STUDY PERFORMANCE REPORT

State: Michigan **Project No.:** F-53-R-13

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

Period Covered: April 1, 1996 to March 31, 1997

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 1996 were respectively 0.557, 0.047, and 0.600 in Chinks Creek; 0.946, 0.056, and 0.029 in the Little Garlic River; 0.085, 0.036, and 0.006 in the Chocolay River at Beckman Road; and 0.227, 0.053, and 0.054 in the Chocolay River at County Road 460. Comparing densities in 1996 to densities in 1995 (±2 SE): age-0 rainbow trout density was unchanged in Chinks Creek and Little Garlic River but significantly lower in Chocolay River at Beckman Road and County Road 460; age-1 rainbow trout density was unchanged in Little Garlic River, lower in Chinks Creek and Chocolay River at Beckman Road, and higher in Chocolay River at County Road 460; and age-0 coho salmon density was lower in Chinks Creek and both Chocolay River sections but was higher in Little Garlic River. There were no differences in stream width, depth, area, volume, and discharge between 1996 and 1995 for Little Garlic River and Chocolay River at County Road 460 sections, but area, volume, and discharge were higher in Chinks Creek and Chocolay River at Beckman Road sections. Redd counts, used to assess 1996 abundance of spawning adults in selected stream sections, documented 7 steelhead (anadromous rainbow trout) redds and 38 coho salmon redds in the 1,300-m section of Chinks Creek, 13 steelhead redds and 38 coho salmon redds in the 2,500-m section of Little Garlic River, 23 steelhead redds and 10 coho salmon redds in the 1,700-m section of Chocolay River at Beckman Road, and 15 steelhead redds and 15 coho salmon redds in the 1,400-m section of Chocolay River at County Road 460. Compared to 1995, number of steelhead redds decreased in Chinks Creek but increased in Little Garlic River and both Chocolay River sections, and number of coho salmon redds increased in all stream 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 3-12 September 1996 (Table 1). Juvenile rainbow trout and coho salmon made up a majority of

salmonine populations 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. Mature rainbow trout and coho salmon have been found in the 305-m population estimate sections only during their respective spring and fall spawning periods. 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 routinely found.

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 1996 to estimates in 1995. Population estimates in each stream section were determined to be significantly different between years if values for ±2 SE did not overlap. Fish were measured to nearest mm so that estimates could be 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 ($P \leq 0.05$). The float method and Embody's formula (Welch 1948) were used to estimate velocity and determine discharge at one site within each 305-m section.

Numbers and density of age-0 rainbow trout in the Chinks Creek study section in 1996 (Table 1) were not different than in 1995 (512±65, 0.559±0.149), but age-1 rainbow trout numbers and density were lower than in 1995 (94±11, 0.103±0.013). Age-0 coho salmon numbers and density in 1996 were lower than in 1995 (975±75, 1.064±0.097), whereas numbers and density of age-1 coho were more variable but not different than in 1995 (15±3, 0.016±0.004). Numbers and density of brook trout in 1996 was similar to 1995. Estimates of area, volume, and discharge were higher in 1996 (Table 2) than in 1995.

Numbers and density of age-0 and age-1 rainbow trout in the Little Garlic River study section in 1996 (Table 1) were similar to estimates in 1995 (1,574±121, 1.111±0.177; 83±14, 0.059±0.010). The presence of age-0 coho salmon in 1996 was an improvement from 1995 when none were found. No brook trout were found in the section in 1996 which was also the case in 1995. Estimates of physical parameters in 1996 (Table 2) were similar to estimates in 1995.

In Chocolay River at Beckman Road, estimated numbers and density of age-0 and age-1 rainbow trout in 1996 (Table 1) were lower than estimates in 1995 (774±109, 0.290±0.057; 155±22, 0.058±0.008). Numbers and density of age-0 coho salmon in 1996 were likewise lower than estimates in 1995 (123±23, 0.046±0.009). Numbers and density of age-0 brook trout in 1996 were lower than in 1995 (183±42, 0.069±0.017), but numbers and density of age-1 and older brook trout in 1996 were not different than in 1995 (31±6, 0.012±0.002). Numbers and density of age 0 and age 1 and older brown trout in 1996 were lower than in 1995 (94±20, 0.035±0.007; 14±4, 0.005±0.001). Estimates of area, volume, and discharge were higher in 1996 (Table 2) than in 1995 (2,670±54, 523, 0.59).

In Chocolay River at County Road 460, numbers and density of age-0 rainbow trout in 1996 (Table 1) were lower than in 1995 (1,462±144 and 0.712±0.116), but numbers and density of age-1 and older rainbow trout were significantly higher than in 1995 (90±13, 0.044±0.007). Age-0 coho numbers and density were lower in 1996 than in 1995 (369±80 and 0.180±0.040). Age-0 brook trout numbers and density in 1996 were similar to 1995. One older brook trout was found compared to none in 1995. As in 1995, no brown trout were found in this section in 1996. Estimated physical parameters in 1996 were similar to estimates for 1995 (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 30 May to 27 June 1996 (Table 3), and coho salmon during 1 October to 6 November 1996 (Table 4). Redds and adult fish 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) for steelhead and coho plus an additional 5,650 m up to falls surveyed for steelhead (8,150 m); 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. High discharge due to prolonged snow melt and rain precluded steelhead spawning surveys until the end of May. Stream discharge was normal and visibility generally good during June. Discharge during coho surveys was slightly above normal, but visibility was good in all but deep pools. No adult steelhead or coho salmon were collected to determine origin or for biological data in 1996.

Most steelhead spawning in Chinks Creek occurred prior to 31 May (Table 3). Seven steelhead redds were observed in the 1,300-m section on 18 June compared to 14 in 1995. No adult steelhead and only two additional redds were observed on 18 June, so I concluded that spawning ended sometime in early June. Most coho spawning in Chinks Creek occurred between 1 and 22 October (Table 4). Only two additional redds were observed on 6 November. Thirty-eight coho salmon redds were observed in the 1,300-m section in 1996, compared to 22 in 1995.

Steelhead spawning in Little Garlic River in 1996 was mostly done by 31 May, but some was still occurring on 20 June (Table 3). Thirteen steelhead redds were observed in the lower 2,500 m and 19 redds were reported in the total 8,150-m section in 1996, compared to 9 and 15 respectively in 1995. Coho salmon were starting to spawn in Little Garlic River on 23 October and many coho were still spawning when the last observation was made on 6 November in 1996 (Table 4). The 38 redds in the 2,500-m section on 6 November 1996 was more than twice the redds observed in 1995 (17) and the highest ever reported for this section.

In Chocolay River, steelhead spawning in 1996 was underway on 5 June and done in both sections by 15 June (Table 3). Twenty-three redds were counted in the Beckman Road section and 15 in the County Road 460 section in 1996, compared to 14 and 8 respectively in 1995. Most coho salmon spawning in 1996 was done in the Beckman Road section and underway in the County Road 460 section by 24 October, but some spawning was taking place in both sections when the last observation was made on 5 November (Table 4). The tally on 5

November was 10 redds in the Beckman Road section and 15 redds in the County Road 460 section, compared to 4 and 3 respectively in 1995.

Job 3. Title: Analyze juvenile and adult population data.

Findings: Data sets necessary to relate adult abundance to juvenile abundance are being assembled but quantitative analysis has not been done. Age-0 juvenile production did not seem to be related to adult abundance (indicated by redd counts), especially in Chocolay River where steelhead redd counts were high but age-0 rainbow numbers and density were the lowest recorded in 10 years.

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, 3-12 September 1996.

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	577	47	2	19	0	0	599	30
±2 SE	99	9	2	9			81	21
Density	0.557	0.047	0.002	0.019			0.600	0.030
±2 SE	0.118	0.011	0.002	0.009			0.105	0.022
Little Garlic River								
Number	1,517	89	0	0	0	0	47	0
±2 SE	130	17					14	
Density	0.946	0.056					0.029	
±2 SE	0.174	0.014					0.010	
Chocolay River								
Beckman Road								
Number	236	101	97	38	18	6	16	0
±2 SE	72	20	31	16	7	0	16	
Density	0.085	0.036	0.035	0.014	0.007	0.002	0.006	
±2 SE	0.027	0.008	0.011	0.006	0.003	<0.001	0.006	
County Road 460								
Number	507	119	2	1	0	0	120	0
±2 SE	95	21	0	0			48	
Density	0.227	0.053	0.001	<0.001			0.054	
±2 SE	0.052	0.012	<0.001	<0.001			0.022	

[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 parameters in the trout and salmon population estimate study sections of three Lake Superior tributaries, September 1996. Width, depth and area are reported ±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							
9 Sept	3.5 ±0.7	0.11 ±0.03	1,000 ±35	108	0.07	204	14
Little Garlic River							
County Road 550							
3 Sept	5.7 ±1.4	0.13 ±0.05	1,602 ±82	204	0.04	171	18
Chocolay River							
Beckman Road							
5 Sept	9.2 ±1.1	0.23 ±0.06	2,785 ±56	667	0.71	262	15
County Road 460							
11 Sept	7.8 ±1.4	0.17 ±0.04	2,230 ±91	379	0.12	235	15

[a] Each study section was 305 m long.

Table 3.–Visual assessment of steelhead (adult rainbow trout) spawning runs in three Lake Superior tributaries, May-June 1996.

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					
31 May	1,300	5	0	1	0
18 Jun	1,300	7	0	0	
Little Garlic River					
County Road 550					
30 May	2,500	1	1	1	1
	8,150	14	5	18	9
20 Jun	2,500	13	1	6	2
	8,150	19	1	6	2
Chocolay River					
Beckman Road					
14 Jun	1,700	23	4	7	7
27 Jun	1,700	23	0	0	
County Road 460					
5 Jun	1,400	4	2	4	4
14 Jun	1,400	15	0	0	
27 Jun	1,400	15	0	0	

Table 4.–Visual assessment of coho salmon spawning runs in three Lake Superior tributaries, October-November 1996.

Tributary, section, and date	Length of section (m)	Redds		Coho	
		Number observed	Number with fish	Number observed	Number on redds
Chinks Creek					
Big Bay Road					
1 Oct	1,300	0		0	
22 Oct	1,300	36	8	28	8
6 Nov	1,300	38	1	5	1
Little Garlic River					
County Road 550					
1 Oct	2,500	0		0	
23 Oct	2,500	7	6	8	8
6 Nov	2,500	38	14	27	20
Chocolay River					
Beckman Road					
3 Oct	1,700	0		0	
24 Oct	1,700	8	0	0	
5 Nov	1,700	10	1	2	1
County Road 460					
4 Oct	1,400	0		0	
24 Oct	1,400	12	9	14	11
5 Nov	1,400	15	4	4	4

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