1980 Progress Report
to
The Huron Mountain Wildlife Foundation

CREATION OF INSTREAM COVER FOR TROUT BY HINGE-CUTTING OF RIPARIAN BRUSH ON THE SALMON TROUT RIVER, MARQUETTE COUNTY, MICHIGAN

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Background and Objectives

In 1976-77, the relationship between abundance of instream cover and abundance of trout was studied in two sections of the Salmon Trout River: (1) approximately 2km beginning 100m below Darby Bend and extending upstream beyond Christy Pool and (2) approximately 2.6km beginning about 200m above Sheet Rock Falls of the Lower Falls complex and extending upstream to Middle Falls. That study indicated that the variation in abundance of trout between 100m "stations" of the stream was primarily due to variation in amount of instream cover (Enk 1977; Enk and White in prep.). This suggested that if more cover were created, the trout population should expand to occupy it.

The primary objective of the present study, conducted in the section between Lower and Middle Falls, is to determine the effect of rapidly creating far more cover. Will the trout population increase and fill the new habitat to the same density as in the previously available cover, or will some other factor such as lack of food, unfavorably low temperature, or devastating floods limit the population so it cannot?

The method chosen to rapidly and cheaply increase cover was "hinge-cutting" of riparian (streamside) brush. This involved sawing the stems part way through, such that the tops lay in the water angled somewhat downstream at the edge of the channel while remaining hinged to the stumps by a flexible band of wood and bark.

Another objective was to see whether riparian hinge-cutting would be practical as a habitat management method. Would the cuttings not only be effective as trout cover, but would they remain in place long enough to be worthwhile, and would they be compatible with the angling they were to benefit as a management?

Further objectives were to measure the ways in which the cuttings alter the form, flow and sediments of the stream and to measure their possible effect on the aquatic invertebrates which form the major share of the trout food supply. We anticipate that the invertebrate population may increase in response to the massive introduction of limbs and twigs which will provide attachment sites and to newly exposed gravel beds which will also be attachment sites. Before the cutting, the streambed covering in many parts of the study area was primarily sand which harbors few invertebrates because they cannot attach to the shifting grains.

Test cuttings of three widely isolated clumps of alders in May 1979 remained in place throughout the next year, despite two severe floods and despite winter icing. They showed signs of improving channel form for trout by regulating sediment deposition. On the basis of this preliminary experience, we felt that more massive cutting would be feasible and durable enough for a several-year experiment. Our concern had been that many hinge-cut bushes might break loose during floods or be ripped away after freezing into streamside ice, then accumulate downstream and clog the channel. There has been no indication of this problem with the test cuttings since May 1979.

The basic approach in testing the effects of hinge-cutting is to compare trout populations and stream characteristics before and after the alteration, as well as to compare results between treated and untreated (control) sections of stream. With respect to study of effects on stream invertebrates, we plan to compare only between treated and untreated sections, as a before-and-after study would be too costly.

As pre-treatment information on the trout population, spring and fall electrofishing inventories existed from the 1976-77 study funded by the Huron Mountain Wildlife Foundation (HMWF), as well as a fall 1979 inventory funded by MSU and a spring 1980 inventory funded by HMWF under the present contract. A just-completed fall 1980 trout population inventory which closely followed the summer 1980 brush cutting should also be considered as "pre-effect" data, since the trout population would be unlikely to have responded significantly in only a month or so.

Some pre-treatment or pre-effect data on the trout population are presented in Table 1 and Figure 1. These are provisional data based on calculations which must be rechecked. A gradual increase in population of trout larger than 7 inches (178mm) may be taking place, especially between Lower Dam and Middle Falls (stations 41-60, Figure 1C). This may be due to the combined effects of no-kill regulations since 1975 and drawdown of the dam since fall 1978. The population in the 5 stations (570m) immediately above the dam appears to have undergone a somewhat more marked upturn than for the whole section (Figure 1B).

The average population of 7-inch-and-larger trout during the three 1979-80 estimates was 50% greater than the average for the four 1976-77 estimates in the five stations just above the dam (stations 41-45), while the increase was 31% for the entire section above the dam (stations 41-60) and 32% for a larger part of the study area (stations 37-60) including four stations below the dam. The four stations below the dam (37-40) appear to have undergone a 43% increase in trout larger than 7 inches, however, if the spring 1976 estimate of only 2 such trout in that section is excluded as a possibly unrepresentative figure, the increase is only 11%. All these figures must be regarded with caution, as our population estimates may not have been precise enough to allow us to say that many of them differ significantly. For example, in Figure 1C, the confidence intervals for only the fall 1976 and spring 1980 estimates do not overlap, and hence we can conclude that only those two estimates differ significantly. The confidence intervals for recent estimates are narrower than for early estimates due to improvements in our electrofishing equipment.

Activity During 1979-80

For the present study, a slightly larger study area between Sheet Rock and Middle Falls was used than in 1976-77. We added three stations to the

downstream end, taking in more of the stream between Lower Dam and Sheet Rock and enlarging the study area from 2.651km to 2.872km, composed of 27 stations averaging slightly more than 100m each. Seven of the stations (691m) lie below Lower Dam, and 20 stations (2181m) are above the dam.

Five "treatment sections" of two stations each were selected for hinge-cutting so as to be separated by 3-station "control sections" which are to remain uncut (Table 2 and Figure 2). Separate data on the trout population and on stream measurements are kept for each station. Thus, if the hinge-cutting has effects on adjacent stations, the central station of each control section may provide a more unaffected comparison.

During mid-June through late August 1980, Mark Ultis (on HMWF funds) and an undergraduate helper, Christopher Bennett (on MSU funds) did the hinge-cutting and made stream measurements before and afterward, as well as obtaining some baseline data on stream invertebrate abundance and operating a continuous recording thermometer for part of the summer.

Results

The results of the physical measurements during 1980 (Table 3) indicate that in the treatment sections, the hinge-cutting caused:

1. a narrowing of the channel by 24% on the average (11-35% among the 10 stations of the 5 sections),
2. a 5.8% average increase in water depth at the deepest point in cross-section during summer low flow,
3. a 25% average increase in water velocity above the deepest point in cross-section during summer low flow, and
4. scouring of sand from the streambed by the increased current and consequent uncovering of gravel beds which should enhance trout spawning habitat, as well as increase habitat for stream invertebrates.

The latter effect is expected to progress for over six months and will be greatly influenced by springtime high water or other floods during that time. The 1980 pre-treatment measurements of amount of stream bed covered by various kinds of sediment will be followed up with post-effect measurements in late spring 1981.

With regard to immediate effects of the hinge-cutting on angling, flycasting from within the stream has been facilitated, while worm-fishing from the bank has been greatly hindered. The pre-treatment density of alders in most parts of the study area precluded flyfishing from the bank unless the flies were fished as worms would be.

Measurements of instream cover for trout in all 27 stations prior to hinge-cutting revealed that amounts within individual stations had changed substantially from July 1976 when measured for the previous study. Some sections contained more cover than before and others less. The net change was a small and probably insignificant increase. The between-station changes were probably due primarily to shifting of instream logs during floods. The measurements of different kinds of cover were recorded separately, and this situation will be analysed in more detail later.

Plans for 1981

Electrofishing for population estimates will be made during May and September 1981. During the intervening summer, it is planned to station another MSU graduate student at the Ives Lake quarters. The primary task of the new student will be to undertake the comparison of invertebrate populations between treatment and control sections. Monitoring of physical changes in the stream will also be continued. The invertebrate study should form the basis of a masters degree thesis for the student.

Mark Ultis will be analysing the 1980 data during the 1980-81 school year and, after supervising the May 1981 electrofishing and physical measurements and analysing the results therefrom, will be completing his masters thesis and graduating in June or July.

Table 1. Population estimates of wild brook trout of 7 inches and larger in subsections of the study area between Lower Falls and Middle Falls on the Salmon Trout River.

Date	The 371m* below Lower Dam (sta. 37-41)		The 570m above Lower Dam (sta. 41-45)		Last 1615m area up to Middle Falls (sta. 46-60)		Total 2556m (sta. 37-60)	
	No.	No./km	No.	No./km	No.	No./km	No.	No./km
Spring 1976	2	5.3	22	38	79	49	103	40
Fall 1976	36	102	15	26	38	24	89	35
Spring 1977	15	40	35	61	46	28	96	37
Fall 1977	31	83	15	26	73	45	119	46
Avg. 1976-77	21	57	22	38	59	36	102	40
Fall 1979	36	102	28	49	72	45	136	53
Spring 1980	29	78	31	54	90	56	150	59
Fall 1980	24	65	41	72	55	34	120	47
Avg. 1979-80	30	80	33	58	72	45	135	53
Change between 1976-77 and 1979-80	+43%**		+50%		+22%		+32%	

* Does not include a deep pool just below the dam. The pool cannot be sampled effectively by electrofishing.

** Change would be only 14% if the spring 1976 estimate were not included.

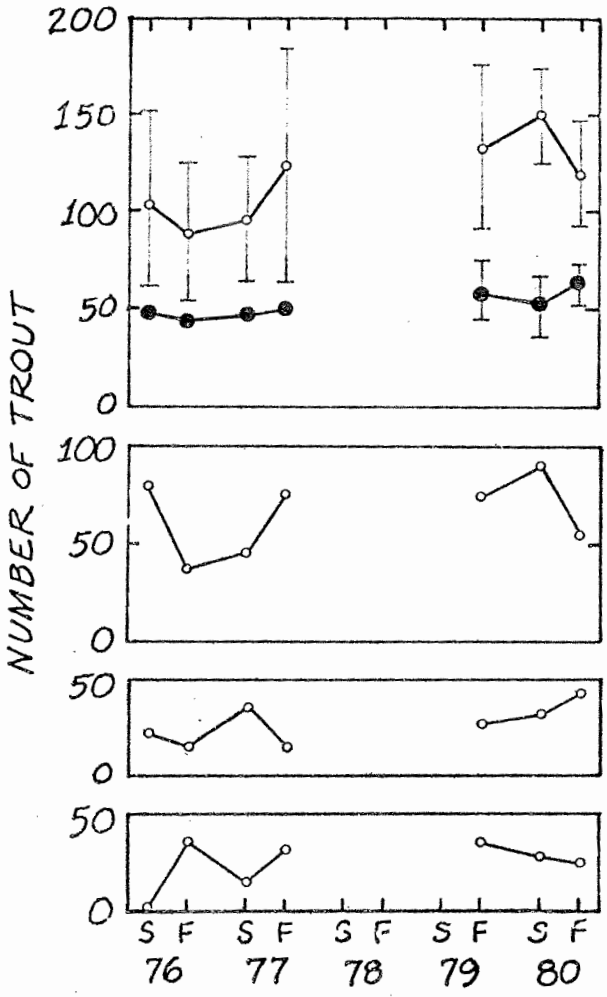
Table 2. Lengths of treated (hinge-cut) and control (uncut) sections of the study area on the Salmon Trout River.

Section numbers	Station numbers	Lengths (m)
	Treated	
T1	37-38	192
T2	42-43	249
T3	47-48	201
T4	52-53	261
T5	57-58	228
Total length of treated sections		1131
	Controls	
C1	34-36	310
C2	39-41	305*
C3	44-46	334
C4	49-51	310
C5	54-56	287
C6	59-60	195
Total length of control sections		1741
Total length of study area		2872

* Does not include a deep pool about 10m long just below Lower Dam.

Table 3. Stream dimensions and water velocity in treatment sections of the Salmon Trout River before and after hinge-cutting of streamside brush during the summer of 1980. Measurements made a 10m intervals along the centerline of the channel.

Section & station		Date		At deepest points in cross sections: Avg width (m)			Avg depth (m)			Avg water velocity (m/sec)		
		Pre	Post	Pre	Post	Diff	Pre	Post	Diff	Pre	Post	Diff
T1	37	7/22	8/6	10.70	8.70	-19%	0.63	0.63	0%	0.28	0.33	+18%
	38	7/22	8/6	10.55	8.03	-24%	0.62	0.63	+2%	0.36	0.36	0%
T2	42	6/28	8/6	8.57	7.62	-11%	0.45	0.48	+7%	0.30	0.36	+20%
	43	6/28	8/6	7.05	4.98	-29%	0.64	0.68	+6%	0.26	0.41	+58%
T3	47	7/4	8/7	6.31	4.31	-32%	0.72	0.86	+19%	0.32	0.50	+56%
	48	7/4	8/7	6.54	4.36	-33%	0.66	0.81	+22%	0.41	0.46	+12%
T4	52	7/10	8/7	7.00	4.54	-35%	0.51	0.62	+22%	0.36	0.46	+28%
	53	7/10	8/7	7.24	6.24	-14%	0.72	0.72	0%	0.30	0.24	-20%
T5	57	7/16	8/8	6.93	5.44	-21%	0.70	0.62	-13%	0.31	0.42	+35%
	58	7/16	8/8	7.98	6.13	-23%	0.59	0.56	-5%	0.36	0.51	+42%
Averages						-24%			+6%			+25%



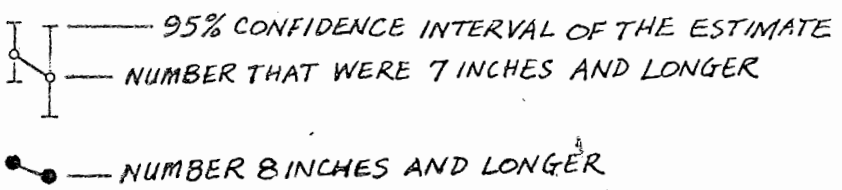
A. STA. 37-60
371m BELOW
LOWER DAM UP TO
MIDDLE FALLS

B. STA. 46-60
THE 1615m BELOW
MIDDLE FALLS

C. STA. 41-45
THE 570m ABOVE
LOWER DAM

D. STA. 37-40
THE 371m BELOW
LOWER DAM

FIGURE 1. NUMBERS OF WILD BROOK TROUT IN VARIOUS SECTIONS OF THE SALMON TROUT RIVER STUDY AREA, 1976-1980, BY MARK-RECAPTURE ESTIMATE.



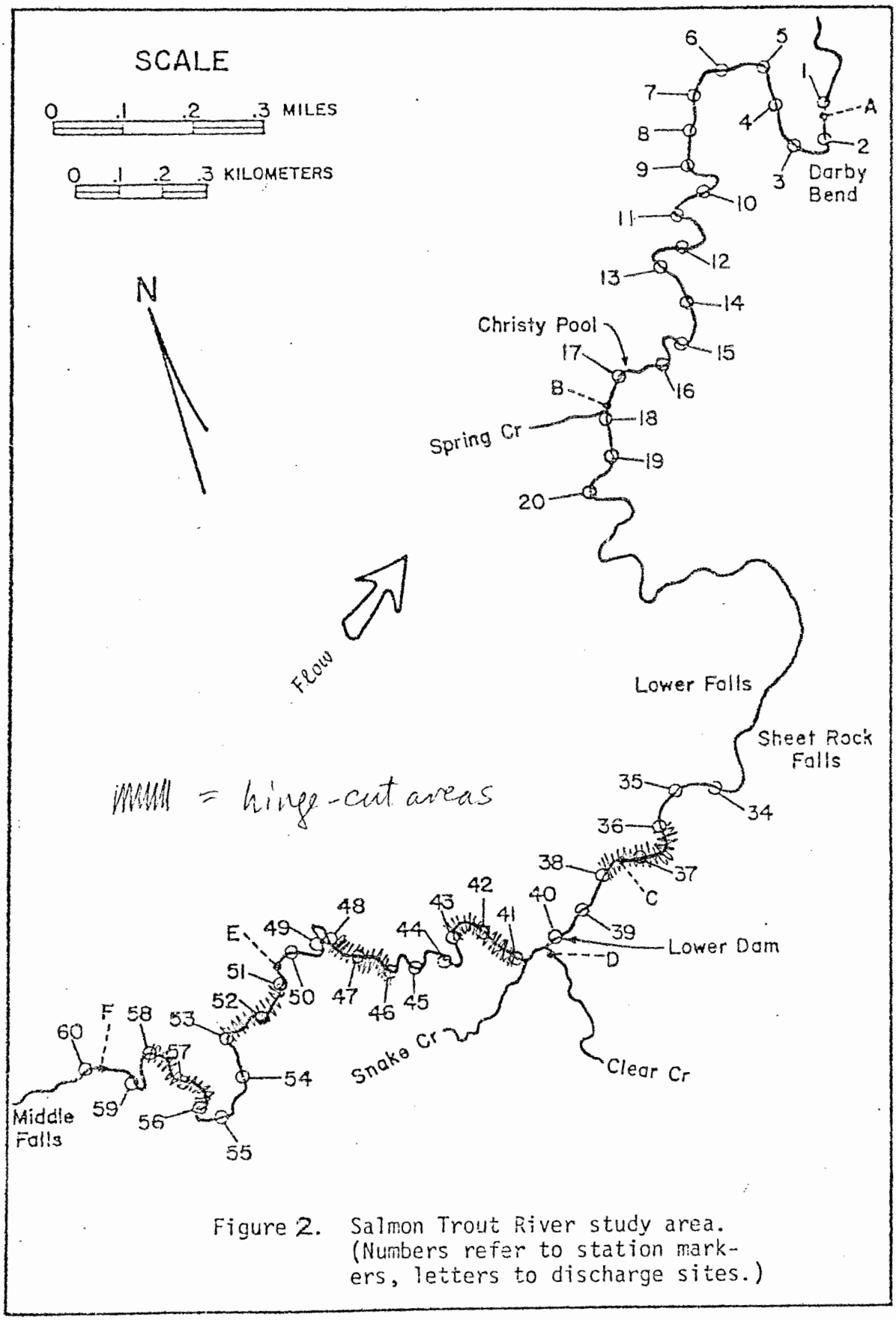


Figure 2. Salmon Trout River study area. (Numbers refer to station markers, letters to discharge sites.)