

Causes of Variable Survival of Stocked Chinook Salmon in Lake Huron

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Abstract.—We investigated several cohorts of Chinook salmon in Lake Huron with emphasis on factors contributing to post-stocking survival. Stocked Chinook salmon were marked with oxytetracycline and/or coded-wire tags (CWT). Returns of CWT Chinook salmon to the recreational fishery were 2.5 times higher for fish pen-acclimated at the Au Sable River than for those stocked there conventionally. Return rates were only slightly enhanced by pen acclimation at Harbor Beach where the fish were probably stressed by excessive acclimation temperatures in most or all years of the study. Acclimation pens also appeared to better imprint fish to the Au Sable River where returns in fall spawning runs were 6.4 times higher for acclimated than conventionally-stocked fish. Transporting pen-acclimated Chinook salmon to the beach at the mouth of the Au Sable River enhanced performance of the 1995 cohort relative to acclimated fish stocked in the river, but beach stocking produced little improvement in survival in subsequent years when alewives were scarce. Returns of CWT Chinook salmon from all stocking sites generally decreased after 1995, as did alewife abundance. Survival of juvenile Chinook salmon and growth, condition, and survival of adult Chinook salmon appear to be positively correlated with adult alewife abundance. One-fourth of spawning-phase Chinook salmon in the Au Sable River were in critically low physical condition in fall 2004, suggesting a significant proportion of the adult population was succumbing to malnutrition. Age-0 Chinook salmon occupied the nearshore waters of Lake Huron for their first 6 months of lake residence. During May and June, both hatchery and wild juvenile salmon were taken by beach seining, particularly at the mouths of the Au Sable and Tawas rivers. Adult alewives were the most abundant of 46 species of fish sampled with beach seines while targeting Chinook salmon, and lake whitefish were caught in beach seines at many locations, especially in the Thunder Bay area. Age-0 Chinook salmon were found in stomachs of walleyes, lake trout, and other predators sampled near the beach seining sites, particularly when alewives were scarce. Pen acclimation appeared to minimize exposure of stocked Chinook salmon to predation in the beach zone because the acclimated fish were larger and appeared to migrate offshore more quickly than smaller conventionally stocked Chinook salmon. Juvenile Chinook salmon were sampled later in the summer with small-mesh gill nets in waters less than 20 m deep where water temperatures were frequently near 18°C. These juveniles fed on terrestrial and aquatic invertebrates until September when they began switching to fish, principally age-0 alewives. Growth rates were rapid, averaging 1.3 mm per day, probably driven by the relatively warm temperatures occupied. Adult alewives were the leading incidental catch in the small-mesh gillnets while targeting juvenile Chinook salmon. Age-0 Chinook salmon appeared to be buffered from predation in years when alewives were abundant. Conversely, their similar size and appearance and spatial association with alewives may have contributed to increased predation on age-0 Chinook salmon when alewives were scarce. Adult alewife abundance declined sharply after 2002, which renders the future of Lake Huron's Chinook salmon fishery highly uncertain.