

STUDY PERFORMANCE REPORT

State: Michigan

Project No.: F-80-R-3

Study No.: 507

Title: Long-term suppression of brook trout reproductive success by sand bed load

Period Covered: October 1, 2001 to September 30, 2002

Study Objective: To determine and document the long-term impacts of a 1-time (period) elevation of sand bed load on brook trout populations in Hunt Creek, Michigan. To explore reasons why young-of-the-year (YOY) habitat remains degraded nearly a quarter century after experimental sand additions were discontinued.

Summary: Recruitment of YOY brook trout in a section of Hunt Creek degraded by excess sand sediment in the early 1970s has remained lower, relative to recruitment in an upstream control zone, for approximately 25 years. The present study was designed to determine if this long-term reduction in reproductive success could be linked to channel morphology characteristics. I attempted to duplicate measurements of channel morphology made during a study of sediment effects on brook trout populations and their habitat that was conducted during 1967-86. Preliminary analyses of channel morphology data collected in 2000-01 suggested that habitat remains degraded by sand sediment. The reduced abundance of brook trout YOY, compared to levels observed prior to 1972 may result from persistent high percentages of sand sediment.

Findings: Jobs 1, 2, and 3 were active this year, and progress is reported below.

Job 1. Title: Characterize channel morphology.—I measured stream width and depth, and characterized dominant substrate types along transects spaced at 100-foot intervals along the study reaches. These data were summarized and reported during previous segments. Briefly, stream width in the reach affected by excess sediment was wider in 2000 than in 1980 when mean width was last estimated (Alexander and Hansen 1986). Dominant streambed substrate was characterized at 1-foot intervals along each transect. These data were summarized and reported during the previous segment. In 2000, the percentage of sand substrate in the section that was subjected to elevated sand bed loads in the 1970's was similar to that reported in 1975 (Alexander and Hansen 1986). Percentages of sand in the upstream control section were approximately double the percentages estimated in 1975. Sediment liberated from a large beaver impoundment that last washed out in 1996 is the most obvious cause of the increase in sand sediment in the control zone. Since then, the dam has not been rebuilt and the stream has cut down through sediments that had accumulated behind the dam for at least three decades.

Job 2. Title: Estimate trout population characteristics.—We estimated brook trout populations each April and September in each of the study reaches. Scale samples collected from subsamples of trout were read to determine trout ages and used to derive age-specific population estimates. Fall abundance of YOY brook trout was similar in a treatment and control zone during the five-year period from 1967-71 before sand sediment was intentionally added to a treatment section (Figure 1). After experimental sand additions, made from 1972-76, September abundance of YOY declined in both the treatment zone and in the contiguous upstream reference zone. However, since 1977, recruitment has been consistently higher in the control zone than in the reference zone (Figure 1). YOY were about 1.1 times more abundant in the treatment zone than

in the control zone during the pretreatment period of 1967-71 (Figure 2). However, YOY in the sand-degraded reach were only 0.54 times as abundant as in the upstream control zone during the twenty-year period from 1977 to 1997 (Figure 2). Since 1997, YOY abundance has increased in the treatment zone, relative to the control zone, due to declines in recruitment in the control zone.

The catastrophic failure of a beaver dam upstream of the control zone in June 1993 was the apparent cause of a weak year class in the control zone in fall 1993. The beaver dam was rebuilt, but it again failed in November 1996. The dam was not rebuilt after 1996. Sediment released from this beaver impoundment may be the cause of lower recruitment of YOY in the control zone during the past four years (Figure 1).

Job 3: Title: Analyze data and write progress report—This progress report was prepared.

Literature Cited:

Alexander, G. R., and E. A. Hansen. 1986. Sand bed load in a brook trout stream. North American Journal of Fisheries Management 6:9-23.

Prepared by: Andrew J. Nuhfer

Date: September 30, 2002

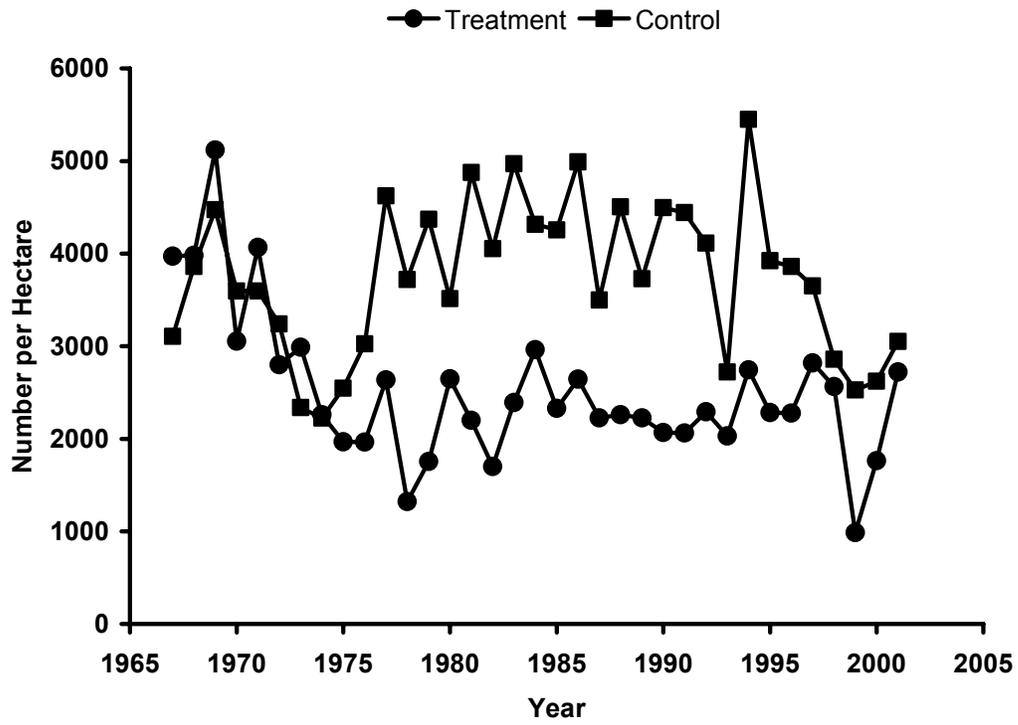


Figure 1.—Fall number of YOY brook trout per hectare in a 1.5 km section of Hunt Creek where habitat was degraded by sand sediment (Treatment) and in a 1.9 km reference zone (Control).

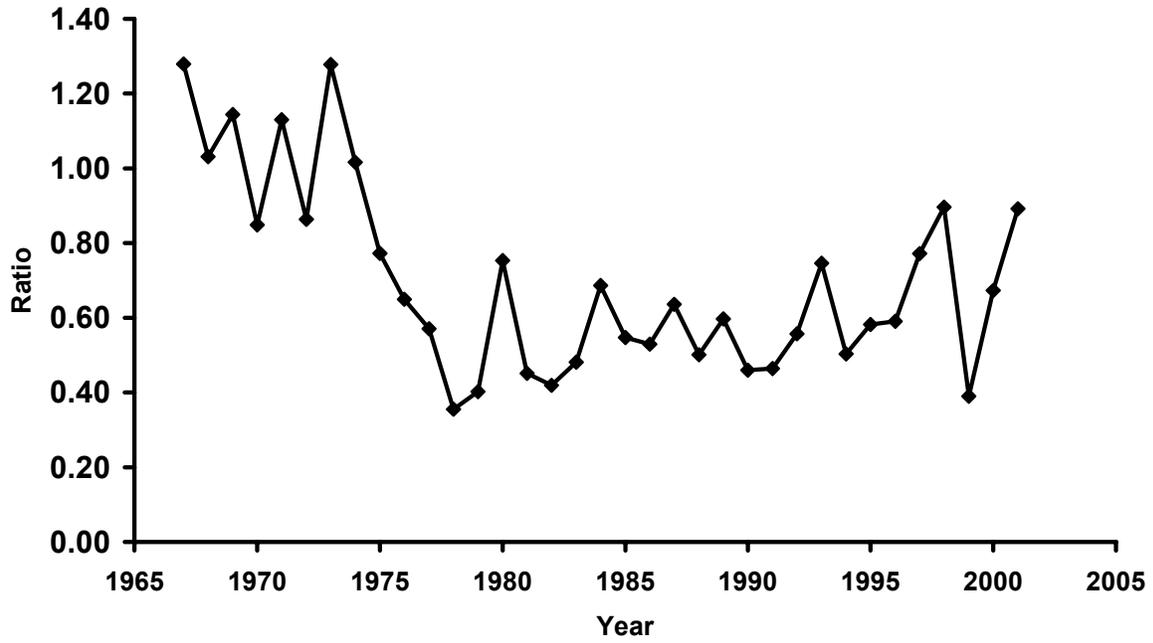


Figure 2.—Ratio of the fall number of YOY brook trout per hectare in a 1.5 km section of Hunt Creek where habitat was degraded by sand sediment to those in a 1.9 km reference zone.