APPENDIX 3E

HYDROACOUSTIC ANALYSIS OF FISH POPULATIONS IN COPCO AND IRON GATE RESERVOIRS, CALIFORNIA

NOVEMBER 2003

Hydroacoustic Analysis of Fish Populations in Copco and Iron Gate Reservoirs, California

Draft Technical Report

by
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November 7, 2003

INTRODUCTION

The hydroacoustic sampling was conducted to better characterize the fish community the deep-water habitat in the Copco and Irongate Reservoirs. The study began with a survey conducted in August 2003 and will continue with surveys in October 2003 and April 2004. The purpose of this interim report is to present initial findings from the August survey. A final report will be prepared in 2004 following completion of the spring survey.

METHODS

Hydroacoustic

Survey paths were designed for conducting the hydroacoustic runs on both Copco and Iron Gate Reservoirs. The paths were set at 150 m wide transects in the main portions of the impoundments with paths that followed the thalwegs in the arms of the impoundments (Figure 1). Areas less than 5 m deep (at full pool) were identified and eliminated from the survey paths unless they constituted a transition to another transect leg. The hydroacoustic analyses were conducted using a BioSonics DT-X acoustic device equipped with a 200 KHz split-beam 6.6° digital transducer. Positional data was acquired with a Sokkia DGPS and linked with the BioSonics unit. The hydroacoustic acquisition threshold was set at –65 dB and a ping rate of 1 per second. Vessel speed generally ranged from 9 to 10 kph. Hydroacoustic and positional data were integrated into files on a Panasonic CF-28 Toughbook®, backed up on CD, and processed using Visual Analyzer® software.

The surveys will be conducted on Copco and Irongate Reservoirs for 2 days (2 day and one night survey) for each sampling season (summer, fall, and spring) beginning in summer 2003.

Netting

Because the hydroacoustic data does not distinguish targets into fish species, vertical gill nets were deployed. Nets will be deployed to sample the range of habitats fish encounter (e.g., epilimnion, metalimnion ans hypolimnion layers). The location of the net sampling will be determined after examining the hydroacoustic survey data. Nets are approximately 12 by 80 feet with a 1.0/1.5 inch bar mesh. At a minimum, net sampling will occur during the day. If there is a marked difference between fish distribution in the reservoirs between day and night surveys, an attempt will be made to net sample at night (if conditions are deemed safe). Water quality information on reservoir profiles will also be collected at different times throughout the net sets at each net. Data collected will include water temperature, dissolved oxygen (DO), pH and conductivity.

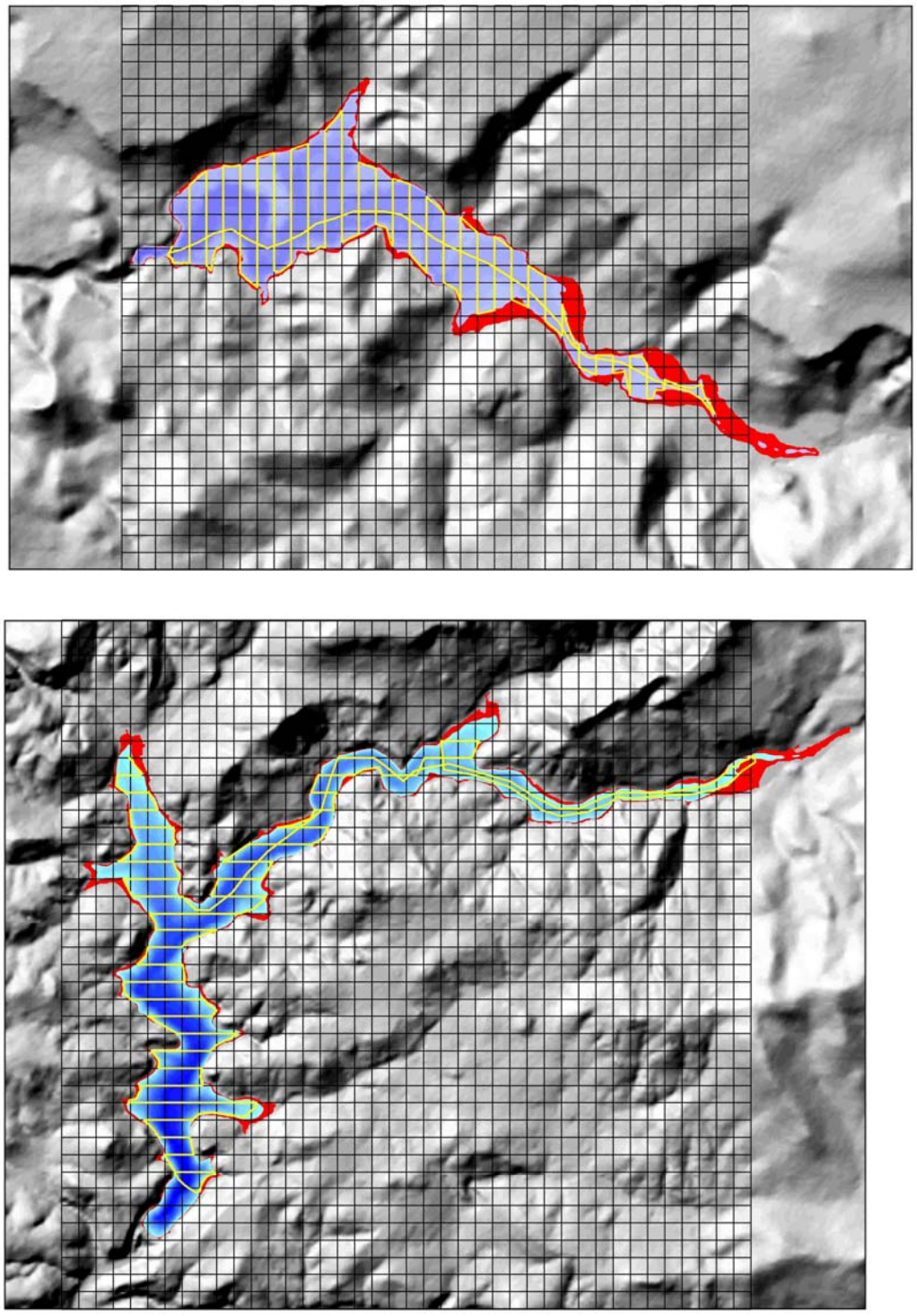


Figure 1. Survey tracks (in yellow) superimposed over the bathymetry for Copco and Iron Gate Reservoirs. Areas shown in red constitute shallow habitat that was excluded from the survey design.

RESULTS FOR SUMMER 2003

The hydroacoustic data indicated the presence of gas evolution from the bottom waters of the impoundments, particularly in the thalwegs of the upper reaches of the lakes. Confirmation that the small targets were gas bubbles was determined by maintaining a stationary position over some of the most target-rich areas and observing the targets move in a constant vertical manner (Figure 2). The maximum gas bubble size was determined to be about –40 dB. Targets equal to or less than –40 dB were censored from the data set and the remaining plots and data summaries are presented without the inclusion of these small targets.

Most of the fish targets observed in Copco Reservoir were generally towards the middle and eastern end of the lake (Figures 3-5). There were relatively few differences in spatial distribution of the targets in Copco Reservoir between the day (Figures 3 and 4) and night run (Figure 5). Most of the fish in Copco Reservoir were distributed between 3 and 11 m during the day, but the fish were typically deeper at night, with an average depth of 11 m (Figure 6). A small number of targets were observed at about 25 m in the second day run on Copco Reservoir (Figure 4).

The distribution of fish in Iron Gate Reservoir showed few fish present in the open-water area (Figures 7-9). Most fish were observed adjacent to the shorelines, especially the eastern shore, and in the inlet arm. During the night run, a large number of fish were congregated in the thalweg, 2 km west of the inlet (Figure 9). The fish were generally observed at depths from 3 to 13 m, with a considerable aggregation near the bottom end of this range (Figure 10).

At the outset of the each netting survey, information regarding the position and depth of likely fish targets were known based on the hydroacoutic surveys. This information guided the placement of the vertical gill net sets. The net sets were run at multiple times during the day and early evening with a target of 2 hr durations per net.

The results for the fish netting show that most of the fish caught were yellow perch (*Perca flavescens*) within the size range of 130 to 285 mm. The median size of fish netted in Copco Reservoir was 193 mm (CV 9.2) and 200 mm (CV 10.3) in Iron Gate Reservoir. The only non-perch fish caught were two black crappie in Copco Reservoir.

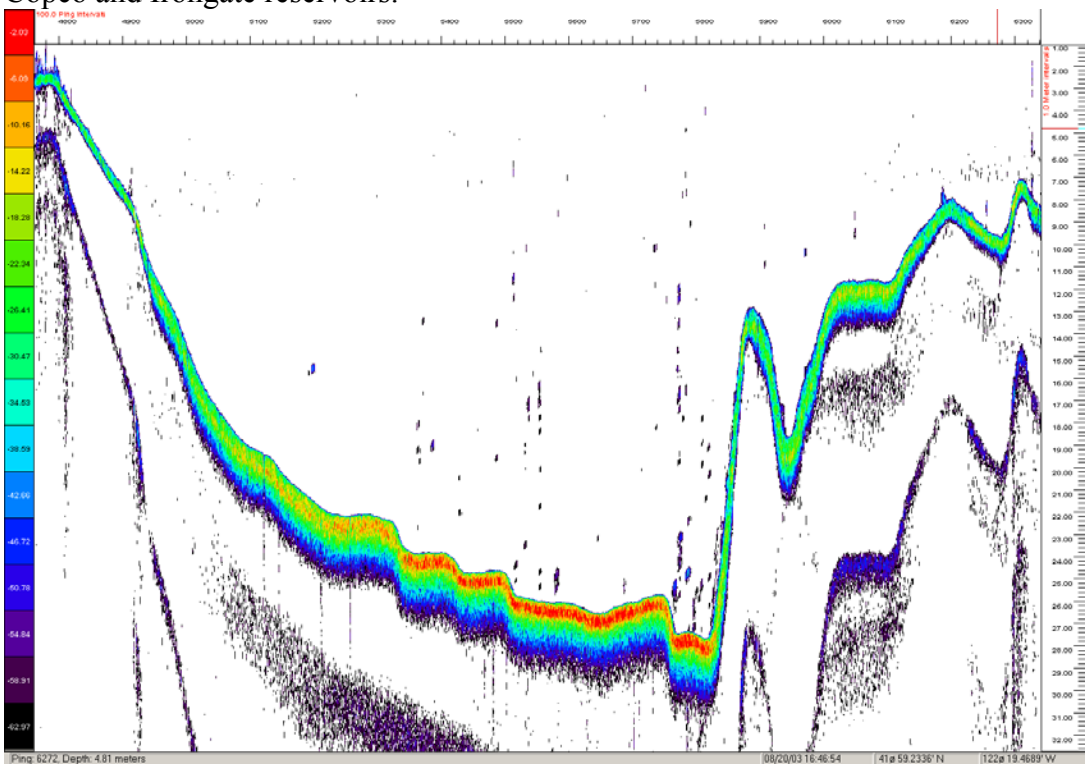
Both Copco and Irongate reservoirs were thermally stratified during the August 2003 sampling. Water temperatures ranged from 23 to 11 ºC in Copco Reservoir and from 24 to 7 ºC in Irongate Reservoir. Both reservoirs had anoxic conditions (DO levels less than 1.0 mg/l) in the hypolimnion.

DISCUSSION

Fish abundance along the survey paths was similar between day and night runs. The results from the August survey indicate that the vast majority of fish targets were above the thermoclines in both impoundments. The vertical distribution of fish in Copco and Iron Gate Reservoirs was strongly influenced by the dissolved oxygen concentrations (Figures 11 and 12). This is particularly evident in Iron Gate Reservoir where a sharp decline in dissolved oxygen occurred at 12 m. The lake temperature declines as well, but the dissolved oxygen depletion occurs more abruptly and slightly precedes the most rapid decline in water temperature. The hydroacoustic signals suggest that some fish are present in the hypolimnion, but these may be brief excursions into this zone of low dissolved oxygen. Net sets in Copco and Iron Gate Reservoirs confirmed the presence of fish at these depths despite the limited concentration of dissolved oxygen at depth (Figures 13 and 14).

ONGOING WORK

Hydroacoustic surveys and netting activities will be repeated in October 2003 and April 2004 to develop a more thorough understanding of habitat use in the deeper areas of the Copco and Irongate reservoirs.



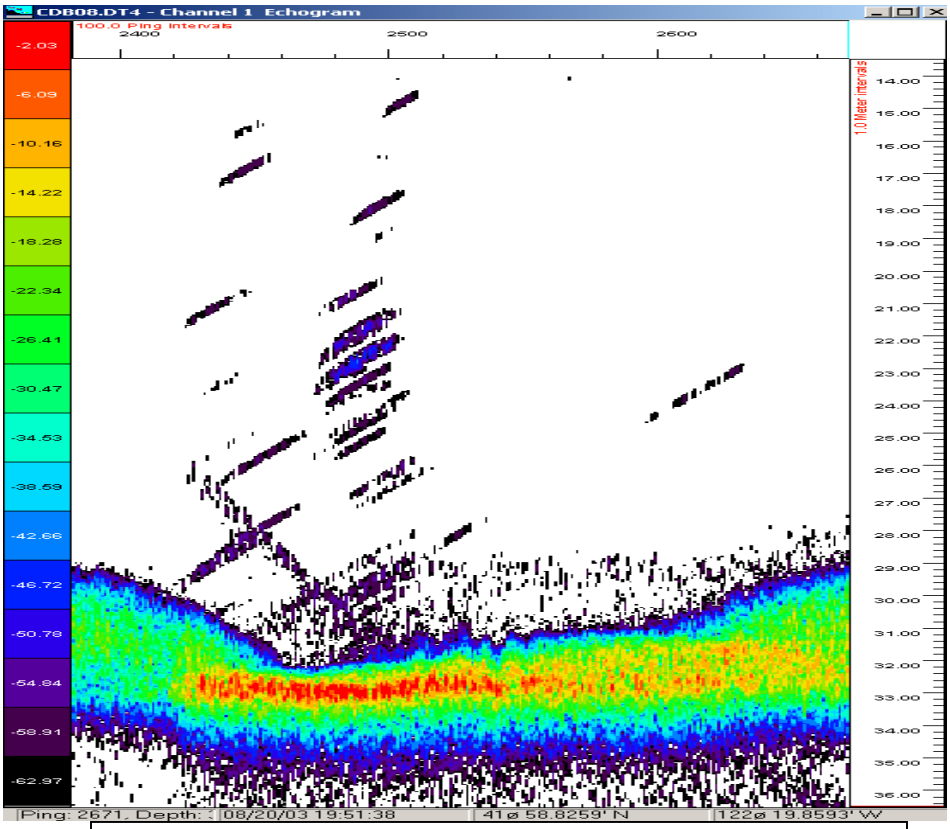


Figure 2. Display of deeper targets in Copco Reservoir from a transect (moving) echogram (top) and an echogram from the same area in a stationary position illustrating the gas bubble patterns.

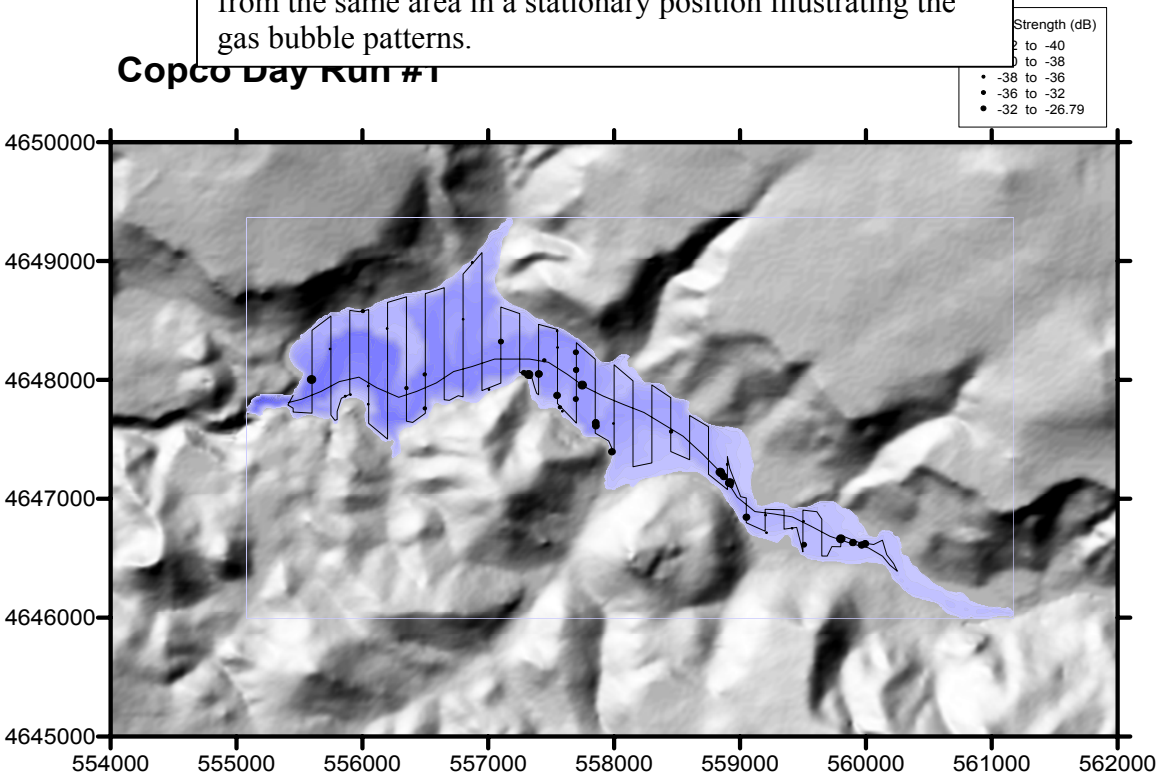


Figure 3.Distribution of fish targets in Copco Reservoir by target strength.

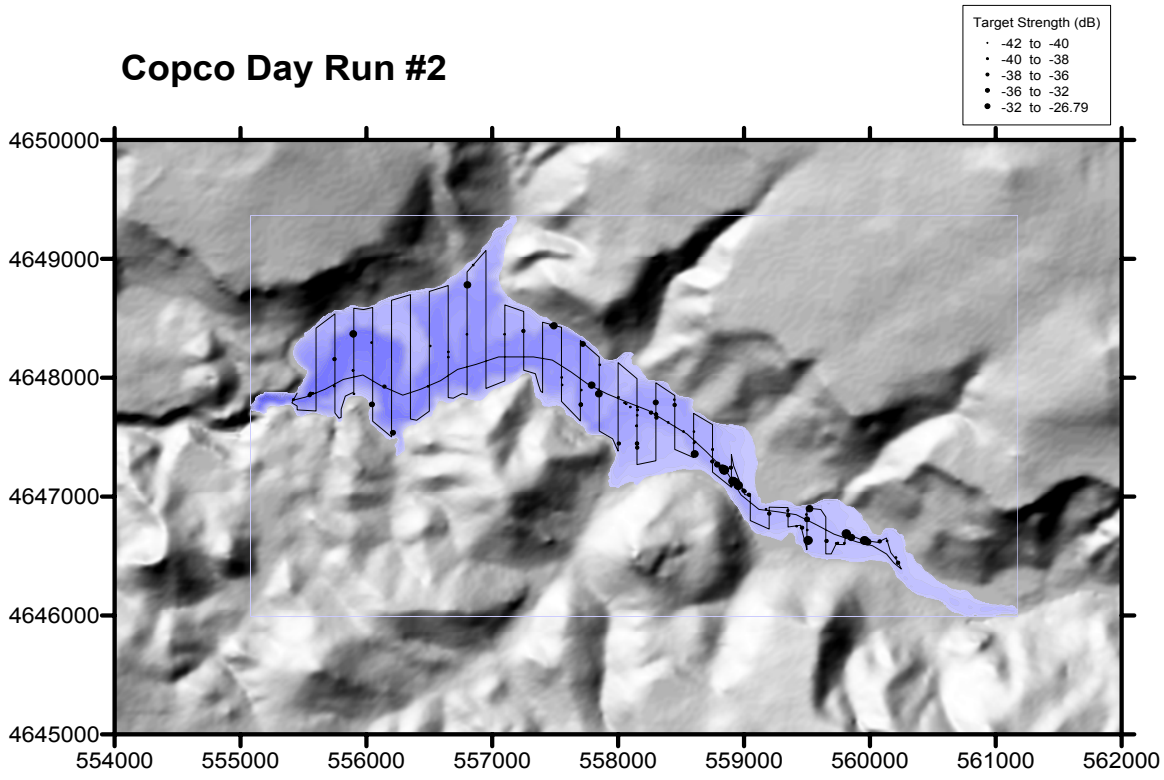


Figure 4.Distribution of fish targets in Copco Reservoir by target strength.

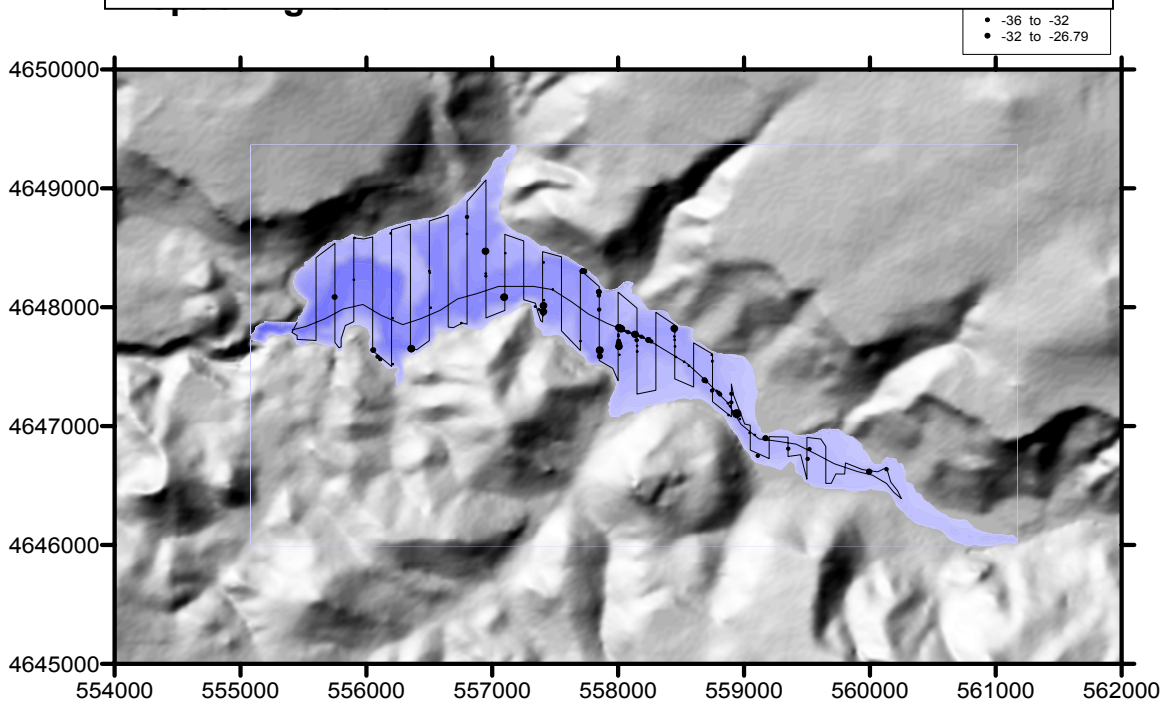


Figure 5.Distribution of fish targets in Copco Reservoir by target strength.

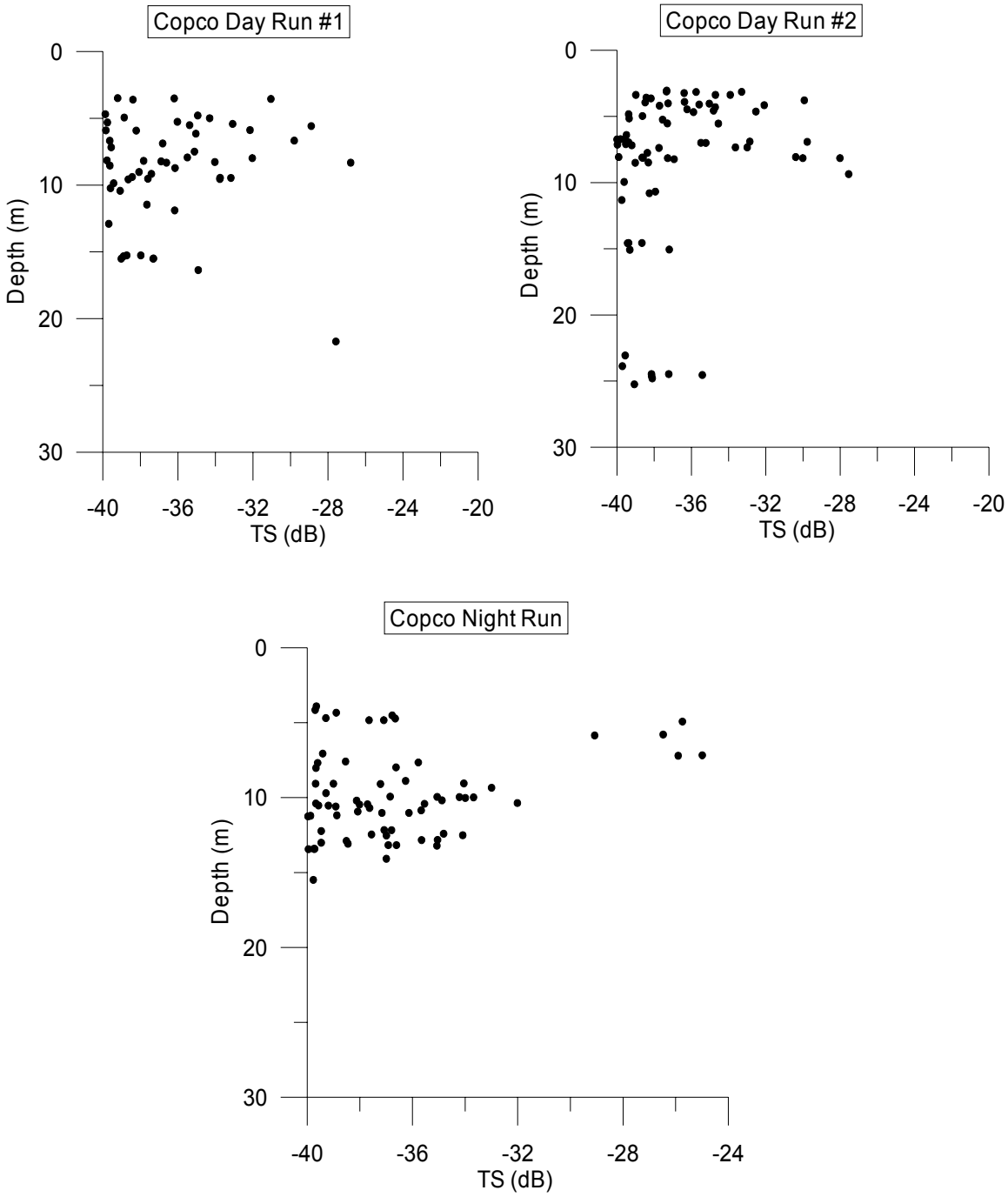


Figure 6. Distribution of fish targets in Copco Reservoir by depth.

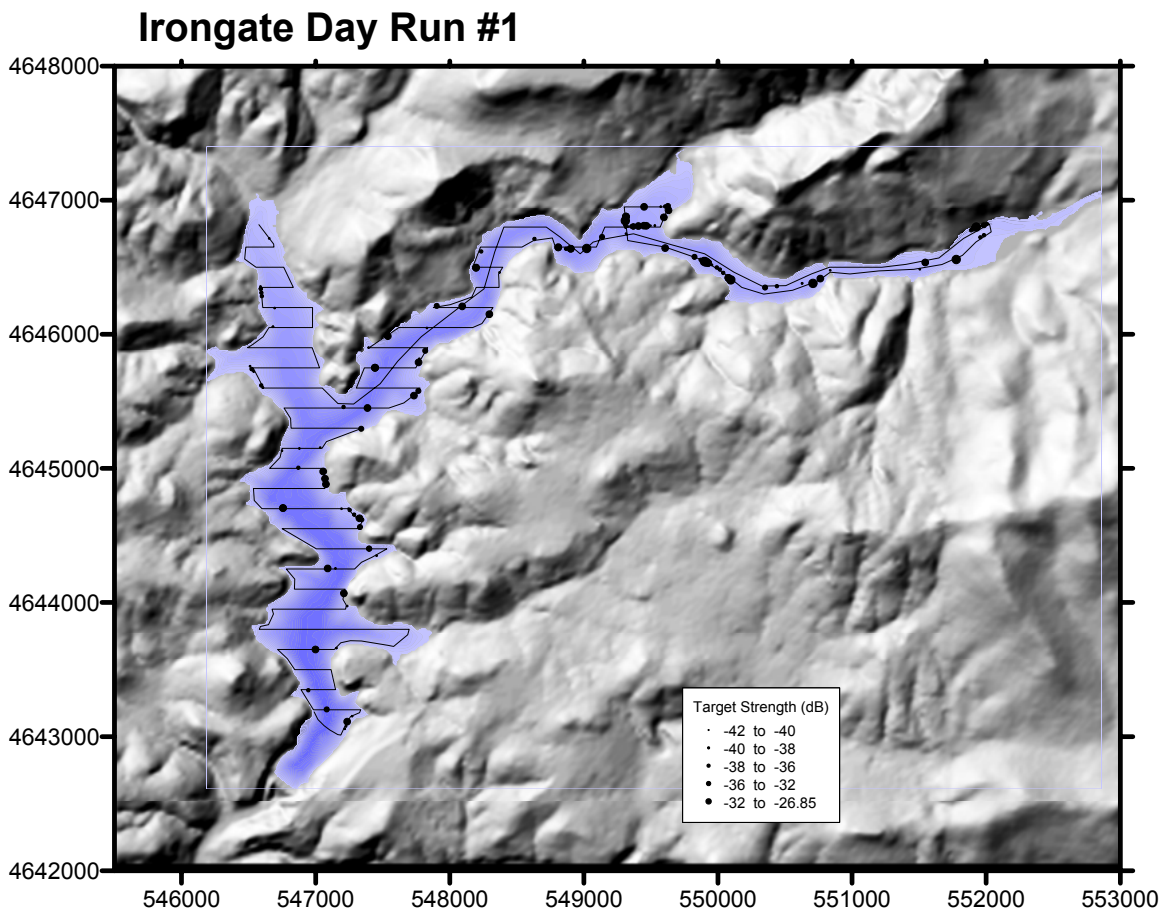


Figure 7. Distribution of fish targets in Iron Gate Reservoir by target strength.

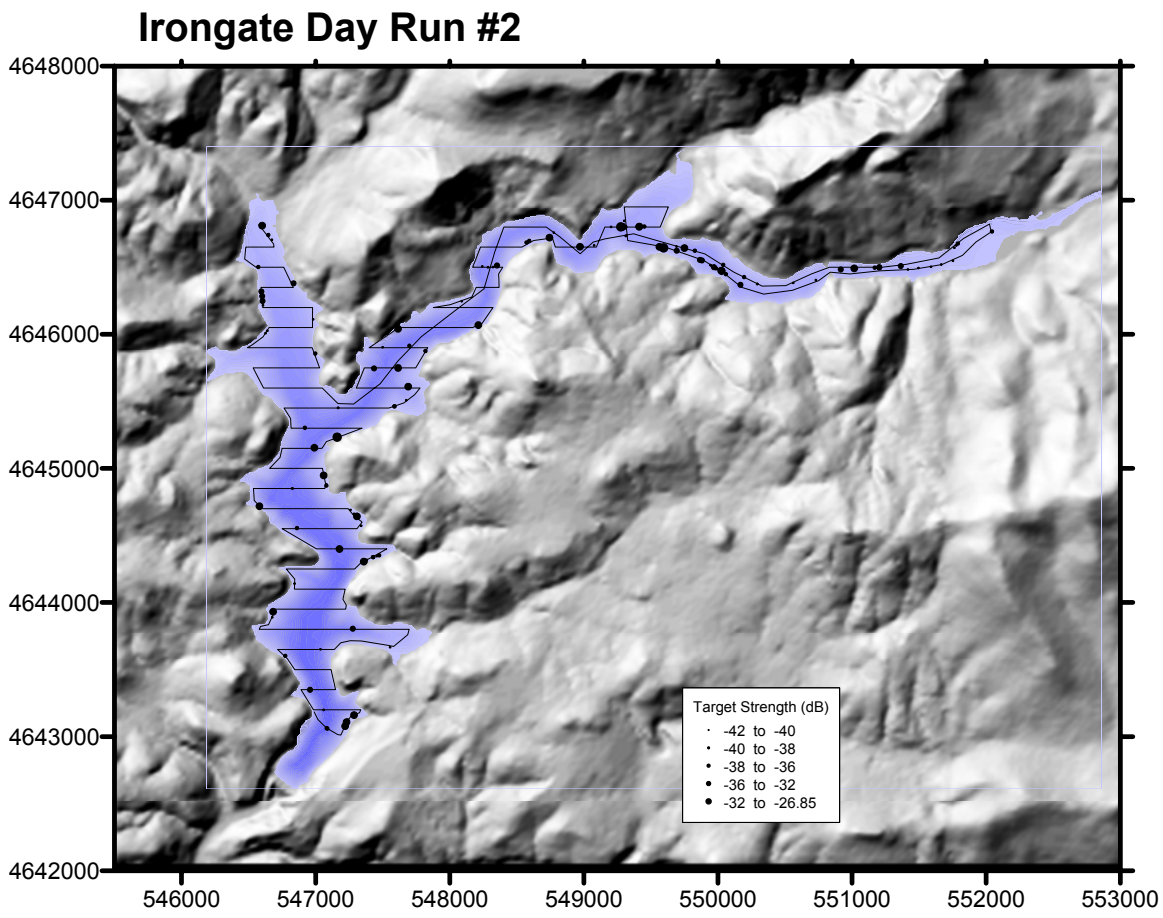


Figure 8. Distribution of fish targets in Iron Gate Reservoir by target strength.

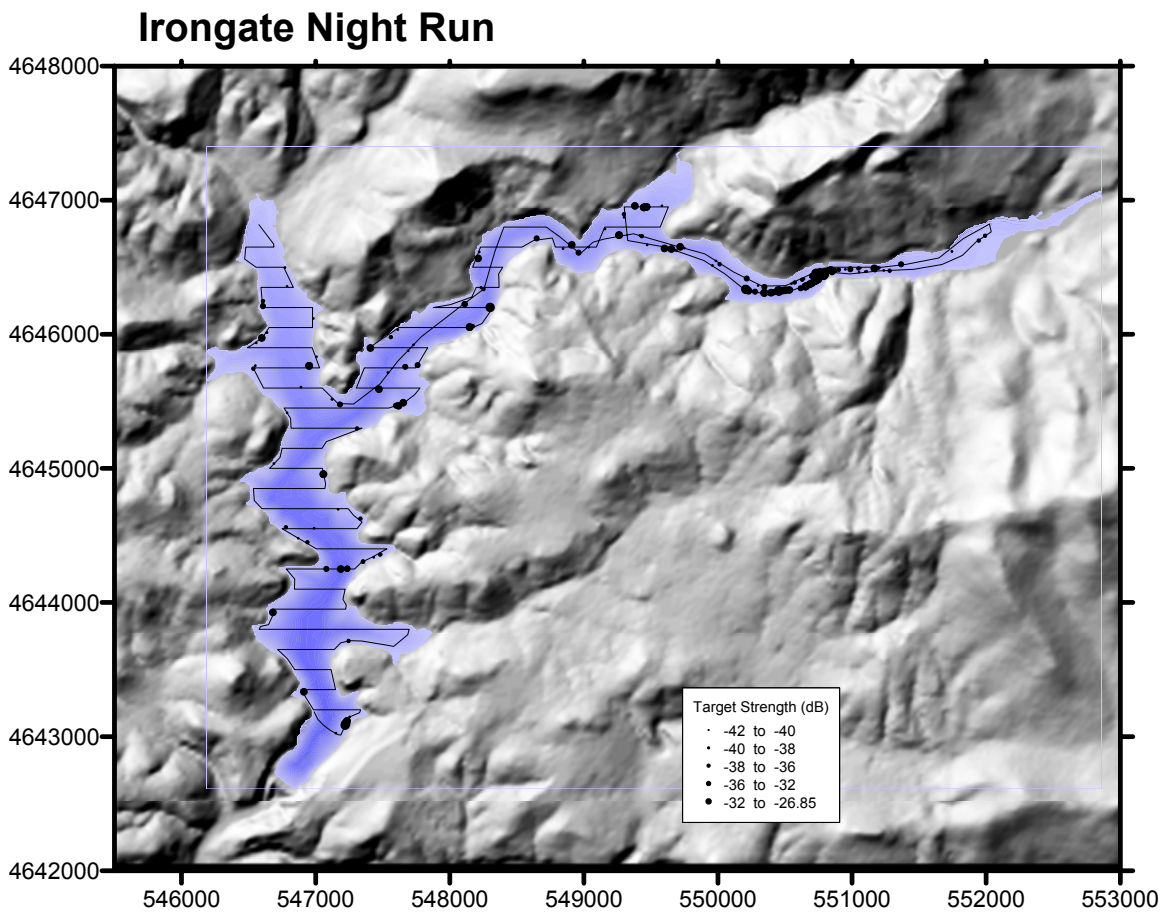


Figure 9. Distribution of fish targets in Iron Gate Reservoir by target strength.

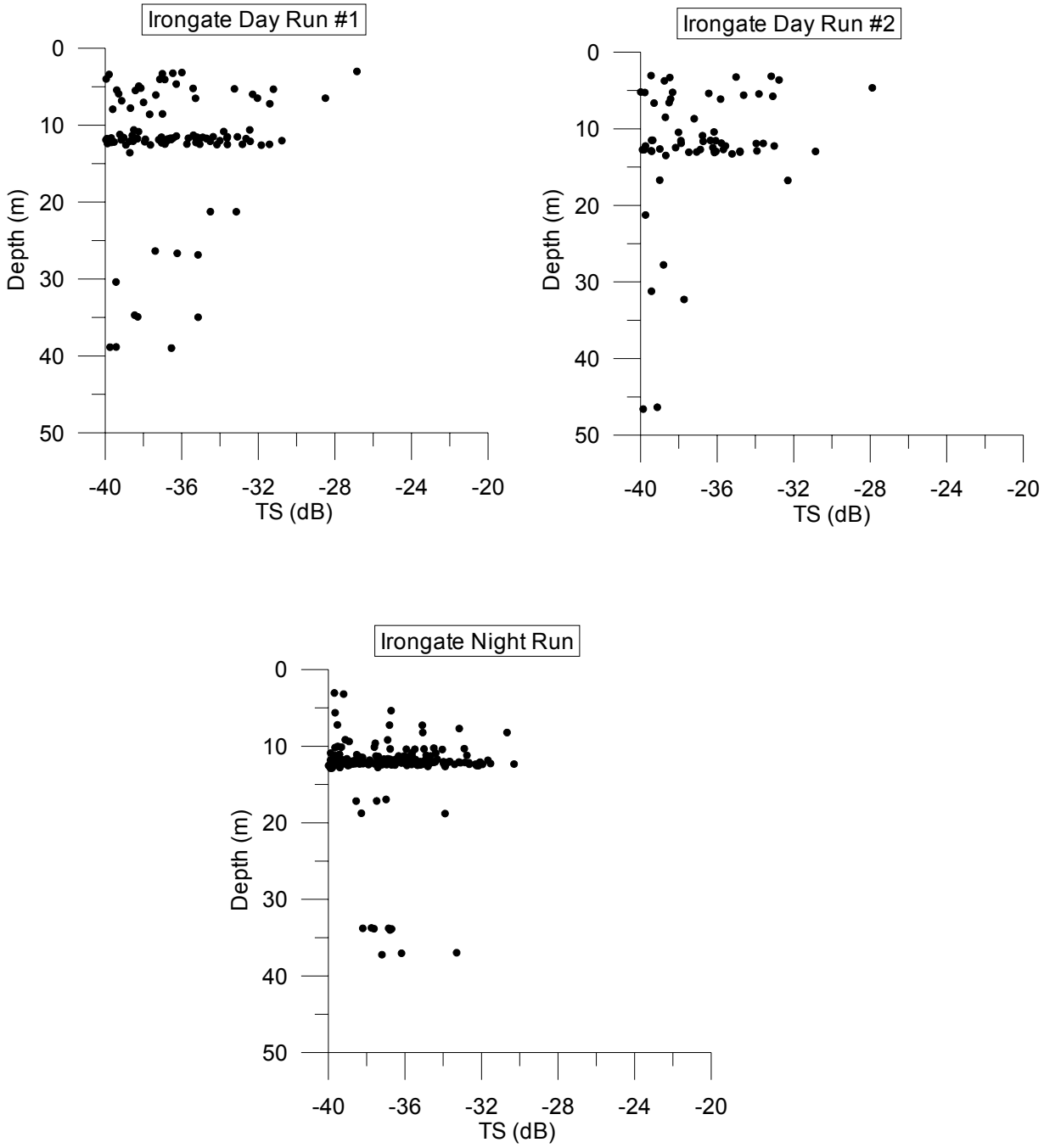


Figure 10. Distribution of fish targets in Iron Gate Reservoir by depth.

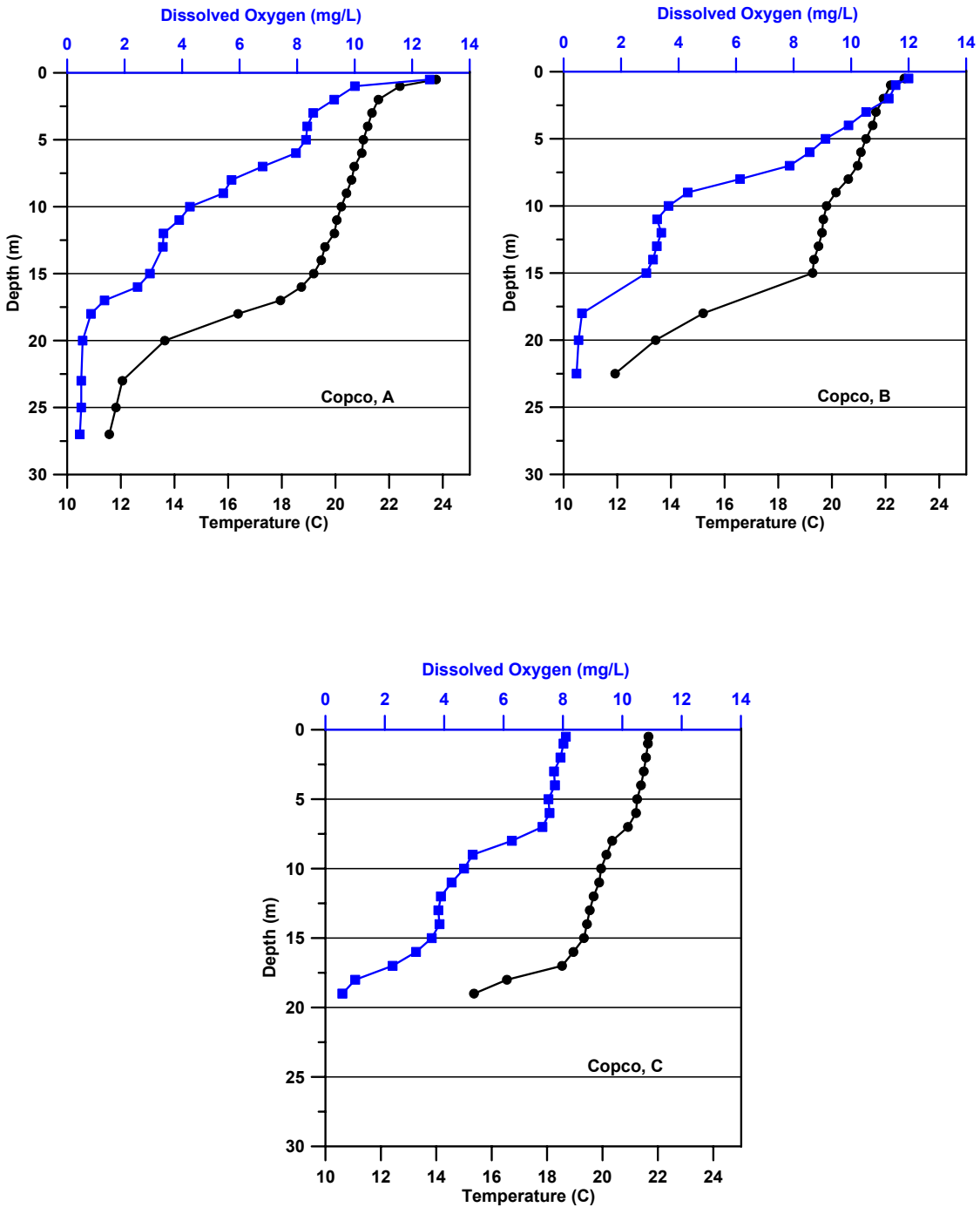


Figure 11. Temperature and dissolved oxygen profiles measured on August 19, 2003 for Copco Reservoir at three locations (Source: L. Prendergast, PacifiCorp).

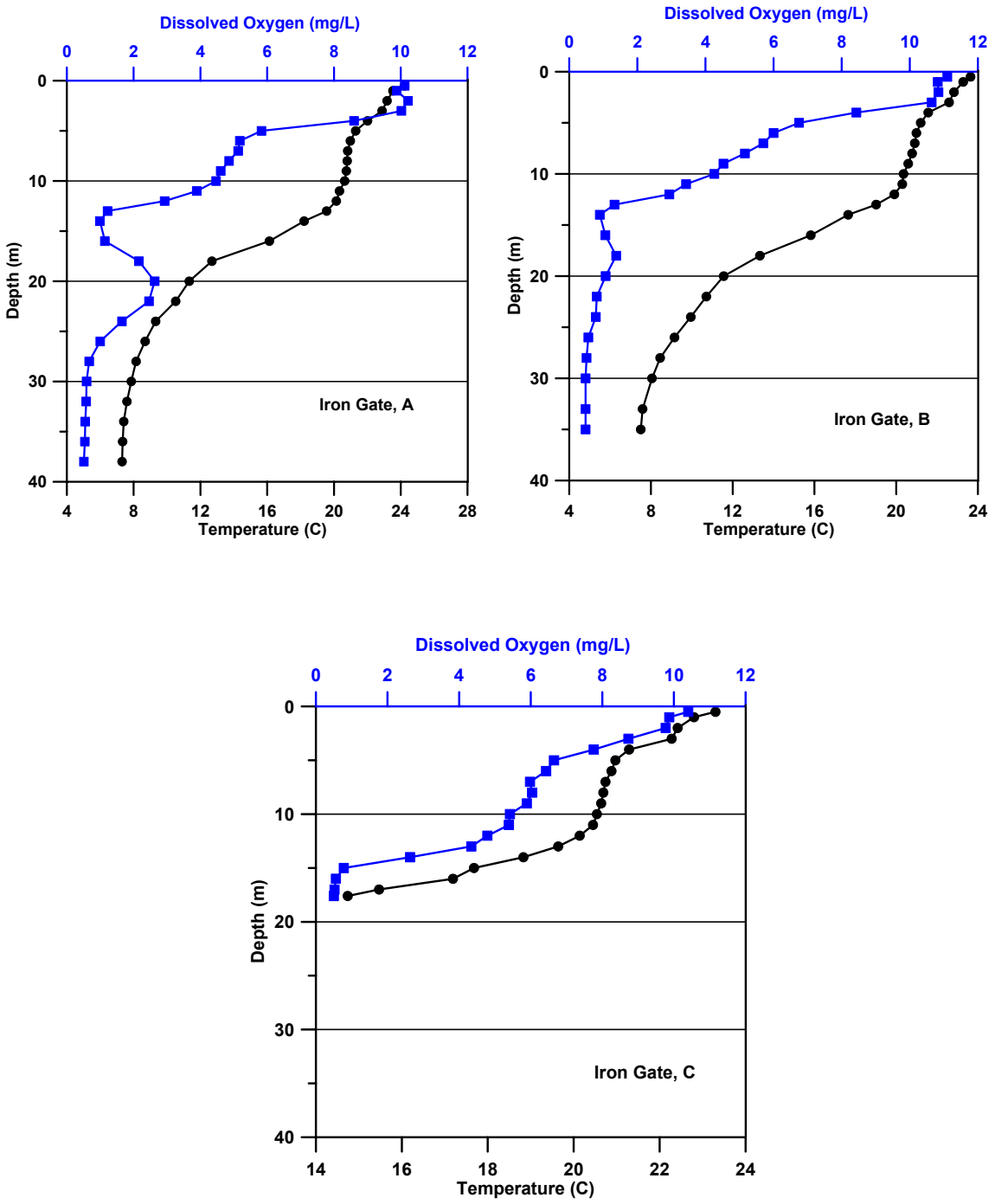
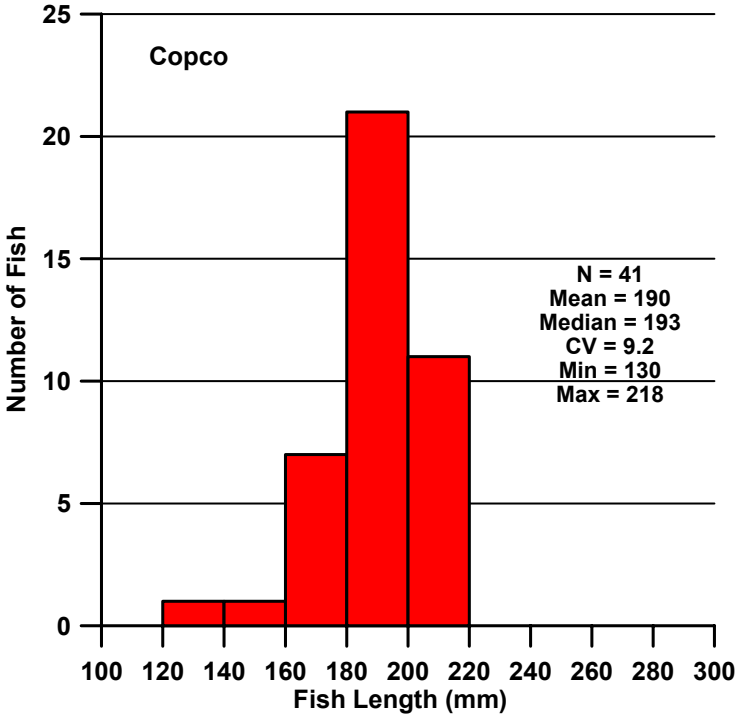


Figure 12. Temperature and dissolved oxygen profiles measured in August 20, 2003 for Iron Gate Reservoir at three locations (Source: L. Prendergast, PacifiCorp).



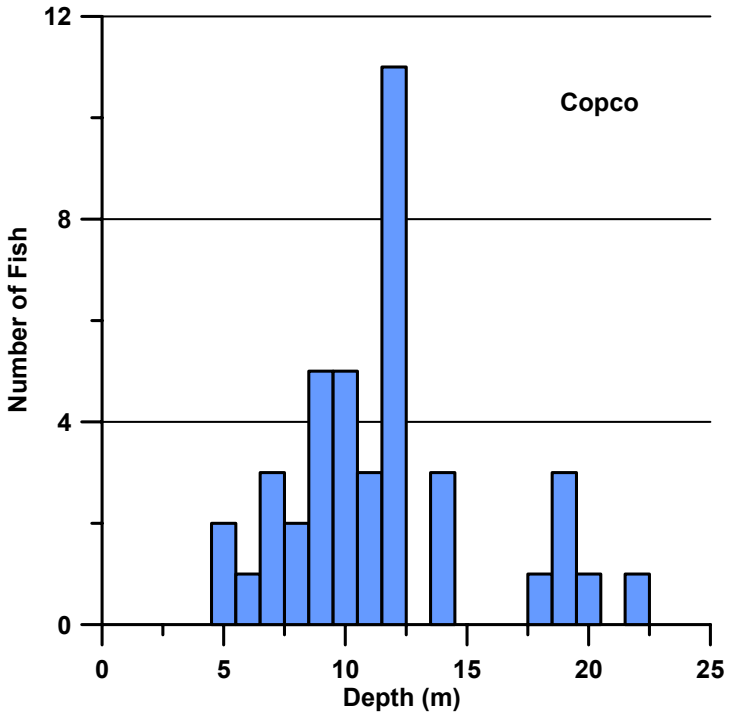


Figure 13. Size distribution (top) and depth distribution (bottom) of fish netted in Copco Reservoir, August 19, 2003

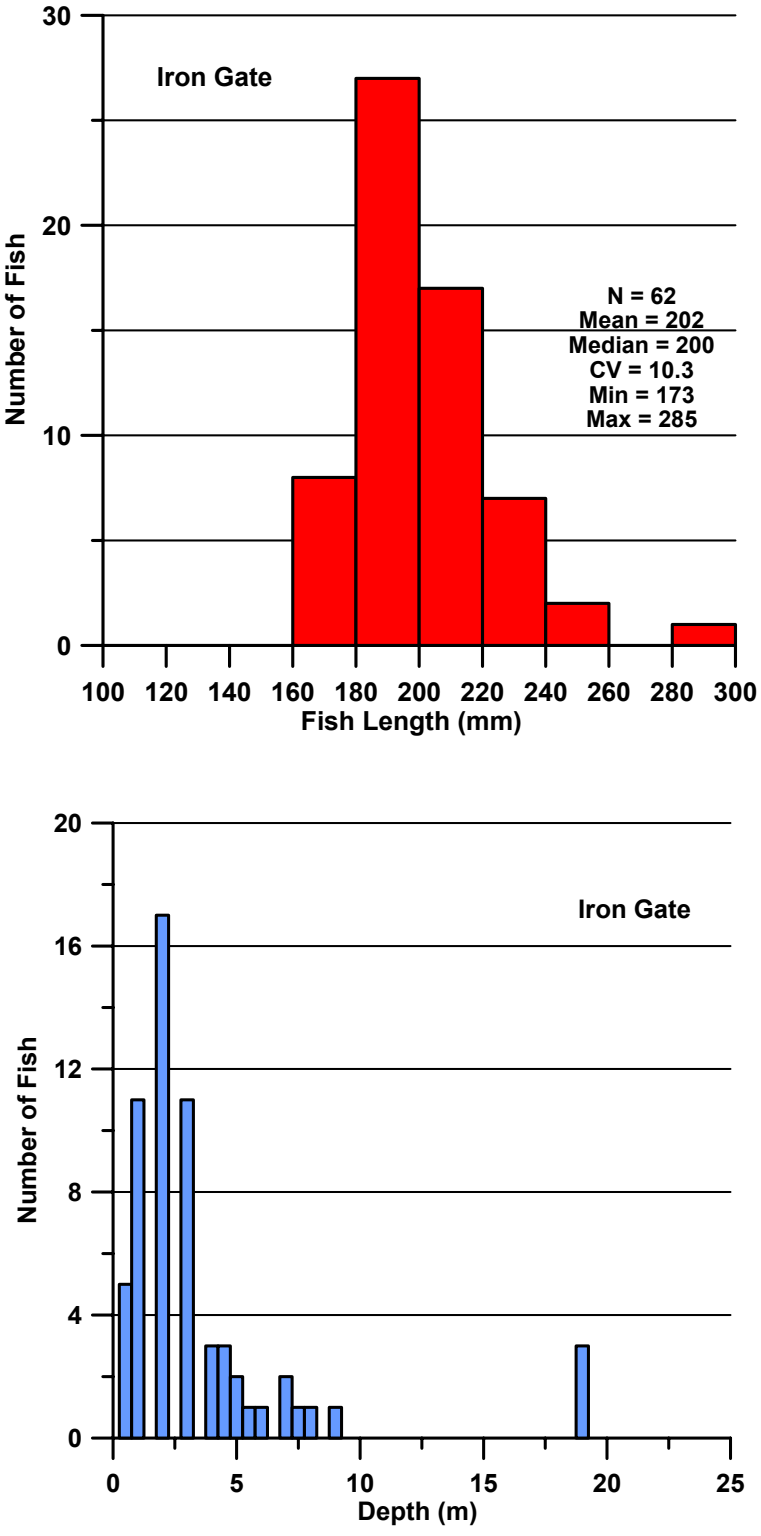


Figure 14. Size distribution (top) and depth distribution (bottom) of fish netted in Iron Gate Reservoir, August 20, 2003