

Volume 4

ARLIS
Alaska Resources
Library & Information Services
Anchorage, Alaska

1962-1963

SH
11
.A73
A4
v. 4

STATE OF ALASKA

William A. Egan, Governor



ANNUAL REPORT OF PROGRESS, 1962 - 1963

FEDERAL AID IN FISH RESTORATION PROJECT F-5-R-4

SPORT FISH INVESTIGATIONS OF ALASKA

Alaska Department of Fish and Game

Walter Kirkness, Commissioner

E. S. Marvich, Deputy Commissioner

Alex H. McRea, Director

Sport Fish Division

Richard Haley, Coordinator

INTRODUCTION

This report of progress consists of Job Segment Reports from the State of Alaska Federal Aid in Fish Restoration Project F-5-R-4, "Sport Fish Investigations of Alaska".

The project is composed of 25 separate studies designed to evaluate the various aspects of the State's recreational fishery resources. While some studies are of a more general nature and deal with gross investigational projects, others have been developed to evaluate specific problem areas. These include studies of king salmon, silver salmon, grayling and State Access requirements. The information gathered will provide the necessary background data for a better understanding of local management problems and development of future investigational studies.

The assembled progress reports may be considered fragmentary in many respects due to the continuing nature of the respective studies. The interpretations contained therein, therefore, are subject to re-evaluation as work progresses and additional information is acquired.

JOB COMPLETION REPORT

RESEARCH PROJECT SEGMENT

State: ALASKA Name: Sport Fish Investigations of Alaska.

Project No: F-5-R-4 Title: Evaluation of the Fire Lake Hatchery Water Supply.

Job No: 8-C-3

Period Covered: April 1, 1962 to February 1, 1963

Abstract:

The highest water temperature at Fire Lake Hatchery was 61° F. in July, with a low of 36° F. occurring in December and January. During periods of sub-zero air temperatures, water was allowed to flow through the bypass valve to maintain suitable water temperature in the hatchery and to prevent the pipeline from freezing. In Upper Fire Lake a high temperature of 65° F. was recorded at the surface in July and 49° F. at the 20 foot depth in August. A concentration of about 10 parts per million of dissolved oxygen existed throughout the summer decreasing with fall turnover. The pH reading ranged from 6.8 to 7.7 in Upper Fire Lake and 6.5 to 7.3 in the hatchery. The carbon dioxide concentration in Upper Fire Lake fluctuated from 4 to 17 p.p.m. with the highest concentration following the fall turnover. The water entering the troughs at the hatchery averaged 9 p.p.m. CO₂ from May to September. Dissolved oxygen at the end of the trough banks was reduced to less than 5 p.p.m. during July and August, and during this period some fish were lost. The deepest snow cover measured 6 inches and ice depth measured 28 inches. In June Fire Creek's peak runoff was 3,128 gallons per minute. During incubation of silver salmon eggs from October to February 1, an average of 75 gallons of water per minute flowed through the hatchery.

Silver salmon eggs required 111 days to hatch with an average temperature of 38.6° F. and a range in temperature from 45° F. to 36° F.

Recommendations:

It is recommended that this study be continued in order to better understand the occurring physical and chemical conditions and their effects upon fish.

It is further recommended that measures be taken to alleviate the collection of gases in the eight-inch water line.

Objectives:

To evaluate the Fire Lake Hatchery water supply and to provide recommendations for improvements and procedures designed to fully utilize this water supply's potential.

Techniques Used:

A continuous temperature recording device was installed in the hatchery during the latter part of February, 1962. Water samples were taken periodically at the intake tower in Upper Fire Lake and at the hatchery to determine the dissolved oxygen, carbon dioxide, pH and total alkalinity. Ice and snow thickness and water temperatures were taken and recorded during each sampling period. Water flow measurements were taken periodically in Fire Creek below the hatchery, at the hatchery outlet and at the bypass valve. Rubber balloons were used to collect gas samples from the hatchery water supply line.

Findings:

A brief description of the operation of Fire Lake Hatchery was presented in the completion report for F-5-R-3, Job No. 8-C-3. Water temperatures were continuously recorded in Fire Lake Hatchery by an automatic recording device during the reporting period (Figure 7). The monthly range and mean water temperatures are presented in Figure 1. The highest temperature in the hatchery was 61° F. in July,

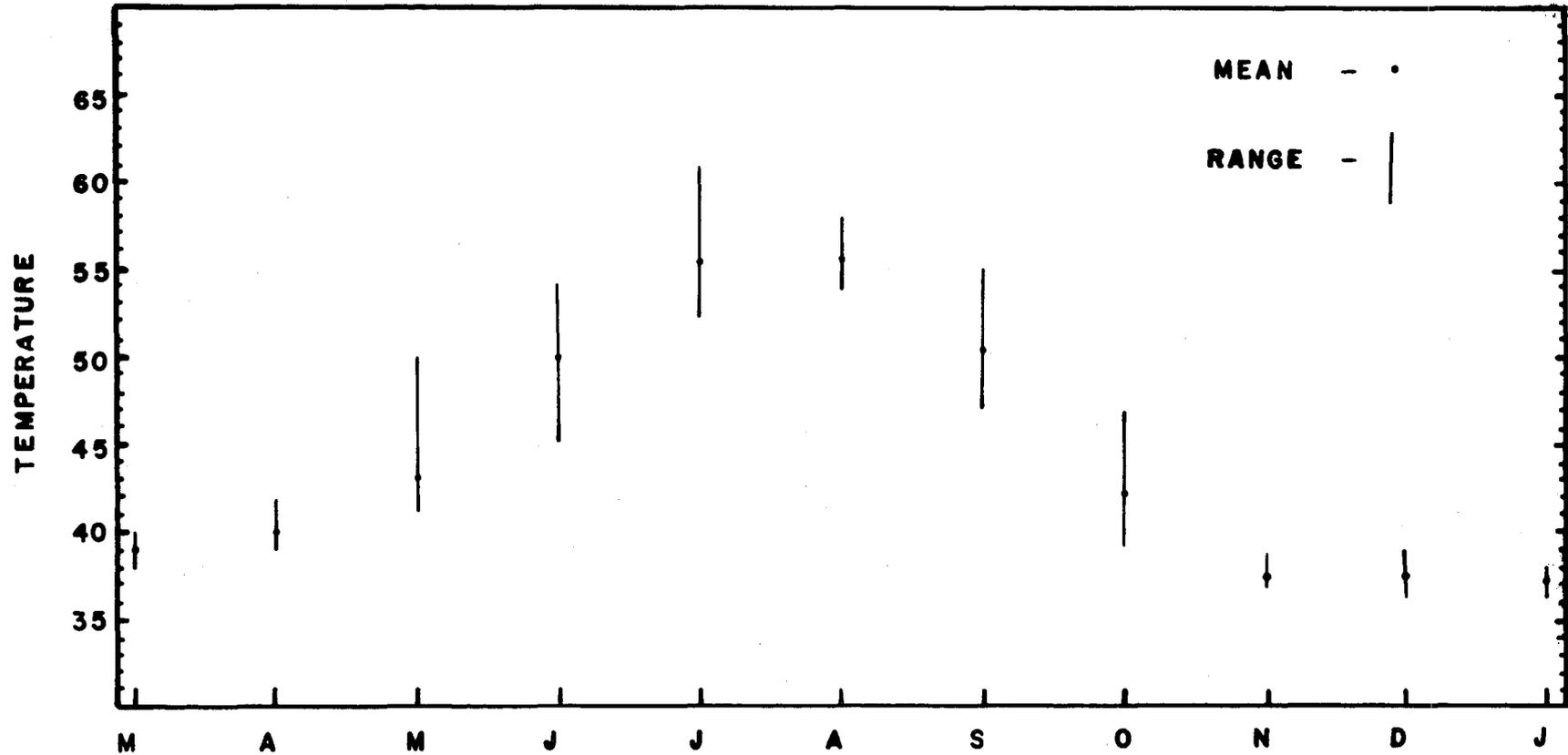


Figure 1. Monthly range and mean water temperatures of Fire Lake Hatchery from March 1962 to January 1963.

with a low of 36° F. occurring in sub-zero weather during December and January. The volume of water flowing through the pipeline during the winter months was manipulated in order to keep the water temperature at about 38° F. By manipulating the adjustable depth of the intake pipe in Upper Fire Lake it was possible to obtain water at 39.4° F. even during the coldest periods. By adjusting the discharge rate of water through the bypass valve it was possible to maintain water temperatures above 36° F. even though the pipeline is above ground and uninsulated.

UPPER FIRE LAKE

Water temperatures were taken periodically at various depths in Upper Fire Lake (Figure 2). A high temperature of 65° F. was recorded on the surface in July, and at the 20 foot level a high of 49° F. was recorded in August.

It was determined from the water temperatures recorded in Upper Fire Lake that the spring overturn occurred in late April and the fall overturn occurred the latter part of September.

Water samples were collected periodically from Upper Fire Lake at various depths and from the troughs at the hatchery during the reporting period to determine the dissolved oxygen, carbon dioxide, pH and total alkalinity concentrations.

The analysis of the data for dissolved oxygen (Figure 3.) collected from Upper Fire Lake revealed that during the winter and spring of 1962 the dissolved oxygen gradually declined at the 15 and 20 foot depths up to April. At other depths there was little variation. A low of 4.4 p.p.m. was recorded at the 20 foot depth in April. Then, during the spring turnover, the lake rapidly took on oxygen, and averaged about 10 p.p.m. during the summer. A high of 11.4 p.p.m. occurred at the 15 foot depth in August. The dissolved oxygen gradually decreased again after the fall turnover.

A high pH reading of 7.7 was recorded in Upper Fire Lake in February 1962 and a 6.8 low in January 1963. There is a slight differential between the pH values recorded at

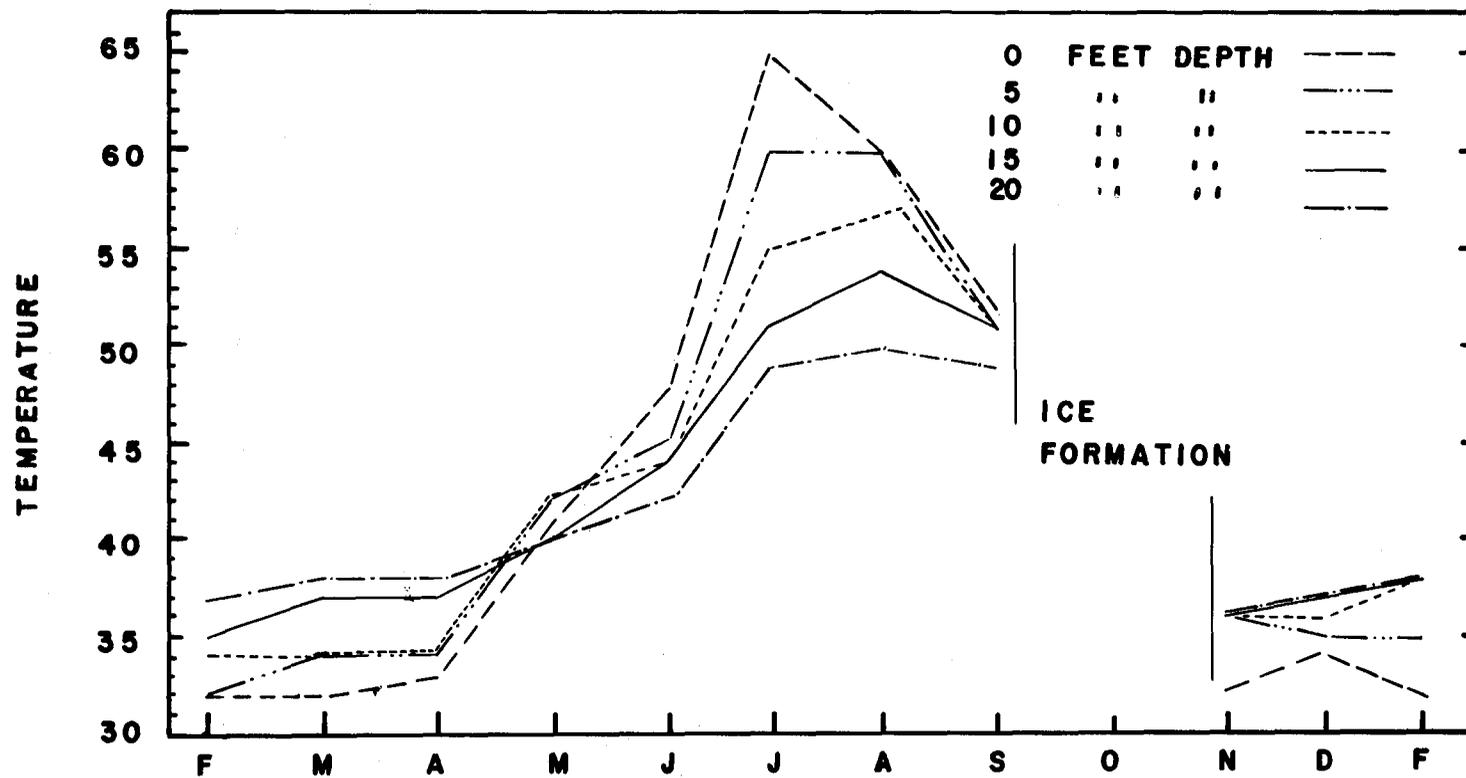


Figure 2. Water temperatures of Upper Fire Lake at five depths from February 1962 to January 1963.

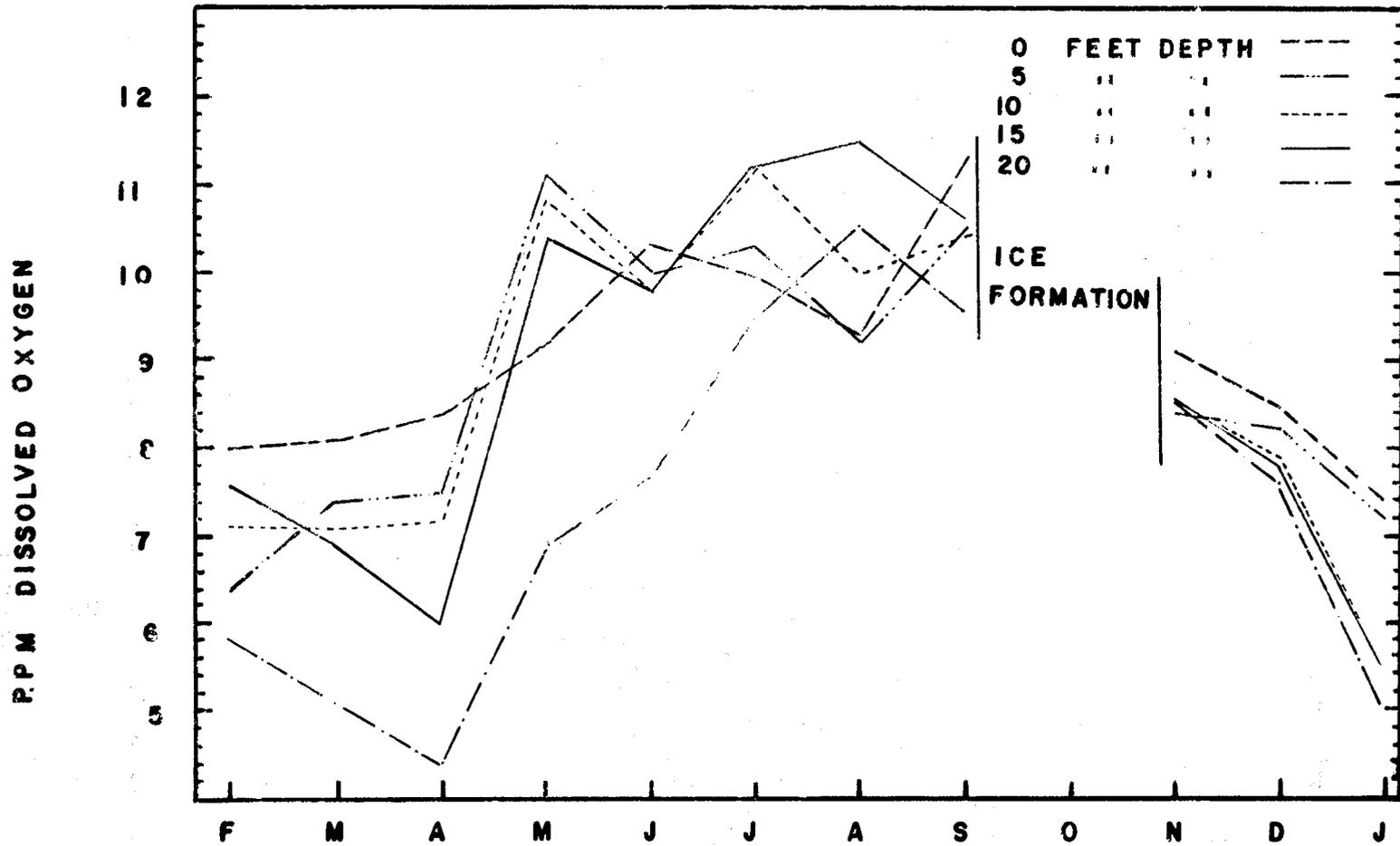


Figure 3. Dissolved oxygen of water at hatchery intake tower of Upper Fire Lake at five depths from February 1962 to January 1963.

the surface and at the 20 foot depth; higher readings were recorded at the surface (Figure 4).

The carbon dioxide concentration in Upper Fire Lake fluctuated from 4 to 17 p.p.m. The highest concentration followed fall overturn and occurred at a depth of 20 feet (Figure 4).

Total alkalinity samples were insufficient; therefore it was impossible to draw any conclusion other than the samples collected averaged 70 p.p.m. (Table 1).

FIRE LAKE HATCHERY:

During 1962 a low of 4 p.p.m. of dissolved oxygen was recorded at the head of the troughs in Fire Lake Hatchery in March, with an average of about 9 p.p.m. between May and September (Figure 5). The dissolved oxygen at the lower end of the troughs dropped to less than 5 p.p.m. during July and August (Figure 6). During the same period an increase in carbon dioxide and water temperature was recorded, together with a decrease in pH values (Figure 1).

The pH readings were slightly higher at the head of the troughs than at the lower ends (Figures 5 and 6).

During the summer the concentration of carbon dioxide entering the hatchery troughs ranged from 4 to 14 p.p.m. (Figures 5 and 6). The carbon dioxide concentration was higher at the lower end of the hatchery troughs with the greatest increase (7 to 16 p.p.m.) occurring during July.

Snow depths on Upper Fire Lake fluctuated during winter months due to new snow and melting conditions. The deepest snow depth was recorded on January 10, 1963, at which time it was 6 inches.

During April 1962, the ice depth on Upper Fire Lake measured 23 inches, but by May 10 only 6 inches of ice remained, and this was gone by May 15 (Table 1). In October, the ice began forming and by the end of January 1963, the ice depth reached 28 inches.

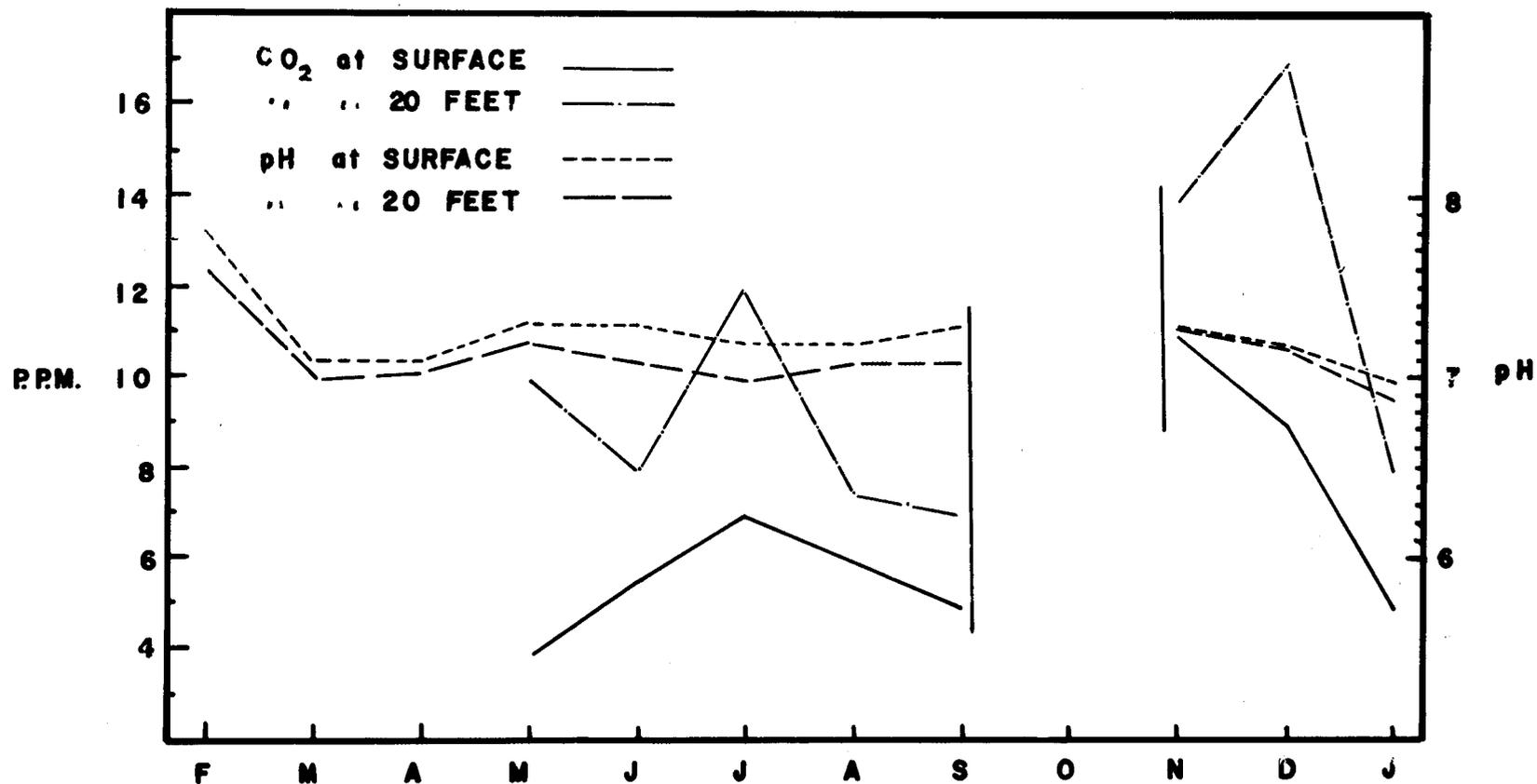


Figure 4. Carbon dioxide and pH of water at the hatchery intake tower in Upper Fire Lake from February 1962 to January 1963.

TABLE 1

Snow and ice depth, water and air temperatures and total alkalinity at the surface by the Upper Fire Lake water intake tower from April 1962 to January 1963.

Date	Snow Depth Inches	Ice Depth Inches	Temperature Water	Air	Total Alkalinity p.p.m.
4-10-62	0	23.0	33	38	
5-10-62	0	6	41	49	
6-5-62			48	56	
7-17-62			65	73	
8-7-62			60	61	
9-11-62			52	50	
11-27-62	1	12.0	32	6	71
12-18-62	1	17.5	34	24	70
1-24-63	0	26.5	32	34	69

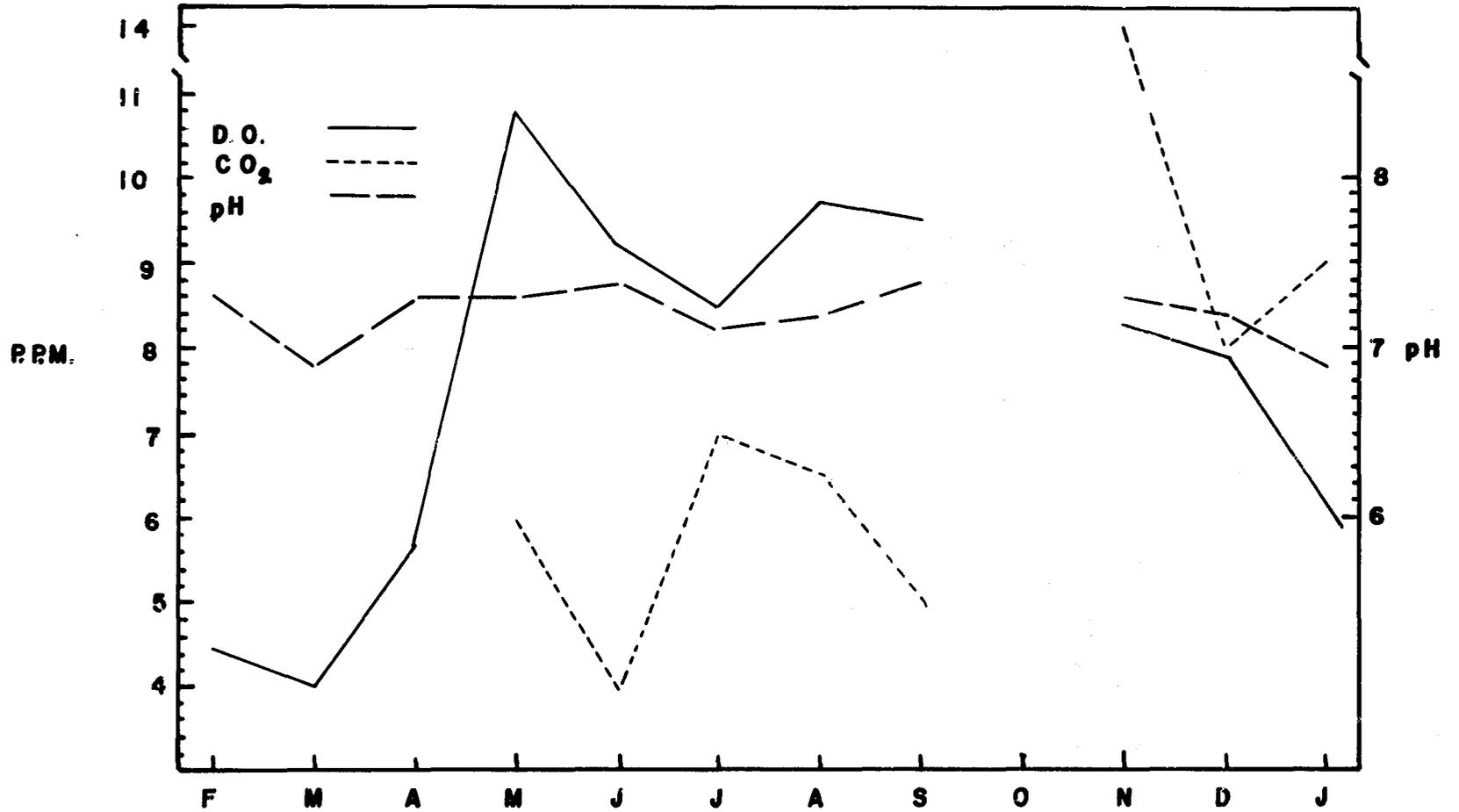


Figure 5. Dissolved oxygen, carbon dioxide and pH of water at head of troughs of Fire Lake Hatchery from February 1962 to January 1963.

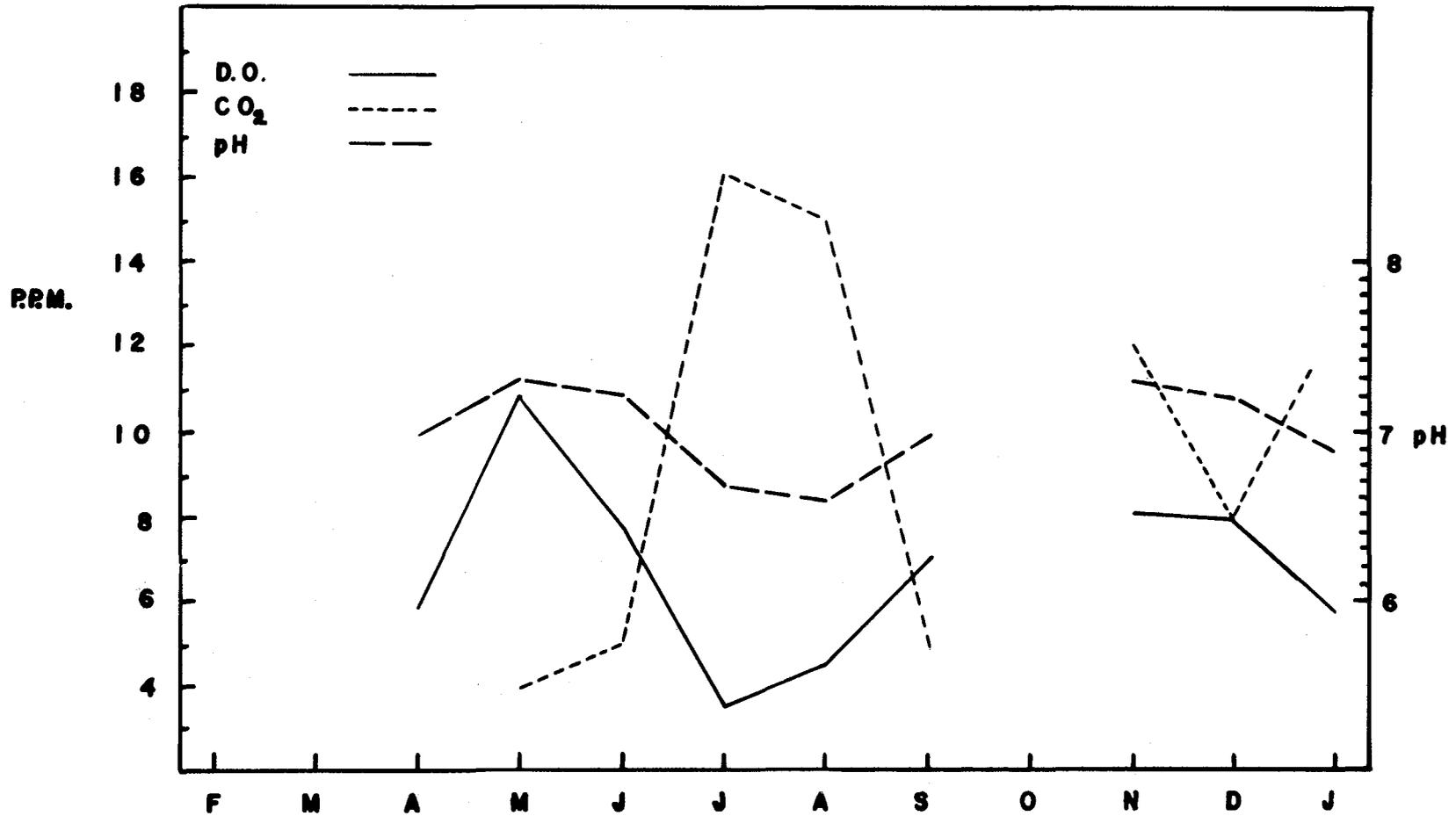


Figure 6. Dissolved oxygen, carbon dioxide and pH of water at end of troughs of Fire Lake Hatchery from April 1962 to January 1963.

Water flow measurements were made periodically in Fire Creek; above the hatchery bypass pipe, the amount going through the hatchery and about 150 feet below the hatchery on Fire Creek (Table 2). The bypass pipe is located about 90 feet above the hatchery building and is approximately 180 feet below the water flow gauge of Fire Creek. The highest runoff in Fire Creek occurred in June for a total of 3,128 g.p.m.. Increased flows were needed in the hatchery during May, June, July and August to meet the demands of rainbow trout and silver salmon being raised at that time. No water goes through the bypass valve from May 1 through September 30. During incubation of silver salmon eggs from October to February 1, an average of about 75 g.p.m. of water was flowing through the hatchery.

During October, 1,464,048 silver salmon eggs were recieved from Swanson River, Bear Creek and Dairy Creek. The eggs received from Swanson River on October 5 began hatching on January 23, 1963. A total of 111 days was required to hatch these eggs at an average temperature of 38.6° F., with a temperature range from 45° to 36° F.

During February and March of 1962, 20 aluminum aerators were constructed (Figure 7). There are two baffles in each aerator, one located four inches below the top and the other three inches above the bottom. The aerator is 27 inches high and 12 inches in diameter. Three holes, 0.094 inches in diameter, were drilled for each square inch of the baffle, thus providing 37 holes in each baffle. A hole was cut in the side of the aerator to allow escape and exchange of gases from the interior of the aerator. The aerators in the picture are in storage on the water line and are not used during the winter months. These aerators have solved the "gas bubble" disease of the fish during the summer months.

Samples of gas were collected from the hatchery water supply line about 300 feet below the intake on Upper Fire Lake where a one-inch valve was initially installed. Samples were taken to a local laboratory for analysis, but the personnel of the laboratory were unable to classify the type of gas in the samples.

TABLE 2

Water flow measurements in gallons per minute at various places of the hatchery water supply system and in Fire Creek, 1962 - 1963.

Date	Fire Creek Above Hatchery	By-pass Valve	Hatchery	Total Fire Creek
4-3-62	300	160	200	660
4-10-62	40*		200	240
4-17-62	111*		200	311
4-24-62	340*		200	540
5-10-62				1274**
5-15-62				1157**
6-12-62				3128**
9-11-62	552*		185	737
10-5-62	422	40	24	486
12-14-62	196	60	60	316
12-19-62	158	60	86	304
1-15-63	331	75	110	516
1-24-63	402	75	120	597

* Flow measurement includes that of by-pass valve.

** Flow measurement includes Fire Creek, by-pass valve and hatchery.

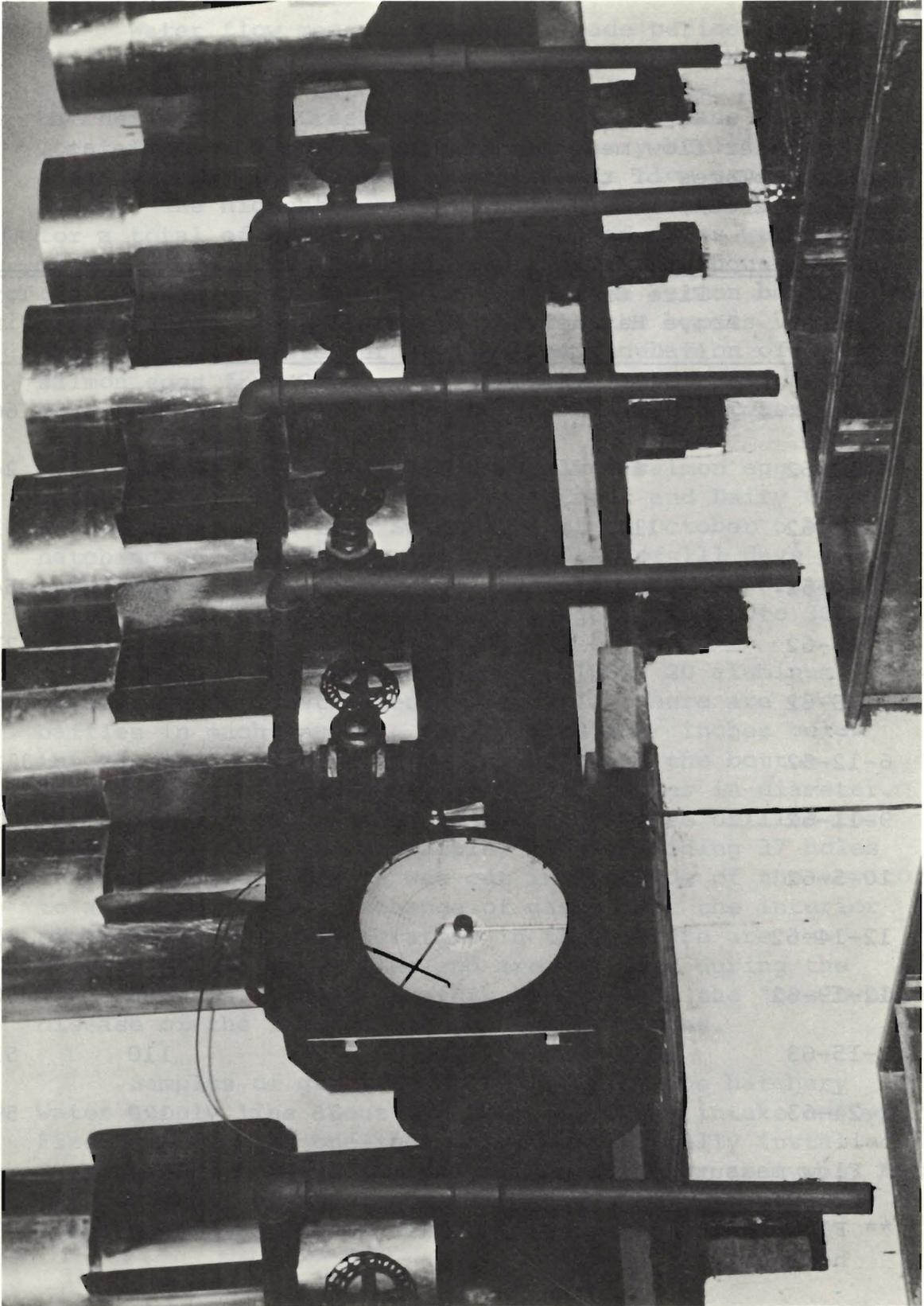


Figure 7. Interior of the Fire Lake Hatchery showing the recording thermometer and the stored aerators.

References

Harvey, H. H. and S. B. Smith. 1961. Supersaturation of the Water Supply and Occurrence of Gas Bubble Disease at Cultus Lake Trout Hatchery. Canadian Fish Culturist, 30:39-47.

Shaw, Paul A. 1936. Hatchery trough aerators. California Fish and Game, 22(2):126-136.

Prepared by:

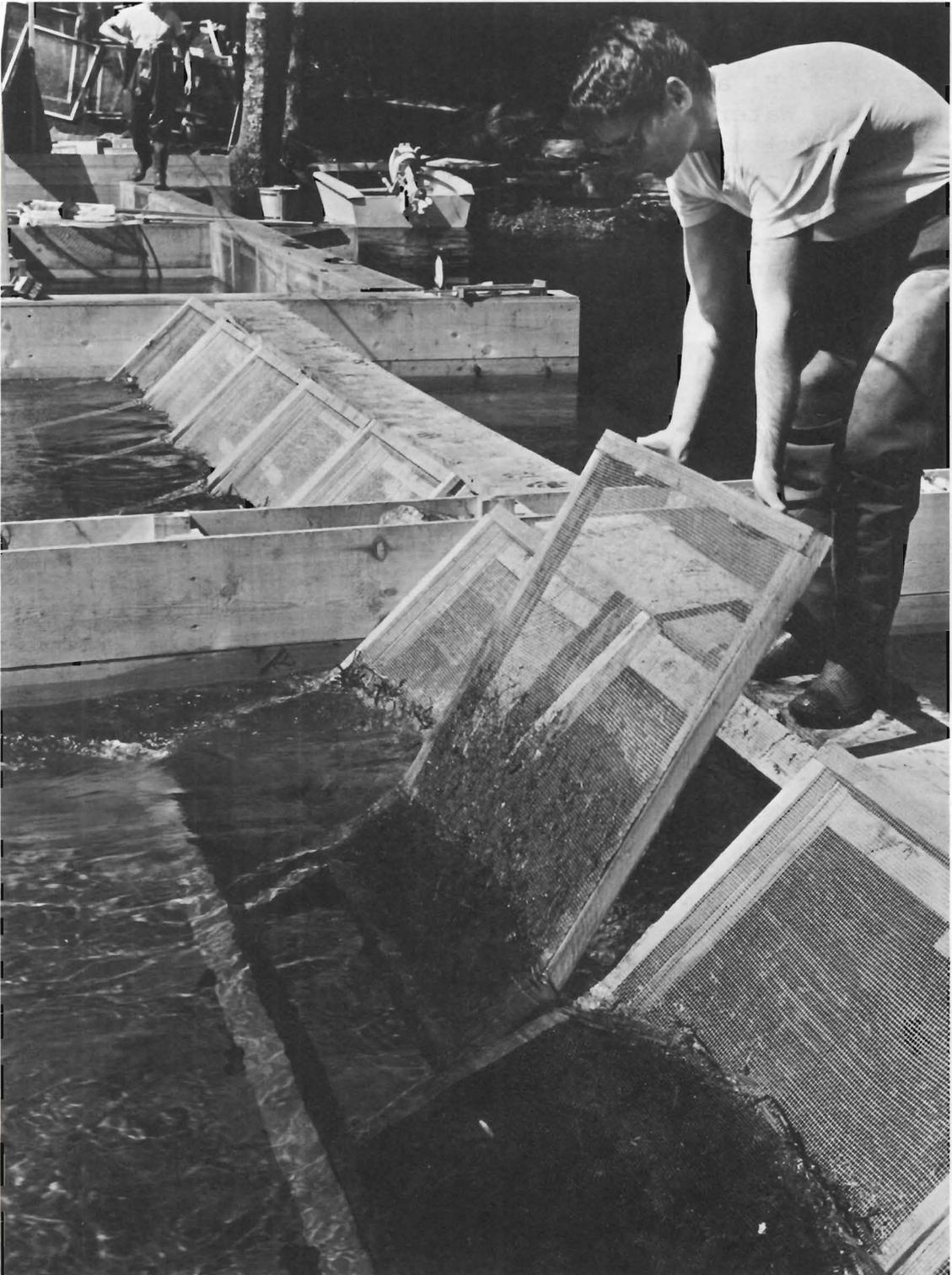
Approved by:

Frank Stefanich
Fishery Biologist

Richard Haley
D-J Coordinator

Date: March 12, 1963.

Alex H. McRea, Director
Sport Fish Division



Weir maintenance is as important as the investigational aspect of the program.