

## Contribution of Hatchery Fish to Chinook Salmon Populations and Sport Harvest in Michigan Waters of Lake Superior, 1990-94

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*Abstract.*—The composition of chinook salmon *Oncorhynchus tshawytscha* populations in Lake Superior was assessed in 1990-94 by all agencies stocking chinook salmon to determine relative contribution of hatchery and naturally-produced fish. These data were gathered to assess chinook salmon stocking programs and provide the basis for evaluating effects of chinook salmon on the Lake Superior fish community. About 1-3 thousand chinook were caught annually in Michigan's Lake Superior sport fishery during 1990-94. Chinook ranked third behind lake trout and coho salmon *Oncorhynchus kisutch*, and represented 6% of total salmonines caught. Most chinook were ages 2 and 3 in lake catches and ages 3 and 4 in stream catches. Michigan hatchery chinook contributed 7% to the Michigan lake catch during 1990-94, with Minnesota, Wisconsin, and Ontario fish contributing 10%, 5%, and 2%. The highest contribution of hatchery fish was in Keweenaw-Huron Bays (31%), with 8% Michigan fish. The lowest was at Black River-Ontonagon (9%), but all were Michigan fish. The 1989 year-class provided the best return to the lake sport fishery as a percentage of number stocked (0.10%), with an average return of 0.07% for all year-classes. Number of coded-wire tags recovered per 100,000 tagged fingerlings stocked were higher from sport fisheries on stocked tributaries than from lake fisheries, with highest returns from Black and Dead rivers. Chinook salmon spawned in at least 10 Michigan tributaries during 1990-94 (four stocked and six non-stocked). Hatchery chinook made up 80% of spawning runs in two stocked streams and most (70%) were Michigan fish; whereas in a non-stocked stream, naturally-produced chinook contributed 70% and most hatchery fish were from Wisconsin (17-22%). Michigan hatchery chinook moved east and west from all stocking sites and strayed throughout Lake Superior, with one moving about 600 miles to southern Lake Michigan. Length-at-age of chinook captured during February-June ranged from 12 inches at age 1 to 33 inches at age 5, with growth increments of 10 inches between ages 1 and 2, 5 inches between ages 2 and 3 and 3 and 4, and about 3 inches between ages 4 and 5. A chinook salmon weight-length relationship calculated from 1992 data was  $\log_e [\text{weight (lb)}] = -8.52 + 3.14 \log_e [\text{total length (in)}]$ , and was similar to relationships calculated from 1993 and 1994 data. Total annual mortality rates for age-3 chinook and older averaged over 70%. Sea lamprey wounding on chinook was less than 5 wounds per hundred fish, and incidence of bacterial kidney disease was 2.3%. Fish made up 99% by weight of chinook food items and most (53%) were coregonines. Michigan should cooperate with other agencies to at least maintain current lake-wide stocking levels. Michigan should explore strategies for increasing imprint and survival of chinook it stocks to develop fisheries in tributaries. The number of chinook stocked in Lake Superior probably could be increased without harming lake trout populations, but it is not certain if this would result in more fish for the fishery.