STUDY PERFORMANCE REPORT

State: Michigan **Project No.:** F-81-R-3

Study No.: 679 **Title:** Ecological river classification as a basis for management of coldwater streams

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

Study Objectives:

1) To complete the classification of Lower Peninsula rivers by including the remaining, smaller coastal rivers (most Lower Peninsula rivers were classified by Seelbach et al. 1997).
2) To review the classification boundaries and codings of all Lower Peninsula stream segments, in light of available data and experiences of field personnel. This revision will add major in-channel lakes, coding of individual tributary streams, current trout stocking prescriptions, and current stream classifications.
3) To develop criteria for classification of coldwater streams, and to then classify all stream segments as appropriate. Segment classifications will be compared with previous Fisheries Division Stream Classifications and changes recommended, if needed. Finally, a process for revision of classifications will be developed.
4) To develop stream criteria for trout stocking, and to then classify all stream segments as to their suitability for stocking to meet specific management objectives.

Summary: Work on this study was not completed as planned due to re-assignment of the principal investigator to other duties. Work continued on attributing the existing valley segment classification with measured temperatures and fish survey data. Delineation of valley segment catchment boundaries was completed and map themes were summarized for all segments in the Lower Peninsula. Differences in line work between the valley segment classification and Fisheries Division's designated coldwater stream map were found and need to be resolved in future work. Relationships between temperature and trout distribution and abundance were evaluated. Preliminary results suggest that coldwater designations should be considered for those valley segments with July mean temperature < 22 C, and July maximum temperature < 24 C, and that trout should be stocked in only those valley segments with July mean temperatures < 20 C, and July maximum temperature < 22 C. The proposed criteria now need to be evaluated by MDNR Fisheries Division Trout Management Committee.

Findings: Jobs 2, 3, 4, 5, 6, 7, 9, and 10 were scheduled for 2001-02, and progress is reported below.

Job 2. Title: Review and update classification.–Summer water temperature data collected at 295 sites were summarized and spatially referenced by valley segment. Average difference in temperature among sites within valley segments was low (July mean = 1.05 C; July maximum = 1.32 C). This result suggests that valley segments are reasonable physical units wherein thermal conditions are relatively uniform. Average temperature variation between years at the same site was also low (July mean = 1.28 C; July maximum = 0.84 C). Therefore, data from multiple sites and multiple years within a valley segment were averaged to create a single temperature record. These records were assumed to represent the average thermal behavior within each valley segment.

Catchment boundaries for all upstream, midpoint, and downstream segment nodes have been delineated and map themes summarized (by catchment) for all segments in the Lower Peninsula. Positions of segment boundaries were reviewed and corrected during the delineation process. Map data have been used to generate landscape-based estimates of base flow yield for each valley segment, and will be used to estimate stream temperature where data are lacking.

Two important issues were found in comparing the valley segment ecological classification (VSEC) with the Michigan DNR's designated coldwater streams. First, the designated coldwater streams layer is comprised of many small tributaries not considered in the current VSEC layer. Therefore, many streams managed as coldwater are not classified as valley segments. Second, valley segment boundaries and designated coldwater stream boundaries frequently do not correspond. These issues need to be resolved if coldwater streams are to be managed using a valley segment classification.

Job 3. Title: Develop coldwater criteria.–These criteria proposed in Job 10 need to be evaluated by MDNR Fisheries Division Trout Management Committee. No further work was completed on this Job.

Job 4. Title: Classify coldwater streams.–Work on this job was not completed due to re-assignment of principal investigator.

Job 5. Title: Develop trout stocking criteria.–The criteria proposed in Job 10 need to be evaluated by MDNR Fisheries Division Trout Management Committee. No further work was completed on this Job.

Job 6. Title: Classify streams re. trout stocking.–Work on this job was not completed due to re-assignment of principal investigator.

Job 7. Title: Write reports.–This annual progress report was prepared as scheduled.

Job 9. Title: Evaluate effects of temperature on trout populations.–Brown, brook, and rainbow trout data were obtained from MDNR Fisheries Division surveys, and consisted of presence/absence and abundance information (number/acre and pounds/acre). Abundance data from multiple sites within a valley segment and from multiple years were averaged to create one measure of trout abundance for each valley segment where data were available. Trout were considered present in a valley segment if at least one site within a segment contained trout.

Relationships between temperature and trout distributions were assessed by plotting presence/absence data for each species against mean and maximum July temperatures. For all species, self-sustaining populations were rarely present at sites where mean and maximum July temperatures exceeded 20 C and 22 C, respectively. Trout populations were present at sites having warmer temperatures, but in most cases, these populations were maintained through stocking.

For those sites where brown and rainbow trout were present, brown and rainbow trout abundances were negatively correlated with measures of mean and maximum July temperature (r ranged from -0.67 to -0.80). Brook trout abundance was not significantly correlated with any temperature summary. Of ten different methods of summarizing the July temperature information, the best predictor of trout abundance was mean July temperature. The patterns for brown trout (Figure 1) and rainbow trout were similar with abundance approaching zero as mean July temperatures approach 21 C.

Job 10. Title: Develop temperature guidelines for management.–Based on results from Job 9, it was recommended that coldwater designation be considered for those valley segments with July mean temperature < 22 C, and July maximum temperature < 24 C. In addition, it was recommended that trout be stocked in only those valley segments with July mean temperatures < 20 C, and July maximum temperature < 22 C. However, segments meeting temperature criteria should not be stocked if a naturally-reproducing population already exists. The differences between the two criteria reflect the fact that trout can survive at temperatures above a mean July temperature of 20 C, although survival of early life stages may be impaired at sites that exceed 20 C.

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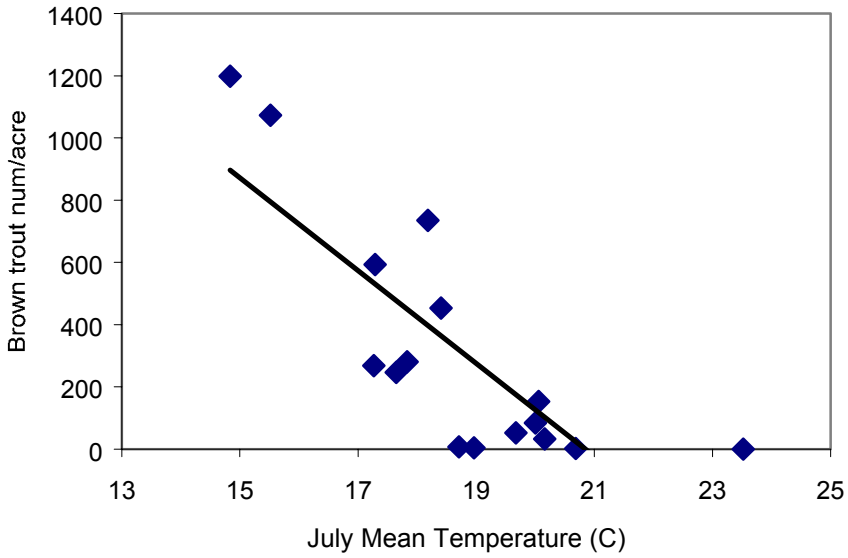

Figure 1.–Relationship between brown trout abundance and July mean temperature in Lower Michigan rivers.