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by

Robert J. Naiman

WOODS HOLE OCEANOGRAPHIC INSTITUTION
Woods Hole, Massachusetts 02543

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TECHNICAL REPORT

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Approved for Distribution: George D. Grice

George D. Grice, Chairman
Department of Biology

DETERMINING THE OSMOREGULATORY ABILITY OF ANADROMOUS BROOK TROUT

Stephen D. McCormick and Robert J. Naiman
Woods Hole Oceanographic Institution

Sea-run brook trout (Salvelinus fontinalis) may obtain growth rates that are four to five times that of their cohorts remaining in freshwater. This fact, in combination with an exceptionally high rate of return of brook trout to their parent stream, has generated keen interest in the use of this species in fish farming, ranching and population enhancement programs (Gibson and Whoriskey 1981; Whoriskey et al. in prep.). For any such program designed to grow brook trout in salt water, the determination of optimal size and age for introduction of young brook trout into sea water is an important first step. Research in our laboratory is designed to answer this and other key questions concerning salmonid smoltification.

In order to determine the relative importance of size and age in determining the osmoregulatory ability of brook trout, it is necessary to grow a large number of fish of a single age class. 20,000 brook trout fry obtained as eggs from the Massachusetts State Hatchery are being grown in culture facilities in the Shore Laboratory at the Woods Hole Oceanographic Institution. Photoperiod has been shown to have a profound effect on salinity tolerance in salmonids (Clarke et al., 1979), one which could mask the effects of size and age. In order to control for the possible effects of photoperiod half of the fish are under a natural daylength light regime while the remainder experience a photoperiod which is three months out of phase with normal day length. In order to develop fish of

different sizes at any given age, half of the fish are being grown at a maximal rate, with the remainder being fed a lesser amount and growing submaximally.

Beginning in spring 1981 the fish currently being cultured will be used for monthly sea water exposure experiments. Fish obtained as fingerling from the Massachusetts State Hatchery at Sandwich and grown to different sizes have already undergone salinity tolerance tests. In these experiments brook trout are gradually acclimated to sea water ($30^{o}/oo$) over a 4 day period at constant temperature in 100 liter aquaria. Fish are kept in seawater for several weeks during which survival and growth relative to freshwater controls will be the major criteria by which the relative role of size, age and photoperiod are judged. In addition to growth and survival, several potential physiological changes are investigated. These include plasma ions and osmotic concentration, gill $Na^{+}+K^{+}$ ATPase, gill histology and levels of thyroxine in the blood.

Results from his study will show the relative roles of size and age in determining the ability of brook trout to osmoregulate in sea water. This information will be valuable in determining successful seawater stocking procedures for brook trout and other salmonids. In addition our examination of physiological changes will detect physiological parameters that might be used to predict the ability of a population to enter sea water as well as increase our understanding of the process of salmonid smoltification.

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