STUDY PERFORMANCE REPORT

State: Michigan **Project No.:** F-53-R-14

Study No.: 461 **Title:** Population dynamics of juvenile rainbow trout and coho salmon in Lake Superior tributaries

Period Covered: April 1, 1997 to March 31, 1998

Study Objective: To annually determine the abundance (number and density) of juvenile rainbow trout and coho salmon in sections of selected Lake Superior tributaries; determine the relationship of juvenile numbers to subsequent adult abundance for one or more cohorts; and determine the production of juveniles relative to natural or man made physical changes in the stream habitat.

Summary: The estimated densities (number per m^2 of stream surface area) of age-0 rainbow trout, age-1 rainbow trout, and age-0 coho salmon in 1997 were respectively 0.418, 0.074, and 0.903 in Chinks Creek; 0.724, 0.064, and 0.234 in the Little Garlic River; 0.167, 0.030, and 0.018 in the Chocolay River at Beckman Road; and 0.547, 0.043, and 0.270 in the Chocolay River at County Road 460. Comparing densities in 1997 to densities in 1996 (±2 SE): age-0 rainbow trout density was unchanged in Chinks Creek and Little Garlic River, but higher in Chocolay River at Beckman Road and County Road 460; age-1 rainbow trout density was unchanged in all streams; and age-0 coho salmon density was unchanged in Chinks Creek and Chocolay River at Beckman Road, and higher in Little Garlic River and Chocolay River at County Road 460. Redd counts, used to assess 1997 abundance of spawning steelhead, were 10 in the 1,300-m section of Chinks Creek, 12 in the 2,500-m section of Little Garlic River, 1 in the 1,700-m section of Chocolay River at Beckman Road, and 2 in the 1,400-m section of Chocolay River at County Road 460. Compared to 1996, number of steelhead redds in 1997 increased in Chinks Creek, decreased slightly in Little Garlic River, and decreased substantially in both Chocolay River sections. No quantitative analysis was done to relate juvenile numbers with abundance of adult spawners the previous year. Data from this study were used to prepare this annual performance report.

Job 1. Title: Estimate abundance of juvenile trout and salmon.

Findings: Marquette Fisheries Station personnel made trout and salmon population estimates in 305-m linear sections of Little Garlic River (Marquette County) and Chinks Creek (Baraga County), and in two 305-m linear sections of Chocolay River (Marquette County) during 18-27 August 1997 (Table 1). Juvenile rainbow trout and coho salmon were the predominant salmonines in study sections in all three streams. Brook trout were present in Chinks Creek and Chocolay River sections, and brown trout were in Chocolay River sections. Most juvenile rainbow trout in these tributaries were age 0 and age 1, with age 2 contributing less than 10% and older ages rarely encountered. Juvenile coho salmon were all age 0 except in Chinks Creek where small numbers of age-1 fish have been found. Mature rainbow trout and coho salmon have been found in the 305-m sections only during their respective spring and fall spawning periods.

Numbers of age-0 and age-1 and older trout and salmon in each section were estimated using the Bailey modification of the Petersen mark and recapture method (Ricker 1975), with marking on one day and recapture the following day. Fish density (number/m^2) was determined by dividing number of fish by stream surface area in each section. Fish were captured using DC electrofishing gear, and marked by clipping the tip of the upper lobe of the caudal fin. I compared population estimates in 1997 to similar estimates in 1996. Population estimates in each stream section were determined to be significantly different between years if values for ±2 SE did not overlap. Total length of all fish was measured to nearest mm on the marking day and the recapture day. Total length (mm), total weight (g), and scale samples were collected from 10 fish per 10-mm size group for each species of trout and salmon in each tributary study section. These data will be used to determine length distribution of ages and to calculate age-specific mean length, mean weight, and weight-length coefficients. Age of juveniles was determined mainly from length-frequency distributions, with scale age used when distributions overlapped. Population estimates were made for age groups of juveniles. Stream parameters measured in each study section during the population estimate were width (m), depth (m), area (m^2), volume (m^3), discharge (m^3/sec), water temperature (°C), and conductivity (µmhos) (Table 2). Stream width and depth were measured at the downstream end of each section and at 30.5-m intervals to the end of the section to calculate section surface area (mean width x 305 m) and volume (area x mean depth). Means with confidence intervals (±95 %) were determined for the 11 measurements of width and 33 measurements of depth in each section, with non-overlapping confidence intervals indicating a significant difference ($P \leq 0.05$). A current meter was used to measure velocity, and discharge was estimated from the formula (width x mean depth x bottom constant x velocity) in Welch (1948) at a channel section within each 305-m study section.

Numbers and density of age-0 rainbow trout in the Chinks Creek study section in 1997 (Table 1) were not different than in 1996 (577±99, 0.557±0.118). Age-1 rainbow trout numbers and density in 1997 were greater than in 1996 but standard errors on density overlapped (47±9, 0.047±0.011). Age-0 coho salmon numbers and density in 1997 were higher than in 1996 (599±81, 0.600±0.105), whereas numbers and density of age-1 coho were comparable and less variable than in 1996 (30±21, 0.030±0.022). Numbers and density of age-0 brook trout in 1997 was similar to 1996 but age-1 brook trout were more abundant than in 1996 (19±9, 0.019±0.009). Estimates of width, depth, and area in 1997 were slightly higher but similar to estimates in 1996, volume was higher, and discharge, conductivity and water temperature were lower (Table 2).

Numbers and density of age-0 and age-1 rainbow trout in the Little Garlic River study section in 1997 (Table 1) were similar to estimates in 1996 (1,517±130, 0.946±0.174; 89±17, 0.056±0.014). Age-0 coho salmon were much more abundant in 1997 than in 1996 (47±14, 0.029±0.10). No brook trout were found in the section in 1997 which was also the case in 1996. Estimates of width and depth in 1997 were similar to estimates in 1996, whereas area, volume, and discharge were higher and temperature was lower (Table 2). No conductivity measurement was obtained in 1997.

In Chocolay River at Beckman Road, estimated numbers and density of age-0 rainbow trout were higher in 1997 (Table 1) than in 1996 (236±72, 0.085±0.027) but estimates for age-1 rainbow trout were similar (101±20, 0.036±0.008). Numbers and density of age-0 coho salmon in 1997 were higher than estimates in 1996 (16±16, 0.006±0.006). Numbers and density of age-0 and age-1 and older brook trout in 1997 were not different than in 1996 (97±31, 0.035±0.011; 38±16, 0.014±0.006). Abundance of age-0 and age-1 and older brown trout in 1997 was comparable to 1996 (18±7, 0.007±0.003; 6±0, 0.002±<0.001). Estimates of area and measurements of conductivity and temperature were lower 1997 than in 1996, but volume and discharge were higher (Table 2).

In Chocolay River at County Road 460, numbers and density of age-0 rainbow trout in 1997 (Table 1) were higher than in 1996 (507±95 and 0.227±0.052), but abundance of age-1 and older rainbow trout was comparable (119±21, 0.053±0.012). Age-0 coho numbers and density were much higher in 1997 than in 1996 (120±48 and 0.054±0.022). Age-0 brook trout numbers and density in 1997 were low but higher than in 1996 when only two age-0 and one older brook trout were found. As in 1996, no brown trout were found in this section in 1997. Estimated physical parameters in 1997 were similar to estimates for 1996, except that discharge was higher and conductivity was lower (Table 2).

Job 2. Title: <u>Assess abundance of adult rainbow trout and coho salmon</u>.

Findings: Marquette Fisheries Station personnel conducted visual surveys in Chinks Creek, Little Garlic River, and Chocolay River to assess abundance of spawning adult steelhead (anadromous rainbow trout) during 7-29 May 1997 (Table 3). No assessment of adult coho salmon was done in 1997 because no assessment of age-0 coho salmon was planned for 1998. Redds and adult steelhead were counted, but redd counts were believed to be the better indicator of spawning activity. Stream sections surveyed for spawning activity were: Chinks Creek - from confluence with East Branch of Huron River upstream 1,300 m; Little Garlic River - from 1,125 m below County Road 550 bridge upstream 2,500 m (1,375 m above bridge) with an additional 5,650 m up to falls surveyed (8,150 m total) at least once each spawning season; Chocolay River at Beckman Road - 1,700 m upstream from Beckman Road bridge; Chocolay River at County Road 460 - 1,400 m upstream from County Road 460 bridge. The juvenile population estimate sections were included in the middle or lower end of these spawning assessment sections. Stream discharge was only a little above summer levels and visibility was generally good when surveys were made during May. No adult steelhead were collected to determine origin or for biological data in 1997. Most steelhead spawning in Chinks Creek and Little Garlic River occurred prior to the start of our survey on 7-8 May as only one additional redd was observed in each stream two weeks later (Table 3). The 10 redds in Chinks Creek and 12 redds in the 2,500-m section of Little Garlic River observed in 1997 compares to 7 and 13 redds, respectively in the two stream sections in 1996.

In Chocolay River, little evidence of steelhead spawning was observed in 1997 (Table 3). One redd in the Beckman Road section and 2 redds in the County Road 460 section in 1997 compares to 23 and 16 redds in these sections in 1996.

Job 3. Title: <u>Analyze juvenile and adult population data</u>.

Findings: Length distribution of age groups, mean weight, mean length, and weight-length coefficients for juvenile trout and salmon collected in 1997 have not yet been analyzed. Data sets necessary to relate adult abundance to juvenile abundance are being assembled but quantitative analysis has not been done. Data collected in 1997 cast further doubt on a positive relationship between adult steelhead abundance (indicated by redd counts) and age-0 production, especially in Chocolay River where steelhead redd counts were high but age-0 rainbow numbers and density were low in 1996 and adult abundance low and age-0 numbers and density were relatively high in 1997.

Job 4. Title: Prepare reports.

Findings: Data from this study were used in preparation of this annual performance report.

Literature Cited:

Ricker, W. E. 1975. Computation and interpretation of biological statistics of fish populations. Bulletin of the Fisheries Research Board of Canada 191.

Welch, P. S. 1948. Limnological Methods. McGraw-Hill Book Company, Inc., New York.

Table 1.–Estimated number and density (number per m^2 of stream substrate) ±2 SE of trout and salmon in 305-m linear sections of three Lake Superior tributaries, 18-27 August 1997.

Tributary and parameters	Rainbow trout		Brook trout		Brown trout		Coho salmon	
	Age 0	Age 1[a]	Age 0	Age 1[a]	Age 0	Age 1[a]	Age 0	Age 1
Chinks Creek								
Number	449	80	6	60	0	0	971	29
±2 SE	86	15	6	35			130	12
Density	0.418	0.074	0.006	0.056			0.903	0.027
±2 SE	0.108	0.019	0.005	0.032			0.199	0.012
Little Garlic River								
Number	1,271	113	0	0	0	0	410	0
±2 SE	188	21					74	
Density	0.724	0.064					0.234	
±2 SE	0.130	0.014					0.048	
Chocolay River								
Beckman Road								
Number	445	79	183	47	43	8	48	0
±2 SE	117	19	68	15	24	2	29	
Density	0.167	0.030	0.069	0.018	0.016	0.003	0.018	
±2 SE	0.045	0.007	0.026	0.006	0.003	0.001	0.010	
County Road 460								
Number	1,100	87	9	6	0	0	543	0
±2 SE	154	22	6	0			117	
Density	0.547	0.043	0.004	<0.001			0.270	
±2 SE	0.137	0.014	0.003				0.081	

[a]Mostly age 1, but rainbow trout includes some age 2 and brook and brown trout includes some up to age 4 in Chocolay River.

Table 2.–Physical habitat parameters in the 305-m trout and salmon population estimate study sections of three Lake Superior tributaries, August 1997. Width, depth and area are reported with ±95% confidence intervals.

Tributary, section, and date	Width (m)	Depth (m)	Area[a] (m^2)	Volume (m^3)	Discharge (m^3/sec)	Conductivity (mmhos)	Water temperature (C^o)
Chinks Creek							
Big Bay Road							
25 August	3.7	0.12	1,076	127	0.04	193	11
	±0.8	±0.04	±59				
Little Garlic River							
County Road 550							
21 August	5.8	0.14	1,754	243	0.12		14
	±1.1	±0.05	±56				
Chocolay River							
Beckman Road							
18 August	9.0	0.27	2,664	713	0.91	143	11
	±1.2	±0.06	±56				
County Road 460							
27 August	7.2	0.19	2,009	379	0.19	199	16
	±1.6	±0.05	±131				

[a] Water area in the 305-m section adjusted by subtracting visual estimate of exposed area within the stream channel.

Table 3. Visual assessment of steelhead (adult rainbow trout) spawning runs in three Lake Superior tributaries, May 1997.

Tributary, section, and date	Length of section (m)	Redds		Steelhead	
		Number observed	Number with fish	Number observed	Number on redds
Chinks Creek					
Big Bay Road					
7 May	1,300	9	2	10	6
23 May	1,300	10	1	4	2
Little Garlic River					
County Road 550					
8 May	2,500	11	1	4	1
	8,150	20	2	13	7
22 May	2,500	12	0	4	0
Chocolay River					
Beckman Road					
10 May	1,700	0		0	
29 May	1,700	1	0	1	0
County Road 460					
10 May	1,400	0		0	
29 May	1,400	2	0	0	

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