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Production of Juvenile Steelhead in two Central Lake Michigan Tributaries

Aaron P. Woldt and Edward S. Rutherford

School of Natural Resources and Environment
The University of Michigan
Ann Arbor, Michigan 48109

Abstract.–Steelhead *Oncorhynchus mykiss* are a large and economically important part of the Lake Michigan sport fishery. Approximately 30-50% of steelhead taken in Michigan's sport harvest are produced in stable, cold-water tributaries in the northwestern part of the Lower Peninsula. In most of these tributaries, hydropower dams limit anadromous salmonid production by denying spawners access to upstream habitat and by altering quality of habitat in downstream river sections. Recent (1989) changes in water flow from peaking to run-of-river over Tippy Dam may have increased steelhead abundance and production in the Manistee River. The objectives of this study were to estimate abundance, growth and survival rates, and production of juvenile steelhead below Tippy Dam and to compare these values with those for parr in the adjacent Little Manistee River, a free-flowing river that historically has supported a healthy population of young steelhead. We estimated steelhead parr abundance and survival in the Manistee River using mark-recapture and multiple pass-depletion methods, and estimated steelhead parr abundance in the Little Manistee River using multiple pass-depletion methods. We collected parr in August, September, and October 1997, and March 1998 in the Manistee and Little Manistee rivers using DC electrofishing. We estimated growth and production from changes in length and weight over time.

Young-of-the-year (YOY) steelhead were abundant (3,029,604 ± 589,803) in the Manistee River in July 1997, but numbers quickly declined in late July due to stressful high temperatures (mean = 20.3°C) which caused very low survival (%S = 1.7) in July. Although parr abundance in July in the Little Manistee River was much lower (307,259 ± 66,248) than in the Manistee River, daily temperatures averaged 17.0°C and were closer to optimum for parr growth and survival, and parr survival (%S = 87.6) was higher. As a result, production of steelhead parr was higher in the Little Manistee River (1.89 g/m^2) than in the Manistee River (1.54 g/m^2) during the July 1997-March 1998 sampling period, and significantly more age-2 pre-smolts were found in the Little Manistee River (30,865 ± 13,297) than in the Manistee River (1,369 ± 492) in March 1998. Growth rates of steelhead parr did not differ conclusively between the Manistee and Little Manistee rivers. The results of this study indicate that thermal stress caused by the surface-release flow regime of Tippy Dam may cause low survival and production of juvenile steelhead below Tippy Dam. On average, daily temperatures in July below Tippy Dam were warmer (mean = 20.3°C) and fluctuated over a significantly smaller range (daily fluctuation = 0.8 ± 0.6°C) than those in the Little Manistee River (mean = 17.0°C, daily fluctuation = 3.5 ± 1.7°C). Higher daily temperatures and smaller daily fluctuations produced a larger number of accumulated degree days (629) in the Manistee River than in the Little Manistee River (527).