NORTH CAROLINA WILDLIFE RESOURCES COMMISSION

Division of Boating and Inland Fisheries

COASTAL FISHERIES INVESTIGATIONS

Federal Aid in Fish Restoration Project F-22

Final Report

Herring Utilization of the Lake Phelps Fish Ladder

Job 1. Evaluation of herring passage through the fish ladder

Job 2. Final Report

Project Type: Survey

Period Covered: April 1 - May 30, 1985

James W. Kornegay

Fishery Biologist

Michael Humphreys

Assistant Fishery Biologist

Raleigh, North Carolina

July 1985

ABSTRACT

The objective of this study was to demonstrate herring utilization of a Denil Fish Ladder on Lake Phelps. Live herring were stocked downstream from the ladder in an enclosed area of Bee Tree Canal. Although optimum spawning temperatures existed during the study period, monitoring of a fish trap on the ladder revealed that herring did not successfully pass through the ladder. Extreme low flow conditions and traumatization of the herring from transport may have been factors contributing to non-utilization of the fish ladder.

INTRODUCTION

During February of 1984, a temporary Denil fish ladder (Clay 1961) was installed on Bee Tree Canal, which connects Lake Phelps and Scuppernong River (Figure 1). This type of fish ladder is used extensively in the northeastern United States to pass herring around obstacles to spawning areas (Saila et al 1972). In the past, alewife (Alosa pseudoharengus) and blueback herring (Alosa aestivalis) on spawning migrations have ascended Bee Tree Canal. During the intermittent years when water gates were open, herring have entered Lake Phelps and spawned. The purpose of installing the fish ladder was to seek a method for assuring continuous access for herring to Lake Phelps.

Net and trap sampling during the 1984 spawning season resulted in no captures of herring in the vicinity of the fish ladder. Because approximately six years had elapsed since water gates had been opened, any homing instincts which herring may have had for the lake might no longer exist. Also, a significant bloom of filamentous green algae occurred in Lake Phelps during the spawning period. Heavy loads of this algae flowing through the ladder and into Bee Tree Canal may have repelled herring from the area.

Because this experimental ladder was constructed of lumber and plywood, its structural integrity may last less than a few years, and prompt evaluation of the ladder was needed. A permanent fish ladder of this type may eventually have utility on Lake Phelps and other coastal locations if utilization by migrating herring can be documented. The project objective was to demonstrate herring utilization of the Lake Phelps fish ladder.

METHODS AND MATERIALS

In order to maximize the possibility that herring would use the fish ladder, we decided to stock live, prespawn herring into Bee Tree Canal just below the fish ladder. We arbitrarily decided that if more than 10% of the herring surviving initial stocking ascended the fish ladder, then the ladder might be recommended for future use.

Before herring were stocked, a screen barrier was installed across the canal approximately 100 meters downstream from the fish ladder. This barrier prevented egress of the stocked herring. A wire fish trap designed to funnel any herring leaving the ladder into a holding pen was attached to the exit point of the ladder (Figure 2).

Live herring were obtained by electrofishing on the Neuse River and from pound nets on the Scuppernong River. Upon capture, the herring were immediately placed in an oxygenated live tank and were transported to Bee Tree Canal. Water from the canal was added to the live tank to acclimate the herring before stocking. Herring were counted as they were stocked into the canal.

Forty-one herring from the Neuse River were stocked in Bee Tree Canal on March 27. Sixty-four herring from Scuppernong River were stocked on April 1, and 78 from Scuppernong River were transplanted on April 2.

After stocking, the fish trap was checked one to three times daily from March 27 through April 6 and on April 8, 10, 11, 12, and 15. At the same times, water temperature was measured in Bee Tree Canal using pocket thermometers.

RESULTS AND DISCUSSION

Monitoring of the fish trap throughout the study period indicated that no herring passed through the fish ladder. The water temperature in Bee Tree Canal fluctuated during the period due to alternating hot and cool weather systems. Optimum spawning temperatures for herring, ranging between 15° and 24° C (Wang and Kernehan 1979), were documented on March 30 and March 31 and on April 1, 2, 5, and 6. The absence of optimum spawning temperatures was evidently not a factor which limited upstream movement through the fish ladder.

By April 6, a total of 97 dead herring had been found within the enclosed study area, leaving 86 herring at large. Numerous turtles were seen in the area, and it is likely that a portion of the remaining herring died and were consumed by the turtles. No dead herring were found after April 6.

Extreme drought conditions existed during the study period. Lake Phelps was at a near record low level, consequently water flow through the fish ladder was minimal. The lack of attractant flow probably was the major factor in non-utilization of the fish ladder. Trauma from transport and confinement probably contributed to initial mortalities and may have altered normal behavior of the surviving herring.

On April 5, a brief electrofishing excursion in the lower portion of Bee Tree Canal documented the presence of two migrating herring in the canal. A local resident of the area also reported catching several herring in a dip net as well as visually witnessing spawning activity within the canal. Had normal flow conditions existed in the canal, it is likely that herring from Scuppernong River would have attempted an upstream migration to Lake Phelps.

RECOMMENDATIONS

Stocking of live herring below the fish ladder and monitoring of the trap should be repeated in 1986. Should migrating herring be detected in the lower reaches of Bee Tree Canal, the screen barrier should be removed to allow completion of their migration to the fish ladder.

Clay, C. H. 1961. Design of fishways and other fish facilities. Department of Fisheries, Ottawa, Canada. 301 pp.

Saila, S. B., T. T. Polgar, D. J. Sheehy, and J. M. Flowers. 1972. Correlations between alewife activity and environmental variables at a fishway. Trans. American Fish Soc. 101(4): 583-594.

Wang, J. C. S. and R. J. Kernehan. 1979. Fishes of the Delaware estuaries, a guide to the early life histories. Ecological Analysts, Inc., Towson, Maryland. 410 pp.

Figure 1. Lake Phelps Fish Ladder Study Area

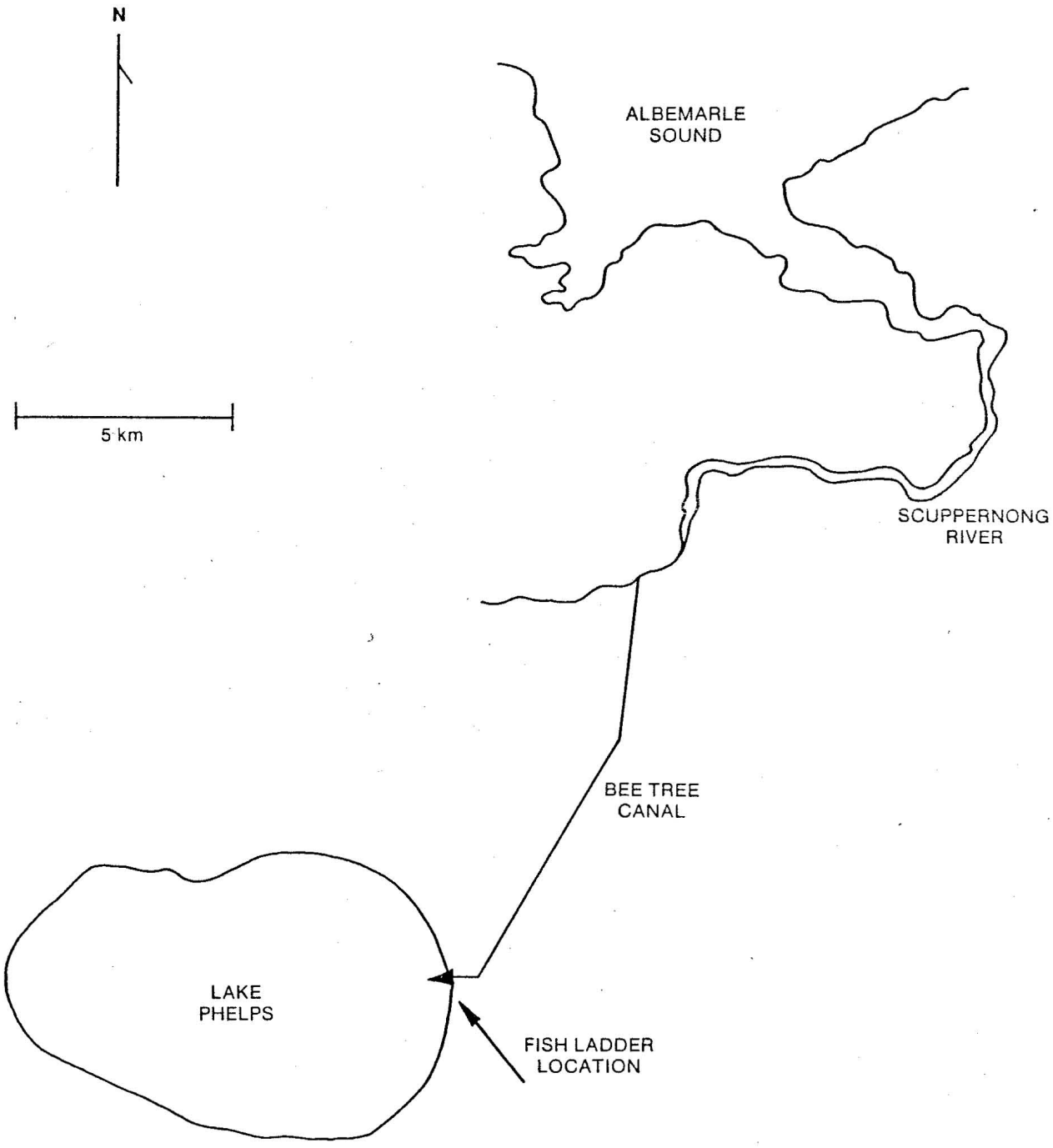

Figure 2. Detail of Lake Phelps Fish Ladder Study Area