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# COOK INLET SALMON STUDIES

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## KEY WORDS

Bear Lake, rehabilitation, fertilization, coho salmon, fingerling, smolt, stocking, Resurrection Bay, sport fishery, creel census, escapement, artificial spawning.

## BACKGROUND

Since 1961 the marine recreational fishery for Resurrection Bay coho salmon has become the second largest (effort and harvest) for this species in Alaska. Wild coho salmon production in Resurrection Bay is believed to be directly affected by the extreme fluctuations in stream flows and water temperatures characteristic of its coastal drainage tributaries. Therefore, it became imperative to stabilize or enhance Resurrection Bay's coho production to satisfy the rapidly growing angler demand evident in the early 1960s.

To eradicate competing threespine stickleback and subsequent annual restocking with coho fingerlings for increased smolt production, Bear Lake was chosen in 1962 as the main thrust for experimental coho salmon enhancement via lake rehabilitation. After reinfestation by stickleback and resultant decline of favorable smolt yields, Bear Lake was rehabilitated again in 1971. Threespine stickleback were completely eliminated and Bear Lake's yearling coho smolt yields from annual fingerling plants exceeded 50%; adult survival was up to 10% returns, contributing 14% to the Resurrection Bay sport harvest. Bear Lake is currently undergoing an artificial fertilization experiment to further increase its carrying capacity for juvenile salmon production.

Another facet of Resurrection Bay coho salmon enhancement began in 1968 with annual plants of hatchery reared smolts at three local release sites having diverse habitat characteristics. Though variable from one site and one year to another, smolt-to-adult survivals have ranged up to 15%; contributions to the sport harvest have been as high as 34%.

Lastly, impediments to smolt and spawning migrations, such as beaver dams, have been removed on a timely basis, and two natural rearing ponds were made accessible to juvenile coho in an attempt to improve wild stock survivals in the Resurrection River drainage.

For more detailed description and background information on the 23-year history of this project, see Logan (1969) and McHenry (1982). Figure 1 shows the Resurrection Bay drainage, and Table 1 lists the anadromous fish species indigenous to its tributaries.

#### RECOMMENDATIONS

- 1. The present objectives of the study should be retained.
- 2. The 1987 stocking density of coho fingerlings in Bear Lake should be adjusted according to emigrating smolt abundance, age composition and condition factor in 1986.

(76.5 percent) were from 40,700 and 34,100 Age 1.0 (1983 brood, Bear Lake origin) hatchery smolts released in Seward Lagoon and Grouse Lake on June 5 and 6, 1984, respectively. The remaining fish (23.5 percent) returned from 93,424 Bear Lake smolts that had emigrated in 1984. Estimated fishing mortalities of Seward Lagoon, Grouse Lake and Bear Lake smolt releases were 1.42, 1.39 and 0.35 percent, respectively. Exploitation rates of these returns in the sport fishery were estimated at 54, 73 and 6 percent, respectively.

The Bear Creek upstream migrant trap was operated continuously from June 1 through October 31. The coho upstream migration extended from September 3 to October 28, and consisted of 4,825 adults and 5 jacks. The adult run was comprised of 493 marked and 4,332 unmarked Bear Lake coho. Smolt-to-adult survivals of the 1984 marked and unmarked smolts were 2.26 and 6.68 percent, respectively, with an overall marine survival of 5.57 percent. Smolt-to-adult survivals of the 1984 Seward Lagoon and Grouse Lake hatchery smolt plants were 2.61 and 1.90 percent, respectively. Grouse Lake's coho survival may be low because of an underestimation of the escapement; the return's exploitation rate in the fishery was thereby estimated too high.

The 1985 catch-to-escapement ratio of marked Bear Lake coho (0.066:1) is the lowest ever estimated for this enhanced run. The male-to-female sex ratio was 1.1:1.0 in the Bear Lake escapement. After pathological screening for bacterial kidney and furunculosis diseases, an estimated 1,003,000 artificially spawned eggs from 264 females were fertilized by sperm from 115 males at Trail Lakes Hatchery. Incidence of bacterial kidney disease in the spawned salmon was only 2.8 percent overall. Eyed-egg mortality, after physical shocking at the hatchery, was 6.4 percent.

An estimated 10-15 coho utilized the lower Jap Creek spawning channel, constructed in 1985 as offsite mitigation for pink, *Oncorhynchus* gorbuscha (Walbaum), and chum salmon, *Oncorhynchus keta* (Walbaum), spawning habitat lost in Spring Creek. Additional coho may be accommodated in time, as spawner modification of the channel's substrate and streambank revegetation offer more protection from potential predators. Evaluation and development of new smolt-release sites near Fourth of July and Lowell Points may be timely to bolster coho returns to expanding shore fisheries in these areas.

Assuming a 4.0 percent wild coho smolt-to-adult survival and assuming that wild adult returns are estimated by marked Bear Lake coho catch-toescapement ratios applied to wild coho harvests, Resurrection Bay's wild coho migrations have averaged 756,000 (373,000-1,240,000) smolts and 30,224 (14,90349,769) adults from 1971 to 1985. Exploitation rates of adults have been moderate, averaging 40.6 (21.9-56.6) percent during this 15-year period.

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# RESEARCH PROJECT SESMENT

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Sport Fish Investigations of Alaska

Project: F-10-1

Study: S-31

Study TETA: LOWER COOK INLET COHO SALMON STUDIES

Job: S-31-2

Job T#t1\*: <u>Resurrection Bay Coho</u> Enhancement

Cooperator: Edward T. McHenry

Period Covered: July 1, 1985 to June 30, 1986

# ABSTRACT

Bear Lake was restocked with 300,000 Age 0.9 toho salmon, Oncorhynchus kisutch (Walbaum), fingerlings on June 5, 1983 to maintain smolt production. About 30 percent were undersized (1,442 per kilogram) because of a late feeding start on an experimental diet.

The Bear Creek weir downstream migrant trap was operated continuously from June 1 through September 10. A total of 105,880 smolts enumerated were comprised of 104,300 Age 1.0 and 1,580 Age 2.0 smolts. Yearling (Age 1.0) smolt survival from the 1984 Bear Lake fingerling plant was 47.4 percent, with a 5.9:1 smolt-to-fingerline biomass yield. Age 2.0 smolt survival was 0.8 percent, with a 0.3:1 biomass ratio. Excepting Age 3.0 smolts, total smolt survival and biomass production from the 1983 plant were 40.1 percent and 5.3:1, respectively. Total smolt survival of the 1982 plant was 50.7 percent, with a 5.9:1 biomass yield.

Bear Lake's predicted average coho smolt production of 2,000 kilograms, or 100,000 smolts, was nearly achieved (1.305 kilograms, or 99,114 smolts) from 1977 to 1982, despite the setback resulting from stocking undersized fingerlings (1,462 per kilogram) in 1979. Following 3 full years of fertilization, Bear Lake has averaged 1,902 kilograms, or 102,696 smolts, which is only a 3.6 percent increase in smolt abundance over prefertilization years. This minor cominge in Bear Lake's coho production may be due to natural variation is ther than lake fertilization effects.

According to the Resurrection Bay salmer creel census (July 8-September 10), an estimated 11,738 coho salmer were harvested for 19,865 angler-days of sport trolling effort. The mean seasonal catch per angler-hour was 0.100 coho. Enhanced coho 1.376 fish) contributed an estimated 11.7 percent to the sport harvest; most of these fish