Report as of FY2007 for 2006MT106B: "Student fellowship: The effects of overwinter dewatering on brown trout redds and egg survival in a Montana creek"

Publications

Project 2006MT106B has resulted in no reported publications as of FY2007.

Report Follows

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Research progress briefing
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Project Title: **The effects of overwinter dewatering on brown trout redds and egg survival in a Montana creek**

For the 2005-2006 field season, 12 baskets containing eggs from wild brown trout specimens native to the site were placed at the study site in Warm Springs Creek. Each basket contained 100 eggs dispersed in gravel that had been sieved to 10-50 mm diameter. The baskets were buried in 6 artificial redds, or fish nests, with two baskets per redd, for a total of 6 sampling locations at the site. Redd locations were selected to replicate the substrate, flow and depth conditions where actual brown trout redds are built. This stretch of Warm Springs Creek is an active spawning location for brown trout, and one member of the study team has been conducting an annual redd count for several years. There was no industry dewatering this year, and streamflow was at its natural level.

The baskets were a modified version of those used by Maret et al (1993) and Rubin (1995), made of rubberized wire and lined with a fiberglass mesh to prevent newly hatched fish from escaping. A metal standpipe was placed in between each pair of baskets for drawing water samples from egg depth (9-12 cm below streambed surface), to measure DO and ammonia. iButton temperature loggers were placed in each standpipe, to record hourly temperatures at egg depth. These were designed to be removed and replaced at each sampling visit; the original study plan was to visit the site semimonthly, sample for DO and ammonia at egg depth, exchange temperature data loggers, and record stream stage and flow data at the head of each artificial redd.

Persistent, bottom-to-surface ice and the disruption of the standpipes led to a modification of the study design. Some ice for much of the wintertime study period was expected, as was total freezing for some parts of the study period. However, there was an early cold snap and by Dec 5 much of the site was iced in. It was found that the metal standpipes became a locus for ice formation, and facilitated bottom-to-surface freezing at almost every basket site. This resulted in a thick layer of ice within the standpipes, hindering data collection; extreme measures to remove the ice, such as pouring heated water down the standpipe, were determined to be too disruptive to the study environment and potentially harmful to the nearby eggs. The standpipes were also frequently scoured out by ice movement, resulting in lost iButtons and holes in the temperature data set. Some sites were occasionally rendered inaccessible due to stream conditions. Temperature, stage and flow data were collected at each accessible redd and, using an existing USGS gauge, just above the study site.

In April 2006, the eggs hatched; the baskets were removed and the number of live fry, live eggs and dead eggs in each basket were tallied. There were very few dead eggs in the samples; almost all showed all live fry. Curiously, up to 60% of the eggs in each basket were simply not accounted for. It is unlikely that any fry escaped, as the mesh lining the basket was tight and the seams were well-sealed. Dead eggs were present and

were quite noticeable, even at advanced stages of decomposition; given the cold instream temperatures, it seems unlikely that more dead eggs existed but decomposed beyond recognition. Stonefly, mayfly and caddisfly larvae were present in some but not all of the baskets, so predation is one possibility for the diminished return. Predation/cannibalism of unhatched eggs, dead eggs and new hatch by other new hatch is a second possibility.

For the 2006-2007 field season, another 12 baskets with 100 eggs each were placed at the same site locations. One site required slight modification to avoid disrupting wild redds. The new location is within .8 meters of the original placement and still within the range of depth and flow typical of brown trout redds. It appears there will not be an overwinter dewatering this season, although it has happened without notice in the past. This season, Hobo temperature loggers were buried in each basket with the egg samples, to be left in place all season. The use of standpipes was discontinued. Regular flow, stage and instream DO and temperature measurements will be taken. When site conditions permit, water samples will also be collected from egg depth in the gravel environment. In April, the baskets will be removed and the numbers of fry/live egg/dead egg will be tallied.

In the summer of 2007, a groundwater and intragravel flow component will be added to the study, to determine how intragravel flow is affected by different stream stage and streamflow conditions as well as the locations of any downwelling or upwelling points at the study site. Intragravel flow is essential for flushing metabolic wastes and carrying oxygen-rich water to the egg environment; it will serve as an approximation for DO and ammonia measurements with developing eggs, which will not be available in the summer. Both instream and intragravel measurements of DO and temperature will be taken. Any variation between the two environments will be noted and examined for significant correlation with stream stage and flow. All DO measurements will be calculated in terms of percent saturation to permit comparison between summer and fall-winter conditions. Combining these results with the winter measurements will allow a more complete description of how ambient conditions at egg depth are likely to shift with changes in stage and streamflow. It will also allow for measurements at very low flows, in case there is not an overwinter dewatering during the course of this study.

Due to funding from another source, the study will continue another year, through the 2007-2008 field season. It is expected that the study design for next season will remain the same as for this season; modified groundwater/intragravel monitoring may continue through the winter season as well.

Again, the outcome of this study will help determine the effects of overwinter dewatering on egg development and survival, and will be used by the Butte branch of Trout Unlimited to determine their position on the practice of industrial overwinter dewatering of Warm Springs Creek. Thanks again for your assistance; the Montana Water Center fellowship has been invaluable to my 2005-2006 research, coursework and fieldwork, making this project possible.