

**Performance of Steelhead Smolts Stocked in Southern Michigan  
Warmwater Rivers**

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**Abstract--**We evaluated post-stocking survival, returns, homing, and contributions of steelhead smolts of two strains stocked in three southern Michigan warmwater rivers. Post-stocking survival was examined by comparing abundance among various stocking groups in the summer Lake Michigan sport catch during 1988-93. Minimum estimates of river returns were obtained by creel census below the first dam (and by counts at one fish ladder) during 1988-94. For Little Manistee steelhead, post-stocking survival varied among years and decreased as stocking sites moved further upriver. About 50% of mortality on downstream-migrating smolts occurred in the final 8-16 km of the journey. Post-stocking survival was very high for Skamania steelhead stocked in the lower St. Joseph River, but much lower for those stocked upriver in Indiana. Minimum returns to Berrien Springs dam on the St. Joseph River averaged 15-16% for both strains but only 2-3% for Skamania fish stocked in Indiana. Homing of Little Manistee steelhead was strong, both to and within the river. On the average, 77% of adult steelhead recovered at a stocking location within the Grand River had been stocked at that site. Fish stocked at the mouth or in downstream tributary streams did not return upstream to the first dam. Stocked Little Manistee steelhead made up 54-77% of the fall-spring adult returns from the 1988-90 smolt cohorts. Stocked Skamania steelhead made up 82% of summer returns and 17% of fall returns. Little Manistee fish stocked in the Huron River (draining to Lake Erie) matured at only 1.8 lake years (as opposed to 2.6 lake years for those

stocked in Lake Michigan) and scales showed unusual signs of mid-summer stress. Stocked steelhead smolts can provide consistent returns and sustain valuable sportfisheries in warmwater tributaries of the Great Lakes. The Skamania strain offers high survival to the open-lake fishery and an extension of the river fishery into summer months; however, their use should be limited to coolwater or coldwater rivers, and potential impacts should be assessed prior to introduction.

Since 1970 large fisheries for steelhead (anadromous rainbow trout *Oncorhynchus mykiss*) have been developed by stocking hatchery-reared juveniles in several southern Michigan warmwater rivers. These successful fisheries provide returning adult steelhead to large urban centers in southern Michigan, Ohio, Indiana, and Illinois.

Growth of these fisheries coincided with the initiation of stocking but contributions of stocked steelhead were never fully evaluated. The Michigan Department of Natural Resources (MDNR) stocked yearling and fall-fingerling parr in several of these rivers during 1969-85 (Figure 1), and substantial fisheries developed in subsequent years (Figure 2; Seelbach 1989). Juvenile steelhead are termed "parr" during their stream-resident phase, and "smolts" as they physiologically transform and migrate in preparation for life at sea (or the Great Lakes). This distinction is size-related; smaller yearlings are typically parr and larger yearlings are smolts. Nearly all fish smolt by age 2. Most stocked parr remain in the river an additional year and can suffer high mortalities. Conversely, smolts imprint to the stocked river and migrate quickly to the lake, minimizing riverine mortalities (Seelbach 1987). Seelbach (1989) found that, for 2 warmwater rivers in southern Michigan, returns of marked yearling parr were fairly low (1-7%), and suggested that most parr died during the additional year of river residence. He speculated that fall-fingerling parr may have suffered similar mortality; and suggested that a sizable portion of returning adult runs may have been strays, as stocking by neighboring states had also increased during this period (Hansen et al. 1991; Breidert and Hudson 1990).

In 1986 MDNR began stocking yearling smolts (Figure 1) with expectations of good imprinting, quick emigration, minimal river mortality, and consequent high returns. MDNR

stocks the Little Manistee River strain, a first-generation product of wild winter- and spring-run steelhead collected in the Little Manistee River, a tributary of central Lake Michigan. MDNR has also experimented with the Skamania strain, a domesticated summer-run strain that has been selected over many generations in Washington for early spawning (and thus good hatchery growth) and late maturity (and thus large size at return). The Skamania strain has been propagated in Michigan since 1985 and in Indiana since 1978. Fish ladders were built to provide passage past dams on the Grand (1975-81) and St. Joseph (1975-92) rivers with hopes of spreading a large new fishery for steelhead (and other salmonines) upriver to previously unavailablereaches. Ladders on the St. Joseph River now allow migrating salmonines access to Indiana waters. Since 1985, the Indiana Department of Natural Resources (IDNR) has stocked large numbers of Skamania steelhead smolts and parr (Figure 1a) into the upper river with the intent of building an upriver fishery.

The purpose of this study was to evaluate these major new management programs: stocking yearling smolts into warmwater rivers in southern Michigan; developing upriver fisheries through upriver stockings and construction of fish ladders; and stocking Skamania steelhead. We had the following objectives. (1) To evaluate post-stocking survival, growth, maturity, returns, and relative contribution to seasonal fisheries for Little Manistee steelhead smolts stocked at various sites in three large, warmwater rivers; (2) To evaluate homing of adult steelhead stocked at upriver sites in the Grand River; and (3) To evaluate the performance of Skamania steelhead stocked in the St. Joseph River.