FRI-UW-7416
December 1974

# ACOUSTIC SURVEYS OF LAKE WENATCHEE AND LAKE OSOYOOS IN 1974

by

Richard E. Thorne

and

James J. Dawson

FINAL REPORT

Service Contract No. 575
State of Washington Department of Fisheries

1974

FRI-UW-7416
December 1974

Fisheries Research Institute
College of Fisheries
University of Washington
Seattle, Washington 98195

# ACOUSTIC SURVEYS OF LAKE WENATCHEE AND LAKE OSOYOOS IN 1974

by

Richard E. Thorne

James J. Dawson

FINAL REPORT

Service Contract No. 575
State of Washington Department of Fisheries

1974

Approved

Submitted: December 20, 1974

Director

TABLE OF CONTENTS

# ACOUSTIC SURVEYS OF LAKE WENATCHEE AND LAKE OSOYOOS IN 1974

## INTRODUCTION

Acoustic surveys have been conducted in Lake Wenatchee since 1972 and for the past two years in Lake Osoyoos. The surveys in both 1973 and 1974 were supported by the Washington Department of Fisheries. Results of the surveys in 1974 are presented in this report.

## MATERIALS AND METHODS

The procedures used in 1974 were essentially the same as the previous year (Dawson, Thorne, and Traynor, 1973). The surveys were conducted both before and after sockeye salmon smoltification in order to estimate the juvenile sockeye salmon populations from the difference in the total populations. Surveys of Lake Wenatchee were conducted on 26 March and 29 May. Surveys of Lake Osoyoos were conducted on 25 March and 28 May.

The acoustic data collection system was the same as that used in 1973. Technical descriptions of the system are given in Thorne, Nunnallee, and Green (1972) and Nunnallee (1973).

Transect locations in Lake Osoyoos were modified from the previous year in order to allocate more efficiently the survey effort over the areas of maximum abundance. A series of 10 transects were surveyed in Lake Osoyoos during March, including six in the Northern Basin (Fig. 1). A series of 12 transects were surveyed in Lake Osoyoos during May, including eight in the Northern Basin. The transect design in Lake Wenatchee for both months was essentially the same as that run the previous year (Fig. 2).

The acoustic data analysis techniques were the same as those used in 1973 and described previously. The data were analyzed with a digital echo integration system and calibrated by comparison with echo counts and sampling volume measurements (Thorne, 1972). The echo target strength distribution was obtained by the method of Craig and Forbes (1969).

## RESULTS

### Lake Wenatchee Surveys

The distribution of target strengths in Lake Wenatchee in March and May are given in Fig. 3. As in 1973, there was a major increase in the proportion of small targets in May. The total population estimate in March was 1.8 million fish, of which 0.9 million had target strengths greater than -54 dB, which theoretically corresponds to a minimum length of about 50 mm. The total population increased to 3.0 million fish in May, but the number of fish with target strengths greater than -54 dB decreased by 0.5 million. The vertical distributions for the two periods are illustrated in Fig. 4. As in 1973, the depth of maximum abundance decreased between the two sampling dates.

Lake Osoyoos Surveys

The target strength distribution in Lake Osoyoos in March was similar to that in Lake Wenatchee for the same period. The total population estimate was 2.0 million of which 1.0 million had target strengths greater than -54 dB. The target strength distribution in May varied considerably among the transects. In order to determine the relative magnitudes of the small and large components, it was necessary to count specifically the number in each size class in most of the transects. The total population increased to 2.1 million, but the large component decreased by 0.6 million.

## DISCUSSION AND CONCLUSIONS

The size distribution of fish targets in Lake Wenatchee changed dramatically between the two survey dates. This phenomenon was also noted in 1973 and probably reflects overlap in the time of lake residency for consecutive year classes. The separation between large and small targets was not as apparent in 1974 as in 1973, probably reflecting imprecision in the technique. The presence of small targets in March 1973 may have been masked by the predominance of large targets. The target strength of -54 dB still seems to be a reasonable value for separation of large and small categories. A similar shift in target size was noted in Lake Osoyoos, but the relative numbers of each size varied tremendously among the transects, greatly complicating the sampling procedure.

The decreases in large targets between March and May in both lakes appear to be reasonable as estimates for sockeye salmon smolt magnitudes, whereas the values obtained in 1973 appear high. The precision of the method for estimating juvenile sockeye salmon smolts is affected by variability in both the estimates of total population and of size distribution, for each of two surveys. Thus the estimates are affected by errors from four sources. It appears unlikely that the method has sufficient precision to serve as an accurate forecast of future adult sockeye returns. The surveys probably result in reasonably accurate estimates of total population magnitude with a rough indication of fish sizes. Thus their value may be limited to their usefulness as a general index of the productivity of the lakes.

The target strength analysis appears to lack the necessary precision for accurate definition of the size structure of the population. The difficulties in the method are compounded by the radical shifts in size distributions noted among the various transects in Lake Osoyoos during May 1974. Since the general size structures for the two dates are reasonably well defined, more accurate definition of the large and small fish components may be obtained by direct counts at two thresholds. Although this method is presently time-consuming, automatic counting systems could be developed at reasonable cost.

## LITERATURE CITED

Craig, R., and S. Forbes. 1969. Design of a sonar for fish counting. Fisk Dir. Skr. Ser. Haunnders, 15:110-219.

Dawson, J., R. Thorne, and J. Traynor. 1973. Acoustic surveys of Lake Wenatchee and Lake Osoyoos in 1973. Univ. Washington Fish. Res. Inst. Report 7315. 18 pp.

Nunnallee, E. 1973. A hydroacoustic data acquisition and digital data analysis system for the assessment of fish stock abundance. Univ. Washington Fish. Res. Inst. Circ. 73-3. 47 pp.

Thorne, R. 1972. Hydroacoustic assessment of limnetic feeding fishes. *In*: J. F. Franklin, L. J. Dempster, and R. H. Waring [eds.], Proceedings, Research on Coniferous Forest Ecosystems, A Symposium, Pp. 317-322. USDA Forest Serv., Portland.

Thorne, R., E. Nunnallee, and J. Green. 1972. A portable hydroacoustic data acquisition system for fish stock assessment. Wash. Sea Grant Publ. 72-4. 14 pp.

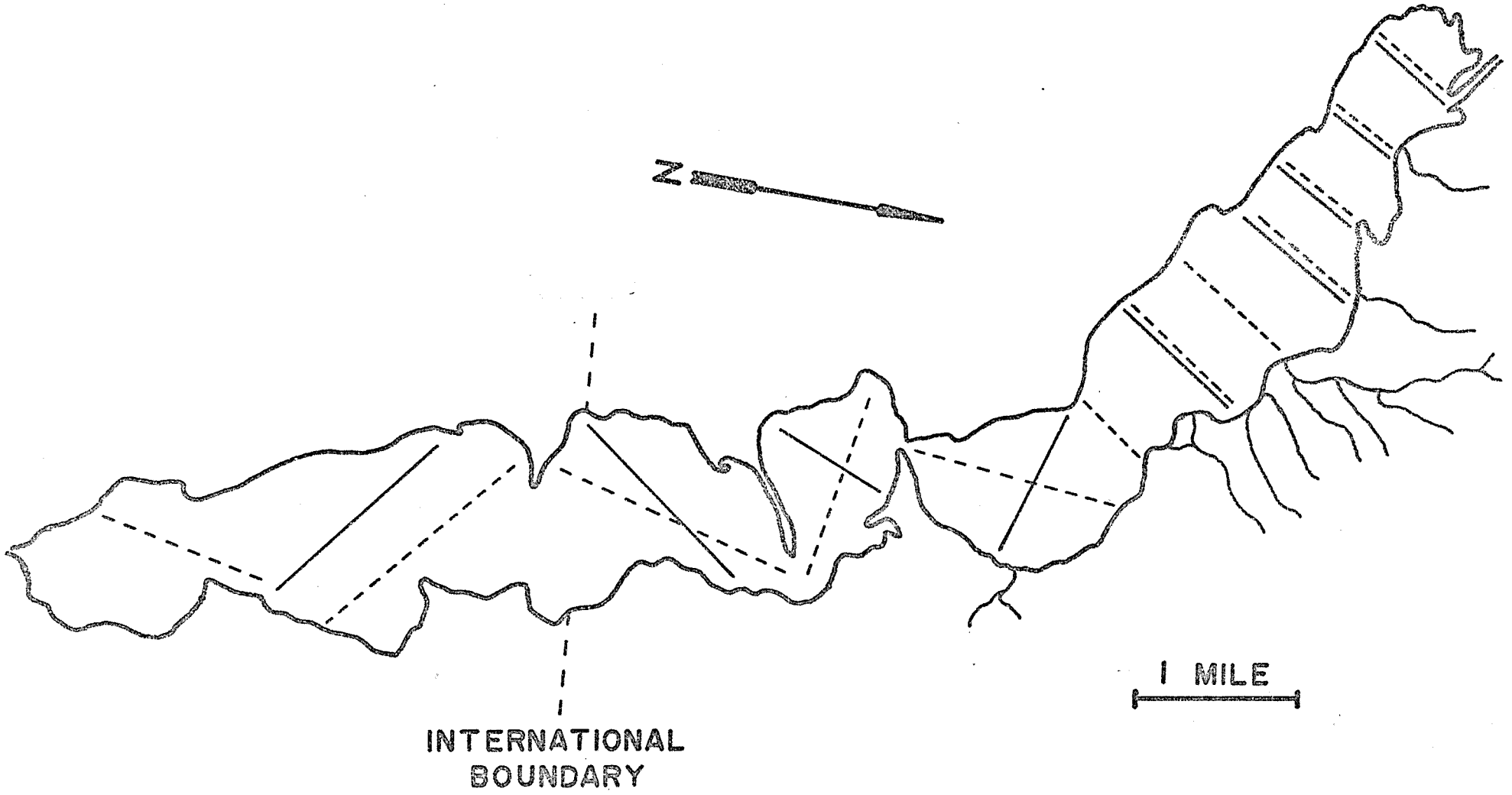


Fig. 1. Location of transects on Lake Osoyoos during March (solid lines) and May (dashed lines) 1974.

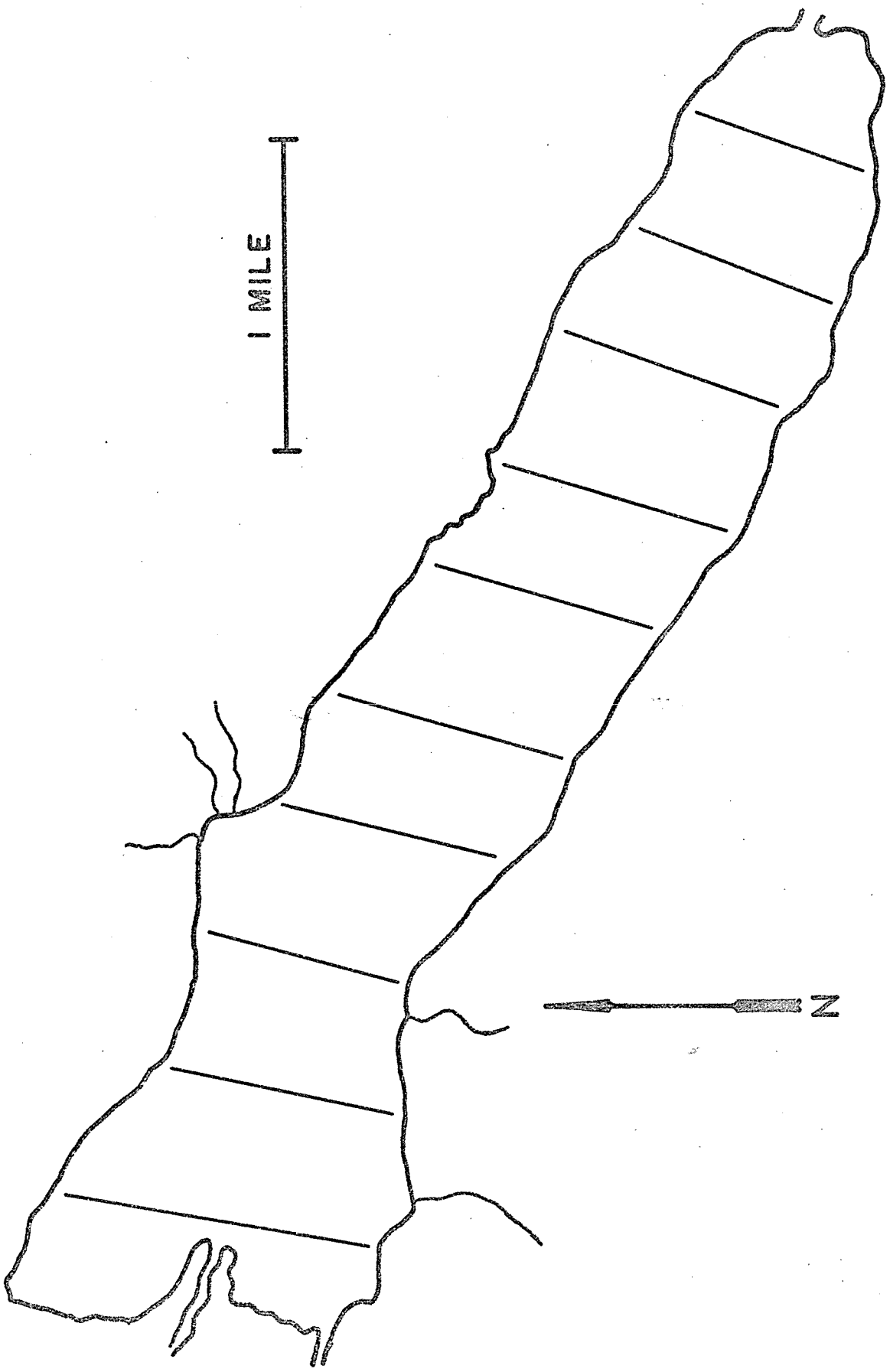


Fig. 2. Location of transects on Lake Wenatchee.

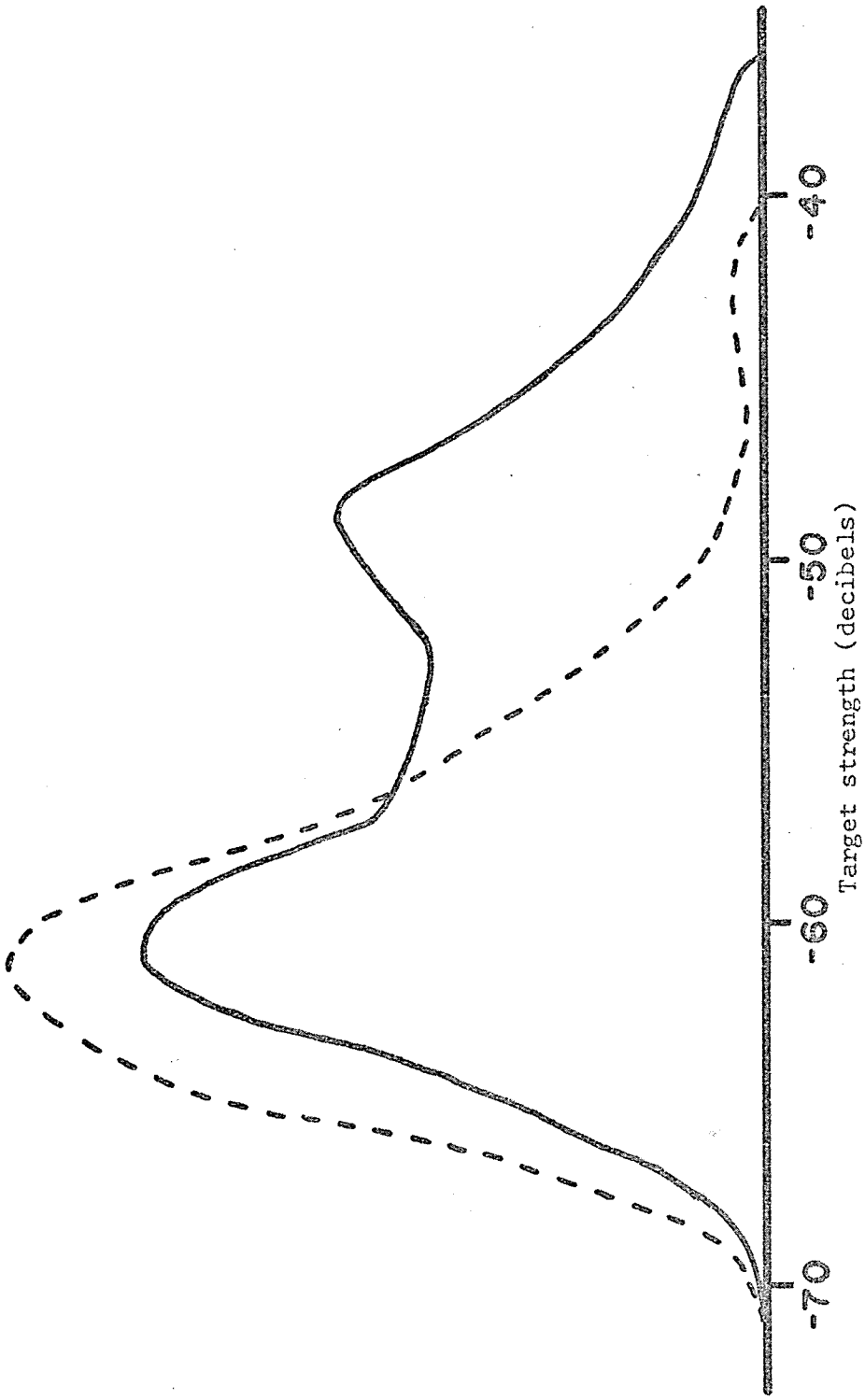


Fig. 3. Distribution of acoustic target strengths in Lake Wenatchee from surveys in March (solid line) and May (dashed line) 1974.

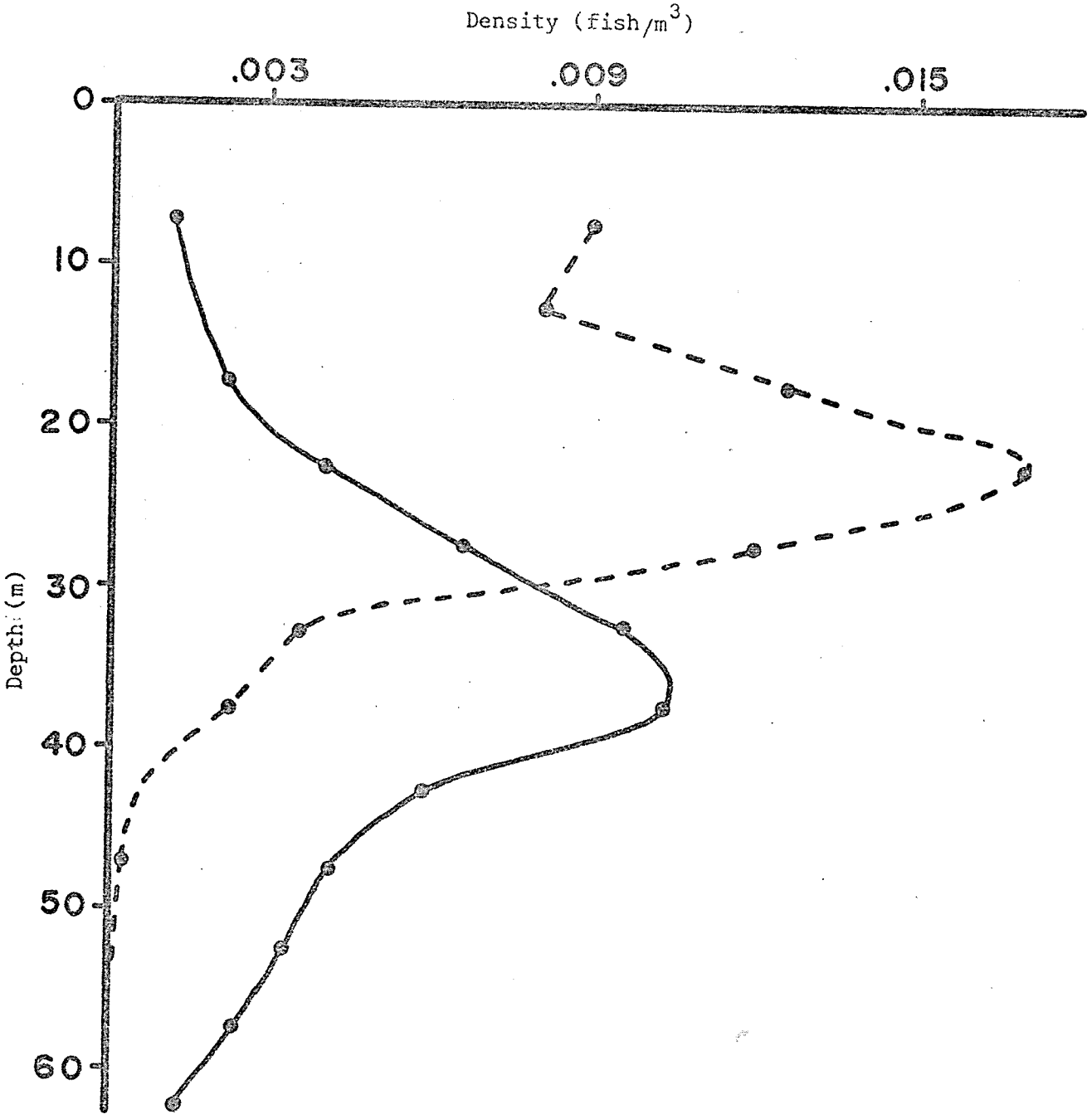


Fig. 4. Vertical distributions of fish in Lake Wenatchee during March (solid line) and May (dashed line) 1974.