CANADA BRITISH COLUMBIA – OKANAGAN BASIN AGREEMENT

PRELIMINARY REPORT N0.22

(SUBJECT TO REVISION)

Fish as Indicators of Water Quality in the Okanagan Basin Lakes, British Columbia

PREPARED FOR THE
OKANAGAN STUDY COMMITTEE

CANADA - BRITISH COLUMBIA OKANAGAN BASIN AGREEMENT

TASK 115

Fish as Indicators of Water Quality in the Okanagan Basin lakes, British Columbia

by

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N O T I C E

This report was prepared for the Okanagan Study Committee under the terms of the Canada-British Columbia Okanagan Basin Agreement. The information contained in this report is preliminary and subject to revision. The Study Committee does not necessarily concur with opinions expressed in the report.

Office of the Study Director
Box 458, Penticton, B.C.

Published
September, 1972

ABSTRACT

The abundance, growth rate, and composition of fish species in the major Okanagan Basin Lakes was documented and evaluated during 1971. The results of this study will be used along with other limnology task findings to provide an overall assessment of the current ecology and trophic state of the five Okanagan mainstem lakes.

Associated studies reviewed in this report include an assessment of the present abundance of kokanee spawning stocks, and the levels of chlorinated hydrocarbons, heavy metals, and other contaminants found in various fish species.

TABLE OF CONTENTS

SUMMARY AND CONCLUSIONS i

INTRODUCTION 3

METHODS ..... **Error! Bookmark not defined.**

FISH SAMPLING ..... **Error! Bookmark not defined.**

Lake Netting And Beach Seining ..... **Error! Bookmark not defined.**

KOKANEE SPAWNER ENUMERATION ..... **Error! Bookmark not defined.**

Stream Spawners ..... **Error! Bookmark not defined.**

Shore Spawners ..... **Error! Bookmark not defined.**

PESTICIDE AND HEAVY METAL ANALYSES ..... **Error! Bookmark not defined.**

Sampling Procedure ..... **Error! Bookmark not defined.**

Analytical Methods ..... **Error! Bookmark not defined.**

RESULTS ..... **Error! Bookmark not defined.**

ATTRIBUTES OF FISH POPULATIONS ..... **Error! Bookmark not defined.**

Species Composition ..... **Error! Bookmark not defined.**

Relative Abundance ..... **Error! Bookmark not defined.**

1. Within-lake comparisons, 1971 .. **Error! Bookmark not defined.**

2. Between-lake comparisons, 1971 .. **Error! Bookmark not defined.**

3. 1948 to 1971 comparisons ..... **Error! Bookmark not defined.**

(a) Skaha Lake ..... **Error! Bookmark not defined.**

4. 1935 to 1971 comparisons ..... **Error! Bookmark not defined.**

(a) Wood and Okanagan lakes ..... **Error! Bookmark not defined.**

Length-Frequency Distribution ..... **Error! Bookmark not defined.**

1. Within-lake comparisons, 1971 ... **Error! Bookmark not defined.**

2. Between-lake comparisons, 1971 .. **Error! Bookmark not defined.**

3. Between-year comparisons ..... **Error! Bookmark not defined.**

Weight-Length Relationships ..... **Error! Bookmark not defined.**

1. Within-lake comparisons, 1971 ... **Error! Bookmark not defined.**

2. Between-lake comparisons, 1971 .. **Error! Bookmark not defined.**

3. Between-year comparisons ..... **Error! Bookmark not defined.**

Age-Length Relationships ..... **Error! Bookmark not defined.**

1. Within-lake comparisons, 1971 ... **Error! Bookmark not defined.**

2. Between-lake comparisons, 1971 .. **Error! Bookmark not defined.**

3. Between-year comparisons ..... **Error! Bookmark not defined.**

KOKANEE SPAWNING ENUMERATION ..... **Error! Bookmark not defined.**

Stream Spawners ..... **Error! Bookmark not defined.**

Shore Spawners ..... **Error! Bookmark not defined.**

PESTICIDE AND HEAVY METAL ANALYSES ..... **Error! Bookmark not defined.**

DISCUSSION..... **Error! Bookmark not defined.**

FISH AS INDICES OF EUTROPHICATION ..... **Error! Bookmark not defined.**

STREAM AND SHORE SPAWNING KOKANEE ..... **Error! Bookmark not defined.**

PESTICIDES AND HEAVY METALS ..... **Error! Bookmark not defined.**

ACKNOWLEDGEMENTS..... **Error! Bookmark not defined.**

REFERENCES..... **Error! Bookmark not defined.**

APPENDICES..... **Error! Bookmark not defined.**

LIST OF FIGURES AND TABLES

Figure 1 The Okanagan basin study lakes showing location and depth profiles for the standard netting stations, as well as position of the gill nets (⊥) set at regular depth intervals offshore..... 3

Figure 2 Catch of fish in standard net sets at designated stations in Okanagan basin lakes, 1971..... 15

Figure 3 Evening echo sounder traces at designated stations in the Okanagan basin lakes in summer, 1971..... 16

Figure 4 Number of "targets" (fish marks) counted on evening echo sounder profiles at designated stations in Okanagan basin lakes, 1971..... 17

Figure 5 Catch in standard gill net sets at designated stations (averaged for combinations shown) of seven species of fish common to the Okanagan basin lakes, 1971..... 19

Figure 6 Length characteristics (based on 10 mm class intervals) of fish taken at standard net sets from Okanagan basin lakes at designated stations (arranged from uppermost to lowermost in the drainage system), 1971..... 27

Figure 7 Average (•) and range (⟷) in length of fish caught by standard net sets in Skaha Lake (Station N) in summer 1971 (upper) and 1948 (lower) 29

Figure 8 Average (•) and range (⟷) in length of peamouth chub caught by standard gill net sets in Wood Lake and Okanagan Lake (Stations K, M) in summer, 1971 (upper) and 1935 (lower) 31

Figure 9 Typical weight-length regressions for selected species of fish from the Okanagan basin lakes..... 33

Figure 10 Weight-length regression of Okanagan Lake rainbow trout..... 35

Figure 11 Average size of different age groups of four Okanagan basin lakes salmonoids in 1971..... 36

Figure 12 Average and range (vertical lines) in length for designated age groups of Skaha Lake fish in 1948 (o) and 1971 (•)..... 38

Figure 13 Average and range (vertical lines) in length for designated age groups of Okanagan Lake fish in 1935 (o) and 1971 (•}..... 40

Figure 14 Average and range (vertical lines) in length for the first six age groups of Okanagan Lake rainbow trout for three time periods..... 41

Figure 15 Spawning habitat and estimated populations of spawning kokanee in the Okanagan basin lakes and streams in 1971..... 44

Table 1	Species[1] of fish taken from Okanagan basin lakes at designated stations[2] during the 1971 survey.....	11
Table 2	Number of fish taken in combined spring, summer and autumn (standard) net sets at designated stations in Kalamalka, Okangan and Skaha lakes.....	12
Table 3	Differences[1] in relative abundance of species caught in standard net sets in Okanagan basin lakes, 1971...	21
Table 4	Number of fish taken in standard summer net sets near designated stations in Skaha Lake, 1948 and 1971.....	23
Table 5	Number of fish taken in standard summer net sets near designated stations in Wood and Okanagan lakes, 1935 and 1971.....	25
Table 6	Average age of four salmonoids caught in standard gill net sets in Okanagan basin lakes, spring-autumn, 1971.....	42
Table 7	Differences in minimum number of years which Okanagan basin rainbow trout reside in streams before lake entry (based on scale reading evidence)	43
Table 8	Mean concentration and range of total DDT in muscle tissue of mountain whitefish (Wood Lake), rainbow trout (Okanagan Lake) and kokanee (Skaha Lake) collected in 1970.....	48
Table 9	Concentration (parts per million wet tissue weight) of heavy metals and chlorinated hydrocarbons in samples of fish musculature, including skin and adipose tissue, in fish from Okanagan Basin lakes....	49
Table 10	Concentration (parts per million wet tissue weight) of heavy metals and chlorinated hydrocarbons in samples of fish musculature in fish from Okanagan Basin lakes.....	53
Table 11	A comparison of ranges of heavy metal and total DDT concentrations in rainbow trout from some headwater and main-basin Okanagan lakes.....	53
Table 12	Matrices of weighted scores developed to compare six Okanagan basin lakes using four attributes of their fish populations in 1971 as indices of eutrophication.....	56

SUMMARY AND CONCLUSIONS

1. Four attributes of fish populations - relative abundance, average length, weight-length regression, and growth rate were used together with other of their characteristics as indices of eutrophication of Okanagan basin lakes.

2. All point towards Skaha Lake as now being the most eutrophic followed by Osoyoos and Vaseux. Kalamalka would seem the least eutrophic and then Okanagan.

3. Changes in the four attributes and other characteristics of the fish populations suggest a marked increase in eutrophication of Skaha Lake since 1948 but little change in Okanagan Lake since 1935.

4. Although Wood Lake now ranks nearly as low as Kalamalka in eutrophication index, several lines of evidence suggest that it has reached this position after passing through a more eutrophic state with respect to its fish populations.

5. In 1971 approximately half a million kokanee spawned in streams tributary to the Okanagan basin lakes, 77% in Okanagan, 12% in Kalamalka, 7% in Skaha tributaries.

6. In 1971 approximately half a million kokanee spawned along special sections of Okanagan Lake shoreline, mostly at depths less than 2 meters (6 feet). Apparently none shore-spawned in any of the other basin lakes.

7. For most lakes, availability of suitable spawning habitat, rather than water quality of the lakes seemed to determine abundance of kokanee spawners.

8. In 1971, 15 out of 107 analyses, representing 50 out of 671 fish sampled from the basin lakes, exceeded 5.0 ppm total DDT - the allowable limit for human consumption. Very high concentrations (15 - 50 ppm) were recorded in large rainbow trout from Kalamalka Lake; high concentrations occurred in Kalamalka mountain whitefish and Okanagan rainbow trout; most other species examined from the basin lakes contained relatively low DDT concentrations.

9. In 1971, 7 out of 107 analyses, representing 10 out of 671 fish sampled from the basin lakes, exceeded heavy metal limits set for human consumption. High concentrations of mercury (0.52 - 1.79 ppm) were found in some rainbow trout and squawfish from Okanagan, Skaha and Osoyoos lakes; most other species examined from the basin lakes contained relatively low heavy metal concentrations.

10. Levels of pesticides and heavy metals found in Okanagan basin fish probably have deleterious effects on their reproduction and survival.

INTRODUCTION

The objectives of this study, "Task 115 – Fish Population and Analysis", under the Limnology Task Force of the Canada - British Columbia Basin Agreement, were to (1) use fish to assess the present status of eutrophication and pollution in the major Okanagan basin lakes; (2) estimate present abundance of kokanee spawning stocks; and (3) check selected species of fish for chlorinated hydrocarbons, heavy metals and other possible contaminants.

That fishes respond to changes in the trophic nature of their environment has long been known, but their use as indices of eutrophication has only recently been considered (Larkin and Northcote, 1969). Limitations in their use arise from their position near or at the top of the food chain (making them often the last and perhaps least affected), their mobility, and their flexibility and variability in feeding, growth and other population parameters. Nevertheless they do attract a significant focus of public attention and concern, especially when dead; they often have had some background of previous study, either in the specific field situation or the laboratory; finally, they may serve as convenient summators, temporally, spatially or both, of the more general effects of eutrophication. Characteristics of fishes which reflect changes in their environment include the relative abundance of species, their length-frequency distribution, their length-weight relationship, and their growth rate. To this end, fish were studied as indices of eutrophication by making comparisons between major lakes of the Okanagan basin at the present time. Then, where possible, comparisons were made over long periods of time within particular lakes.

In the time available it was not possible to obtain reliable population estimates for any of the fishes except kokanee. Because this species at maturity congregates in the autumn, either in streams or

along lakeshores, it is relatively easy to make estimates of the spawning component of the various populations.

Because of the considerable public concern over pesticides and heavy metals, particularly mercury, in sport fishes of the Okanagan basin – a partial ban on eating large trout already had been placed on Okanagan Lake - it seemed logical to broaden the information available in this area. The ability of fish to concentrate some natural and foreign materials from their surrounding environment enables us to view changes in the environment before they become catastrophic or unmanageable. Species for analysis were selected firstly on the basis of their importance as sport fish and utilization for human consumption. Others then were added which might become important in the future or which by their predatory nature might be expected to better exhibit exposure to contaminants.