Chemical Limnology)
C.C.I.W., I.W.D., Environment Canada

K. Patalas, O. Saether, J.G. Stockner,
Margaret P. McLean, and A. Salki,
(Biological Studies)
F.R.B, I.W.D., Environment Canada

Typist
L.W. Jackson, Study Office

EDITORIAL REVIEW

John G. Stockner
Pacific Environment Institute
R.J. Buchanan
B.C. Water Investigations Branch
A. Murray Thomson
Study Director



THE OKANAGAN BASIN

IN

BRITISH COLUMBIA - CANADA **Figure A**

FOREWORD

This Technical Supplement describes and presents the results of limnological research on the main valley lakes as carried out under the Canada-British Columbia Okanagan Basin Agreement. The results of associated studies on water quality, and waste treatment for the control of nutrient discharges, are covered in Technical Supplements IV and VI respectively. The presentation and discussion of alternatives concerning limnology is confined to the main report.

The material presented in this supplement supercedes that of all earlier preliminary reports or publications prepared under the terms of reference of the Agreement.

A. Murray Thomson
Study Director

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GLOSSARY OF TERMS

Algae	Chlorophyll-bearing plants – some are planktonic and others are filamentous and attached
Aquatic	Living in Water
Benthos	Plants or animals living on the lake bottom
B.P.	Before Present time
Chironomids	Aquatic benthic insects (midges)
Epilimnion	Upper region of warm circulating lake water during summer period
Eutrophic	Nutrient-rich lake, high biological production
Fauna	Animals
Flora	Plants
Hypolimnion	Deep, cold and relatively undisturbed region of lake in summer period
Lake overturn	Period of complete mixing, in most lakes occurring in winter and spring
Limnology	The study of bodies of fresh water in all their aspects
Littoral zone	The submerged shoreline of lakes supporting plant growth
Lock-in nutrients	Nutrient elements which have formed a bond with bottom sediments and which prevents their recycling (occurs only in well-oxygenated lakes).
Macrophytes	Aquatic rooted vegetation
Mesotrophic	Moderate nutrient concentration and production
Metalimnion (Thermocline)	Water layer of rapidly decreasing temperature between the epilimnion and the hypolimnion
NO_3 (N)	Nitrate Nitrogen
Nutrient elements	Elements essential for the growth and reproduction of plant and other simple forms of aquatic life. The most critical nutrient elements (those most often in short supply) are nitrogen and phosphorus
Oligochaetes	Benthic Segmented worms
Oligotrophic	Nutrient-poor lake, low biological production
Periphyton	Attached aquatic algae
Photic zone	Limit of light penetration, zone of biological production

Phytobenthic Communities	Plant populations at bottom of lakes
Plankton	Microscopic floating or drifting plant and animal life of the sea or lakes
PO_4 (P)	Phosphate Phosphorus
Salmonids	Any fish of the Trout-Salmon family
Secchi Depth	Lake transparency as measured by extinction of a 22 cm. (8″) white disc.
Zoobenthic Communities	Animal populations at bottom of lakes

CHAPTER 1

Introduction

1.1 RATIONALE

It would seem fitting, and necessary that Limnology: "the study of physical, chemical, meteorological and biological conditions in fresh waters" (Grove, 1973), should play a role in the Okanagan Basin Study.

Limnology is an essential part of most water body examinations in that it is the tool needed to determine the present trophic state of waters, a basis for future planning and management.

Many attributes and functions, of life in the Okanagan Basin affect and are affected by the trophic state of the basin lakes (Figure 1.1). Limnological study then, is in this case a descriptive exercise to provide a firm data base for water planning and management in the Okanagan main valley lakes. It provides a historical perspective of the lakes as well as an analysis of the dynamic state of the lakes.

The general objective of the limnology program was to provide a broad characterization of the main valley lakes with a view to determining the cause of apparent water quality deteriorations. Based on the knowledge gained from this study, standards were also established with respect to the annual phosphorus load each of the main valley lakes can assimilate.

1.2 APPROACH

As with the entire study, the limnology program was carried out through a series of defined tasks. Major limnology tasks, agency and personnel responsibilities are outlined in Appendix A, Data summaries for each of the major fields of study are detailed in Appendices B to H.

This technical supplement is an attempt to integrate the separate tasks and manuscript reports pertaining to limnology into an overview of the trophic state of each lake and situations pertaining thereto. Due to the organization of tasks and specialities of sundry investigators, it has been necessary to first organize the supplement in a way which presents specific aspects (i.e. geology, chemistry, etc.) of all lakes and then integrate these in the final chapters.

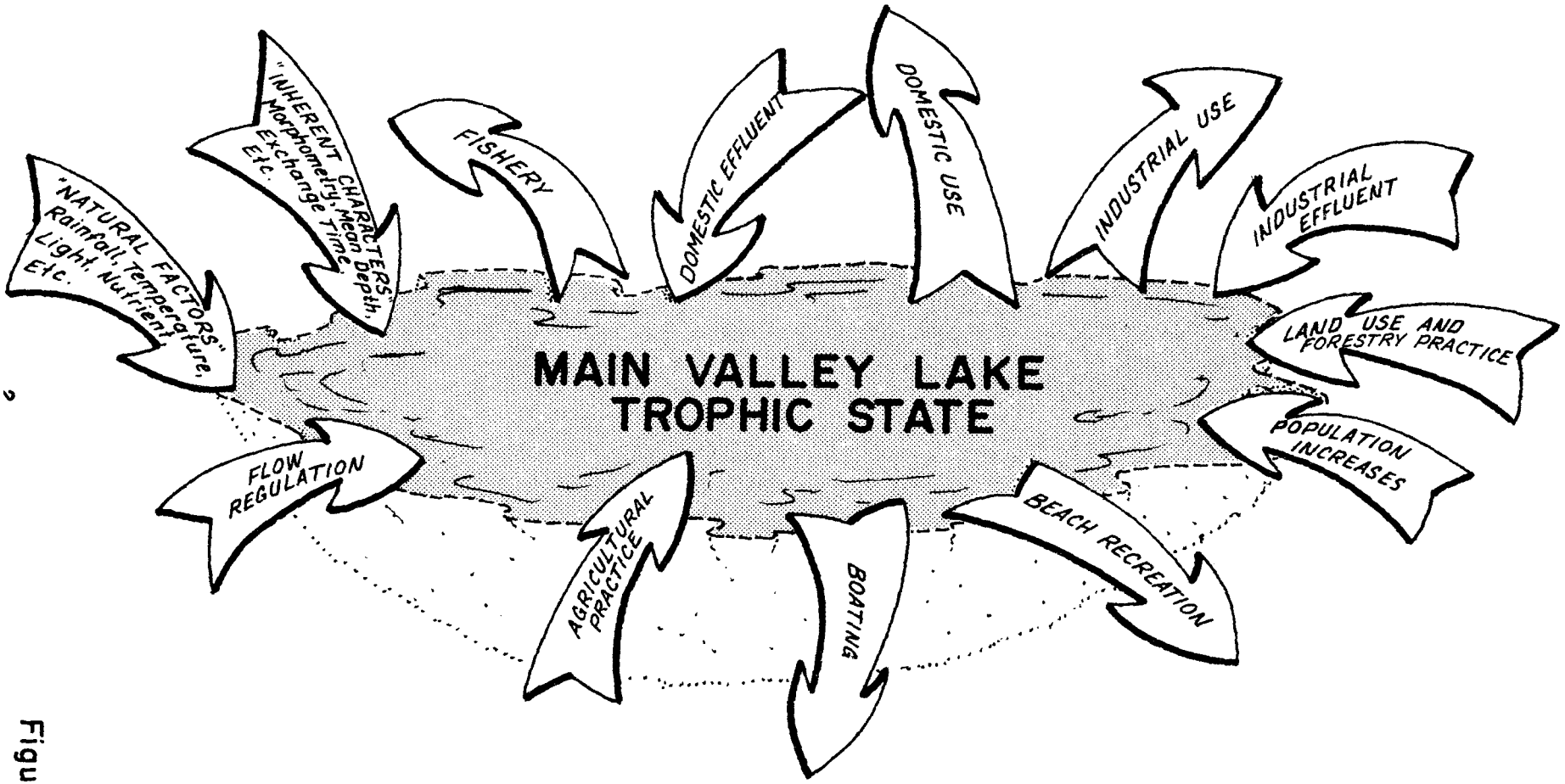

Figure 1.1

SCHEMATIC REPRESENTATION of HUMAN FACTORS AFFECTING (INPUTS) and AFFECTED BY (OUTPUTS) THE TROPHIC STATE of the OKANAGAN MAIN VALLEY LAKES.

1.3 SCOPE

The limnology program adopted a wide scope in an attempt to get as complete an impression as possible of the limnological state, trophic condition and factors affecting the main valley lakes.

Geological studies centered on basin structure, sedimentation rates and paleolimnological survey. These studies present the history of the main valley lakes on a geologic time scale as well as giving valuable indications of more recent man influenced changes in the lakes.

Physical studies provided data on lake morphometry, temperature series, heat content, light transmittance and water transparency. Character of the Okanagan River plume as it enters Skaha Lake was also examined. Chemical studies measured oxygen, nutrient and major ion concentrations in the lake waters.

Biological studies involved nutrient bioassay; phytoplankton, periphyton and aquatic macrophyte studies as well as zooplankton, bottom fauna and fish studies. Biological studies actually represent an examination of the end product of the physics, chemistry, geology and meteorology of waters since the trophic state of a lake as expressed by densities and varieties of biota, is dependent upon these non-living aspects of a particular water. The expression of a particular trophic state in a lake by its biota is usually the factor most affecting people's use of that water. By understanding the flora and fauna of a lake and the critical factors regulating its life processes, the key to controlling it for man's benefit is provided.

The Okanagan main valley lakes have been subject to limnological study prior to the inception of the Canada-British Columbia Okanagan Basin Agreement. Specifically oriented studies are referred to in the appropriate sections where a more detailed review can be accorded them. In 1935, Rawson conducted a general limnological survey of Okanagan, Wood, Ellison and Kalamalka Lakes, which provided a basis for later studies. This study was part of a more extensive survey conducted to determine the condition of some of the lakes as a scientific basis for development of a comprehensive fish culture program (Clemens, *et al*, 1939). Sismey (1921) collected algae from a number of Okanagan Valley lakes as part of a floristic survey of central interior B.C.