POPLAR RIVER FISHERIES STUDY
PROGRESS REPORT

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February 1979

Research Conducted by:

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Montana Department of Fish & Game

Sponsored by:

U. S. Environmental Protection Agency

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BACKGROUND

A description of the Poplar River, the problems related to development in the drainage, and aquatic work undertaken have been described in a previous report (Stewart 1978a). Portions of the results of field studies conducted in 1977 were not available at that time. These results are shown in a later report (Stewart 1978b), which is enclosed. This report will give partial results of field work done in 1978. Much of the data workup and analysis of 1978 field data has not been completed and will be shown in a future report.

Streamflows in the Poplar River in 1977 were among the lowest ever recorded. Streamflows in 1978 were somewhat above average, with the exception of the East Fork Poplar River, where Cookson Reservoir impounded most of the streamflow. This gave an opportunity to assess fish populations and especially game fish reproduction under a wide range of streamflows.

OBJECTIVES

Goals of this study are to inventory fish populations and the associated biological communities and physical and chemical habitat which support game fish populations. Goals also included defining effects of the Canadian power plant development and determining ways of mitigating any detrimental effects on game fish populations. Specific 1978 objectives were the following:

A. Complete stream channel measurements, including width and depth, for stream sections where game fish population estimates are made;

B. Measure winter and summer dissolved oxygen at key locations;

C. Complete separation of quantitative invertebrate samples from debris and enumerate organisms to appropriate taxonomic group; obtain identification of organisms in samples;

D. Tag game fish captured and determine spawning migrations by angler tag return and electrofishing recapture;

E. Locate spawning areas of game fish by electrofishing for spawners and by capturing larval fish with drift nets set in riffles and towed larval nets;

F. Estimate game fish numbers, age structure and growth in stream sections; locate rearing areas;

G. Monitor stream temperatures in the West and Middle Forks with thermographs; (East Fork temperature measurements by USGS);

H. Locate walleye eggs using an egg basket and make depth-velocity-substrate measurements; locate northern pike spawning sites by hand picking vegetation;

I. Determine upstream distribution of game fish in the West Fork Poplar River and its tributary, Cottonwood Creek;

J. Collect game fish for metals analysis from the East, West and Middle Forks of the Poplar River.

K. Develop tentative minimum instream flows for the Poplar River drainage using data developed during the project.

PROCEDURES

Most of the methods and procedures used were reported previously (Stewart 1978a). Only methods for egg sampling and larval towing were not described.

A nylon screened basket described by Priegal (1970) was used to sample walleye eggs. The basket was placed on the streambottom and a garden rake was used to disturb the streambottom upstream of the basket. The basket was then raised to inspect for eggs. Walleye eggs were recognized by their size (1.8-2.0 mm). They could be easily distinguished from white sucker and northern pike eggs, which are much larger. These two species are the only ones in the Poplar River that spawn as early as the walleye.

In 1978 larval fish were sampled by tow nets as well as the set nets described by Stewart (1978a). The tow nets were 6 ft long with a 0.5 meter opening, mesh of 760 microns and with a detachable bucket similar to those on set nets. The net was towed from a boat propelled by a 6 hp outboard motor.

FINDINGS

Stream Channel Measurements

Measurements were made on one additional section in 1978. This section was 2.0 miles in length and located on the lower Poplar River near the Crowley slab (Figure 1). Data workup and tabulation have not been completed; data will be included in a future report. Data for the nine sections completed in 1977 are in Stewart (1978b).

Stream Temperature

Stream temperature measurements on the Poplar River are a cooperative effort with the U. S. Geological Survey. The USGS maintains thermographs on the East Fork Poplar River near the border and at the Pittinger bridge. (See Figure 1 for station locations.) Thermographs are maintained through the ice-free period on the Middle Fork (Ofstedal location) and on the West Fork (Susag location) by the Montana Department of Fish and Game. A summary of monthly maximum and minimum temperatures is shown in Table 1.

Summer maximums reach 80 F most years. The maximum in 1975 was 85 F on the East Fork. Maximums on the West and Middle Forks are 83 F. These

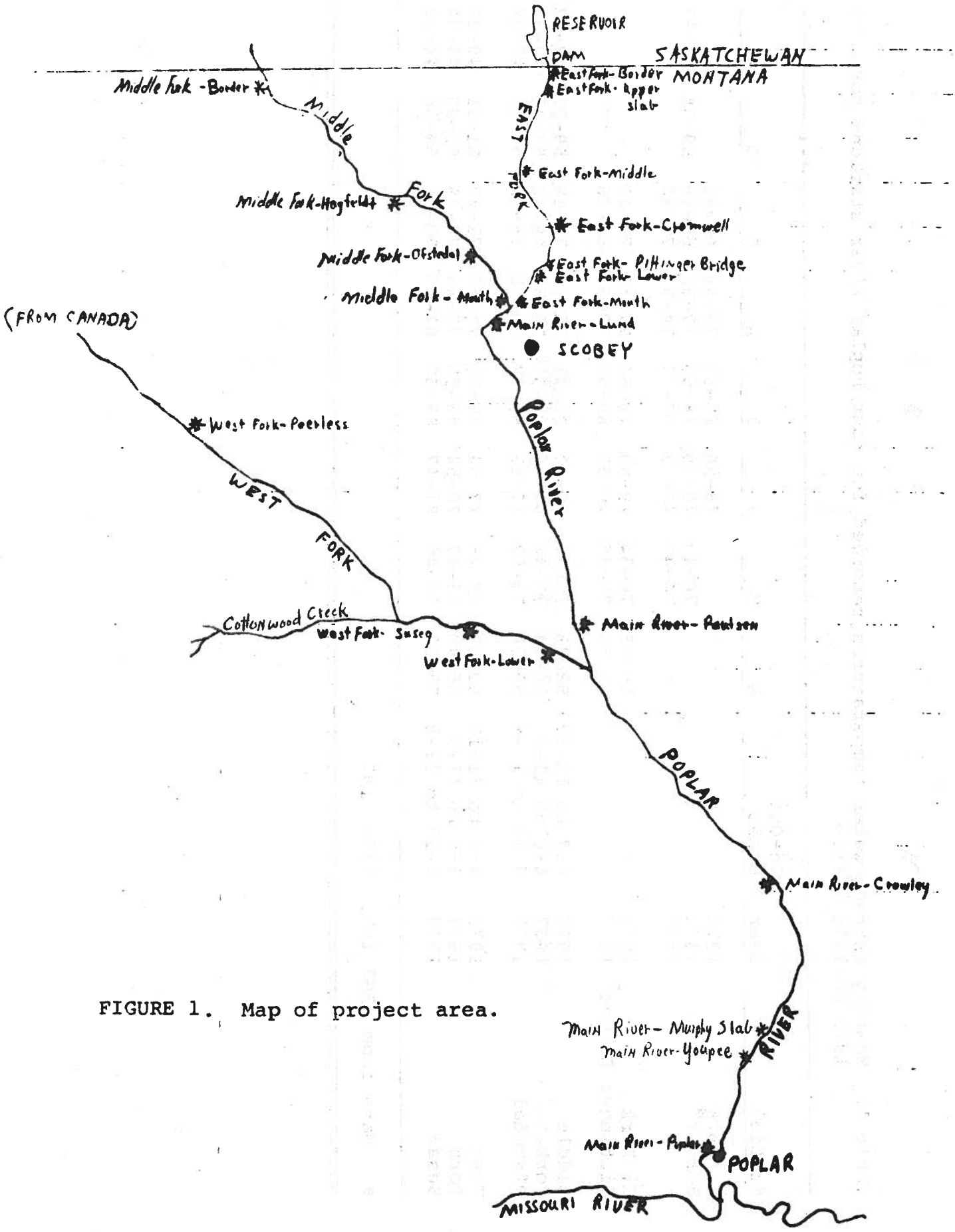

FIGURE 1. Map of project area.

Table 1. Monthly extreme water temperatures recorded for four Poplar River stations for 1975 to 1978 (^{o}F).

Station	Year	In-Out Dates	A	M	J	J	A	S	O	N
E. Fork Border[a]	1975	-			78-56	85-67	73-54	64-45		
	1976	-		70-43	79-59	78-60	77-55	68-49	59-35	42-33
	1977			74-49	79-53	83-61	74-55	71-44		
E. Fork Pittinger Bridge[a]	1976	-	55-35	70-54	79-59	79-64	77-55	70-48		
	1977		66-33	73-46	79-53	80-59	73-55	69-46		
Middle Fork Ofstedal	1976	4-7 to 11-12	58-38	70-47	79-57	80-61	78-55	72-48	59-32	42-32
	1977	4-6 to 11-9	66-34	73-48	80-56	83-57	75-57	69-48	52-36	43-34
	1978	4-11 to 11-8	59-38	73-52	77-49	83-62	80-58	76-46	57-35	42-32
West Fork Susag	1976	4-6 to 11-12	59-37	69-45	77-54	79-60	76-52	71-47	61-32	40-32
	1977	4-6 to 11-9	65-40	73-47	78-54	83-58	78-54	74-46	51-33	44-34
	1978	4-10 to 11-8	59-37	74-49	81-47	83-62	82-55	73-44	59-36	44-32

a - Data from USGS 1975, 1976, 1977

With some exceptions, summer values were not far below saturation values of 8-9 milligrams per liter (Table 2). On the West and Middle Forks and on the main river, values were never significantly less than 6 mg/l. Values on the East Fork were mostly lower, averaging lowest at the middle station. Values were also low at times at the base of the dam. In the United States portion of the East Fork, only values at the middle station were sufficiently low to cause stress in walleye and northern pike. With this exception, summer dissolved oxygen in the Poplar River drainage does not appear to be a problem for fish.

Bottom Fauna

Data for samples collected in March and June 1977 were given in an earlier report (Stewart 1978b). Table 3 contains results of samples collected in November 1977.

The insect orders Ephemeroptera, Trichoptera and Diptera made up the majority of organisms in all but one sample on the East Fork Poplar River, which contained a large number of amphipods. Average numbers of organisms per square foot were high. Averages for all samples were the following: March - 615, June - 803, November - 965. Average number of organisms per square foot was less than 100 at two stations in March, but none of the stations in June and November averaged fewer than 200 organisms per square foot.

Organisms from all samples have been given to Mr. Mike Fillinger of Helena, Montana for identification. No results have been received as yet.

Fish Studies

Game Fish Distribution

Additional work has been done on game fish distribution since that reported by Stewart (1978a). Northern pike were found in summer 1978 at all points sampled in the West Fork Poplar upstream to and including the Peerless sampling station. None were found upstream of this point. Northern pike were not present at the Peerless station in 1977. This species is probably not a year-round resident in this portion of the West Fork. Spring runoff may be required to allow northern pike to reach upstream points on the West Fork. This runoff was not present in 1977, but was in 1978.

Fish populations were also sampled in Cottonwood Creek, a West Fork tributary (see map, Figure 1). Small numbers of walleye were found at these sampling locations distributed over the length of the drainage. No other game species were found. Nongame species in Cottonwood Creek are all found in the West Fork Poplar River.

The burbot (ling) is present in the lower several miles of the Poplar River. This species was not listed by Needham (1976). It was captured in spring 1978 and may be a Missouri River migrant.

short-term extremes are probably not harmful to walleye and northern pike acclimated to temperatures not far below the extreme values. The lethal threshold temperature for northern pike acclimated to 77 F is 90 F (Committee on Water Quality Criteria 1972). Similar data for walleye were not found, but the lethal threshold temperature for this species is probably slightly lower. Small increases in stream temperature could cause fish kills. An increase in the duration of temperatures in excess of 80 F is undesirable because of possible fish stress and growth rate depression.

Dissolved Oxygen

Historical and winter 1977-78 dissolved oxygen values for the Poplar River drainage were shown in previous reports (Stewart 1978a, 1978b). Additional measurements were made in July and August 1978 between 4 and 8 a.m. to determine minimum summer dissolved oxygen values. Results are shown in Table 2.

Table 2. Dissolved oxygen (mg/l) in the Poplar River drainage, July and August 1978.

Location	Date									
	7-18	7-19	7-21	7-24	7-25	7-28	8-3[a]	8-7	8-10	Mean
W. Fork - Susag	8.9	6.8	5.9	5.8	6.1	6.3	7.8 7.7	6.3	6.2	6.7
Main River-Paulsen	7.9	7.3	6.4	6.2	6.1	6.9	7.8 7.9	6.6	6.8	6.9
Mid.Fk.-Ofstedal	8.5	6.7	7.1	8.2	6.5	6.2	7.5 7.5	7.0	7.3	7.2
E.Fk.-Lower	8.6	6.4	5.7	6.2	5.2	5.8	7.2 7.3	5.9	5.6	6.3
E.Fk.-Cromwell	7.4	5.8	6.3	5.9	6.0	5.0	7.0 6.9	7.0	5.8	6.2
E.Fk.-Middle	3.0	7.7	4.4	3.8	2.8	3.2	6.8 6.8	5.7	4.4	4.6
E.Fk.-Upper Slab	8.2	8.1	11.2	9.6	8.9	7.9	10.4 10.2	8.9	7.8	9.0
E.Fk.-Base of Dam	-	-	6.6	2.9	6.2	7.8	11.3 6.5	3.5-5.5[b] 4.6[c]	3.1-3.6[b] 3.4[c]	5.8

a - Two samples separated by 50-75 feet taken at all stations this date.
b - Range of four samples separated by 50-75 feet.
c - Mean of four samples.

Table 3 continued. Number and volume (milliliters in parentheses) of macroinvertebrates collected in 1 square foot riffle samples for stations in the Poplar River drainage.

Date	Ephemer-optera	Diptera	Trich-optera	Amphi-poda	Anne-lida[b]	Mollusca[c]	Other[d]	Total
			West Fork Poplar River - South of Peerless					
11/7/77	175(1.0)	129(.4)	443(4.8)	4(.6)	6(.4)	9(.2)	0	766(7.4)
11/7/77	77(.4)	295(.8)	46(.8)	5(T)	6(.8)	1(T)	0	430(2.8)
11/7/77	118(.8)	179(.6)	31(.3)	1(T)	8(1.1)	0	1(.8)	338(3.6)
11/7/77	466(4.4)	125(.2)	47(.4)	16(.6)	19(2.8)	5(2.0)	0	678(10.4)
11/7/77	142(1.2)	138(.6)	75(1.0)	10(.6)	2(T)	1(T)	1(T)	368(3.4)
			West Fork Poplar River - Susag					
11/3/77	233(1.2)	55(.2)	303(3.6)	2(T)	4(.4)	0	0	597(5.4)
11/3/77	30(.2)	36(.2)	516(4.2)	0	1(.1)	0	0	583(4.7)
11/3/77	123(.7)	24(T)	336(2.8)	2(T)	2(.2)	0	1(.3)	488(4.0)
11/3/77	53(.2)	33(T)	976(9.2)	0	1(T)	0	0	1063(9.4)
11/3/77	220(.8)	127(T)	1772(7.4)	3(T)	0	0	0	2122(8.2)
			Poplar River - Lund					
11/7/77	0	107(T)	1372(16.8)	9(T)	6(T)	0	0	1494(16.8)
11/7/77	0	96(.2)	4396(7.0)	1(T)	0	0	0	4493(7.2)
11/7/77	0	132(.2)	1639(22.0)	0	1(T)	0	0	1772(22.2)
11/7/77	1(T)	288(1.2)	1431(22.0)	120(1.1)	30(.3)	88(2.1)	2(.3)	1959(27.0)
11/7/77	2(T)	112(T)	3244(32.6)	4(T)	2(T)	3(T)	0	3367(32.6)

Table 3. Number and volume (milliliters in parentheses) of macroinvertebrates collected in 1 square foot riffle samples for stations in the Poplar River drainage.

Date	Ephemer-optera	Diptera	Trich-optera	Amphi-poda	Anne-lida[b]	Mollusca[c]	Other[d]	Total
East Fork Poplar River-Border								
11/7/77	0	285(.5)	105(1.4)	24(.2)	73(.4)	7(1.2)	1(T)[a]	495(3.7)
11/7/77	0	27(T)	4(T)	1(T)	29(.1)	4(.2)	0	65(.3)
11/7/77	0	499(.2)	76(.3)	413(7.5)	13(T)	30(6.5)	0	1031(14.5)
11/7/77	8(T)	212(.3)	480(8.8)	139(1.6)	16(.2)	43(5.2)	0	898(16.1)
11/7/77	1(T)	98(.2)	334(4.8)	154(6.0)	9(.2)	37(4.2)	0	633(15.4)
East Fork Poplar River - Pittinger Bridge								
11/7/77	1(T)	158(.4)	430(4.2)	12(.2)	7(.2)	0	0	608(5.0)
11/7/77	2(T)	168(1.2)	413(5.4)	14(.3)	1(.3)	1(T)	0	599(7.2)
11/7/77	2(T)	578(.6)	1013(8.6)	9(.3)	7(.3)	3(T)	0	1612(9.8)
11/7/77	2(T)	363(1.6)	898(6.2)	26(.7)	6(.5)	0	0	1295(9.0)
11/7/77	58(.4)	276(1.6)	308(1.8)	144(1.5)	11(.3)	0	8(1.0)	805(5.6)
Middle Fork Poplar River - Near Border								
11/7/77	12(T)	429(2.4)	99(.8)	36(2.8)	19(1.8)	0	3(T)	598(7.8)
11/7/77	30(T)	376(3.1)	67(1.2)	23(1.6)	9(1.2)	0	0	505(7.1)
11/7/77	5(T)	138(.4)	1053(15.4)	17(.7)	4(.2)	27(.5)	0	1244(17.2)
11/7/77	6(T)	236(1.6)	569(8.0)	7(.4)	6(.3)	0	0	824(10.3)
11/7/77	3(T)	124(.6)	1139(13.8)	22(1.5)	4(T)	0	0	1292(15.9)
Middle Fork Poplar River - Ofstedal								
11/7/77	0	132(.4)	1024(13.0)	0	3(T)	0	0	1159(13.4)
11/7/77	1(T)	41(.2)	668(11.0)	0	8(T)	0	0	718(11.2)
11/7/77	0	50(.6)	865(11.3)	4(T)	0	4(.2)	0	923(12.1)
11/7/77	0	75(3.1)	1680(21.4)	3(T)	7(T)	0	0	1765(24.5)
11/7/77	1(T)	149(.7)	351(2.1)	5(T)	24(.2)	0	0	529(3.0)

Fish Spawning

Walleye and northern pike were sampled during the April spawning season in 1978 (Table 4). Results were similar to those of 1977. Spawners both years were found in all of the forks and the main river. Walleye were concentrated around riffle areas at the head and tail of pools. Ripe females were found over periods that were a few days later in 1978 than in 1977; this was probably due to cooler April weather in 1978 than in 1977.

No game fish were found in the upper East Fork in April 1978, but large numbers of young-of-the-year northern pike were present here later in the year. Spring sampling either missed the spawners that were present or sampling was not done when the spawners were present in this portion of the East Fork.

There was considerable mortality of walleye and northern pike in the East Fork in late winter 1978. Forty-four dead walleye and six dead northern pike were found in April by walking approximately 2 miles of stream downstream from the Pittinger bridge. Only one live walleye was found in electrofishing approximately 3 miles of the East Fork downstream of the Pittinger bridge in April 1978 (Table 4). Over 100 walleye were captured in the same section in April 1977 (Stewart 1978a). Late winter dissolved oxygen was sufficiently low to cause the fish kill (Stewart 1978b). The situation was probably aggravated by extremely thick ice (over 4 feet in places) that left very little fish living area available. A few dead walleye and northern pike were found on the bank in April 1978 in other parts of the East Fork, but not in the concentrations found downstream of the Pittinger bridge.

Low numbers of game fish captured in April 1978 compared to April 1977 suggest winter mortality in the remainder of the drainage, as well as the East Fork. Numbers of walleye captured in April in the East Fork were 196 (1977) and 77 (1978); corresponding numbers for northern pike were 52 and 33, with similar effort in both years. For the remainder of the drainage, the numbers of walleye captured in April 1977 compared to April 1978 were 417 (1977) and 199 (1978); corresponding numbers for northern pike are 140 and 59, again with similar effort in the 2 years. Dissolved oxygen was measured intensively only in the East Fork, but it may have been low in the remainder of the drainage. Ice depths are known to have been similar.

Spawners were sampled in the lower river from the Murphy slab (figure 1) to the mouth in April 1978. Results are shown in Tables 4 and 5. Ripe female northern pike were found earlier here than in upstream areas. The first ripe female northern pike in the lower river was found on April 6, 1978 as compared to April 14 for upstream locations. The lower portion of the drainage also had considerable numbers of sauger in spring (Table 5). These were not present in upstream portions of the drainage.

Table 3 continued. Number and volume (milliliters in parentheses) of macroinvertebrates collected in 1 square foot riffle samples for stations in the Poplar River drainage.

Date	Empeher-optera	Diptera	Trich-optera	Amphi-poda	Anne-lida[b]	Mollusca[c]	Other[d]	Total
			Poplar River - Paulsen					
11/3/77	9 (T)	167(.3)	121(1.0)	6(T)	2(T)	0	6(T)	311(1.3)
11/3/77	16 (T)	147(.3)	1232(8.0)	4(T)	0	0	0	1399(8.3)
11/3/77	30(.2)	808(1.4)	732(7.5)	4(T)	2(T)	0	0	1576(9.1)
11/3/77	25(.2)	485(.7)	465(4.1)	2(T)	2(T)	0	0	979(5.0)
11/3/77	18(T)	316(T)	705(3.5)	13(T)	0	0	0	1052(3.5)
			Poplar River - Crowley					
11/3/77	169(.8)	13(T)	521(3.0)	0	0	0	0	703(3.8)
11/3/77	94(.6)	30(T)	653(6.2)	0	0	0	0	777(6.8)
11/3/77	43(.5)	366(.7)	424(2.8)	2(T)	0	0	1(T)	836(4.0)
11/3/77	54(.4)	47(T)	343(1.4)	6(T)	0	0	0	450(1.8)
11/3/77	233(1.6)	190(T)	820(4.5)	3(T)	0	0	0	1246(6.1)

a - Trace; less than 0.1 ml.
b - Annelida consists of Hirudinea and Oligochaeta.
c - Mollusca consists of Gastropoda and Pelecypoda.
d - Includes Decapoda, Hemiptera, Neuroptera, Gordioidea.

Table 4 continued. Total number of walleye and northern pike captured and numbers of fish in spawning condition, spring 1978.

Location	Date	Walleye			Northern Pike		
		Number Caught	Ripe Males	Ripe/Spent Females	Number Caught	Ripe Males	Ripe/Spent Females
			Lower Main Poplar River				
Near Mouth	3-29	17	6	0	3	0	0
Near Mouth	3-30	10	0	0	6	0	0
Near Mouth	4-3	13	4	0	7	3	0
Near Mouth	4-5	5	1	0	3	1	0
Youpee to Mouth	4-6	11	4	0	9	4	4
Near Mouth	4-13	0	0	0	6	3	0
Murphy Slab	4-13	17	11	0	3	1	2
Murphy Slab to town of Poplar	4-17	58	45	2	11	3	3
Near Mouth	4-26	0	0	0	3	0	0
Youpee to Mouth	5-8	55	15	0	3	0	0
Totals		186	86	2	54	15	9
Grand Totals		462	250	7	146	51	35

Table 4. Total number of walleye and northern pike captured and numbers of fish in spawning condition, spring 1978.

Location	Date	Walleye			Northern Pike		
		Number Caught	Ripe Males	Ripe/Spent Females	Number Caught	Ripe Males	Ripe/Spent Females
East Fork Poplar River							
Upper Slab	4-11	0	0	0	0	0	0
Upper Slab	4-18	0	0	0	0	0	0
Cromwell	4-12	4	0	0	9	0	0
Cromwell	4-24	26	15	0	4	1	1
Cromwell	4-25	46	37	1	6	2	1
Lower	4-24	1	1	0	5	3	2
Near Mouth	4-20	0	0	0	9	3	5
Totals		77	53	1	33	9	9
Middle Fork Poplar River							
Near Border	4-21	5	4	1	6	2	3
Hagfeldt	4-11	48	15	0	4	3	0
Ofstedal	4-19	63	37	1	3	3	0
Near Mouth	4-20	4	1	0	2	2	0
Totals		120	57	2	15	10	3
West Fork Poplar River							
Susag	4-18	12	8	0	3	1	1
Lower	4-21	14	11	2	17	6	4
Totals		26	19	2	20	7	5
Upper Main Poplar River							
Lund	4-12	13	9	0	1	1	0
Lund	4-14	32	22	0	7	4	1
Paulsen	4-10	2	2	0	9	2	5
Paulsen	4-14	2	1	0	4	1	2
Crowley	4-10	4	1	0	3	2	1
Totals		53	35	0	24	10	9

Table 6. Physical characteristics of sites where walleye eggs were found.

Location	Date	No. of Samples[a]	Substrate Size (Inches)	Mean and (Range) No. of eggs per Sample	Water Depth[b]	Water velocity at 0.6 of Depth[c]
Poplar River-Youpee	4-19-78	4	0.2-3.0	13 (4-20)	1.7 (1.2-2.0)	1.79 (1.47-2.10)
Poplar River-Crowley	4-27-78	20	Coarse sand to 6.0	6 (2-17)	1.25 (0.9-1.6)	1.98 (1.47-2.29)
Middle Fork Poplar-Ofstedal	4-28-78	13	Coarse sand to 6.0	4.6 (1-12)	1.1 (0.5-1.7)	1.79 (0.69-2.92)
East Fork Poplar-Cromwell	5-3-78	11	Coarse sand to 6.0	28.6 (7-70)	0.6 (0.4-0.8)	1.77 (0.7-2.56)
West Fork Poplar-Susag	4-27-78	17	Coarse sand to 6.0	7.1 (1-28)	0.9 (0.5-1.3)	1.51 (0.9-2.86)

a - Each sample consisted of approximately 5 ft^2 of streambottom.
b - Feet.
c - Feet per second.

Table 5. Numbers of sauger captured in the lower Poplar River, spring 1978.

Location	Date	Number Caught	Ripe Males	Ripe or Spent Females
Near Mouth	3-29	14	2	0
Near Mouth	3-30	58	14	0
Near Mouth	4-3	27	5	0
Near Mouth	4-5	13	5	0
Near Town of Poplar	4-6	1	1	-
Near Mouth	4-13	1	1	0
Murphy Slab	4-13	1	0	0
Murphy Slab to Town of Poplar	4-17	3	0	0
Near Mouth	4-26	0	0	0
Youpee to Town of Poplar	5-8	10	3	0
Totals		128	31	0

Walleye and northern pike spawners captured in 1977 were aged from scale impressions. Male walleye spawned for the first time at age II. A few may not have become sexually mature until age III. Female walleye first ripened at age III. Male northern pike became ripe at age I. A few female northern pike probably spawned at age I, but most did not become sexually mature until age II.

Walleye Egg Sampling

Walleye eggs were found at all locations where spawners were found and on some riffles where spawners were not captured by electrofishing. Table 6 summarizes walleye egg data and associated physical parameters. Walleye eggs were found at other locations, but physical parameters were not measured. Numbers of walleye eggs on a given unit area of stream bottom are thought to be much greater than shown in Table 6. The eggs are rather adhesive; many eggs were probably not freed from the substrate to float into the egg basket.

Walleye eggs, almost without exception, were found in pool tail and riffle habitats and on gravel substrates. Streamflows at time of egg sampling varied from approximately 5 cfs at the East Fork-Cromwell station to approximately 200 cfs at the Poplar River-Youpee station. In spite of this, mean velocity of water over eggs among the five stations ranged only from 1.51 to 1.98 feet per second (Table 6). Walleye accepted shallower water for spawning in locations where streamflow was lower. Mean water depths in which eggs were found varied from 0.6 feet for the low streamflow station to 1.7 feet for the high streamflow station.

Table 7. Estimates for numbers per mile of walleye and northern pike young-of-the-year made in fall 1977 and 1978.

Location	Walleye		Northern Pike	
	1977	1978	1977	1978
East Fork-Upper Slab	10	0	0	406
East Fork-Cromwell	3	64	0	0
East Fork-Lower	3	136	1	130
Middle Fork-Border	-	58	-	241
Middle Fork-Hagfeldt	186	208	4	97
West Fork-Susag	61	184	0	53
Main River-Lund	37	65	3	84
Main River-Paulsen	76	11	28	116
Main River-Crowley	-	121	-	81
Average-All Sections	54	94	5	134

Poor northern pike year classes in 1977 were probably caused by April streamflows too low to flood terrestrial vegetation. Flows in the East Fork were also probably too low for walleye spawning. Flows for 1978, while not yet published by the U. S. Geological Survey, were much greater in April 1978 than in April 1977.

Movement and Migration

Game fish movement in most of the Poplar River was low in 1977 (Stewart 1978a). Most fish seemed to spawn in the same locality occupied the remainder of the year. This was also true in 1978, although flows were much greater in 1978. Table 8 summarizes percentages of recaptured walleye and northern pike that moved from the point originally captured. Of 130 walleye recaptured in 1978, only 3(2 percent) had moved; the corresponding figures for northern pike were 80, 5 and 6 percent. Fish tagged in spring and fall 1977 were recaptured in both spring and fall 1978. Fall 1978 recapture was also made of fish tagged in spring 1978.

Spawners were captured in the lower Poplar River (Murphy Slab to mouth) in spring 1978. Considerable numbers of sauger were present here at this time (Table 5). Considerably larger numbers of sauger were caught in late March and early April than in late April (Table 5). These sauger may be quite migratory. Many of them may spawn in the Poplar River and reside outside the drainage at other times of the year. Of seven sauger recaptured, over 50 percent (4) had moved. One sauger marked in 1977 in the West Fork Poplar River and one marked in 1977 at the Paulsen location on the upper main river were both recaptured in the lower main river in spring. Another sauger marked in summer on the Yellowstone River near Fallon was caught in spring on the lower Poplar. The fourth recaptured sauger was marked in the lower Poplar in early April 1978 and recaptured later in the year on the Yellowstone River near Miles City.

Larval Fish

Larval fish were sampled in spring 1977 and 1978 to locate spawning areas, to assess the early strength of year classes, and in part to determine stage of mortality in young-of-the-year walleye and northern pike. The 1977 data are reported in Stewart (1978b). In summary, only 20 walleye and no young-of-the-year northern pike were captured. None of the walleye larvae were captured on the East Fork Poplar River. Young-of-the-year walleye population estimates later in the year showed that almost none were present in the East Fork, so the failure of the year class apparently came quite early.

Identification of larval fish from 1978 samples has not been completed and only preliminary observations can be given. Sampling efforts in 1978 were considerably more successful than in 1977. To date several hundred walleye and more than 30 northern pike have been identified from both larval set nets and larval tow nets. Largest numbers have been found on the downstream portions of the main river.

Fish Population Estimates

Estimates of numbers and weight of walleye and northern pike in seven stream sections were made in 1977. Estimates for these same seven sections and for an additional two were made in 1978. Data for 1977 were reported in Stewart (1978b). The field data for 1978 estimates have not been tabulated because of time required to receive scale impressions and time required for computer runs. Only the estimates for young-of-the-year walleye and northern pike are completed. These are shown in Table 7 along with the 1977 young-of-the-year estimates for comparison.

Numbers of young-of-the-year were considerably larger in 1978 than in 1977 for both species. For northern pike, numbers per mile greatly increased except for the East Fork-Cromwell section where none were present in either year. The lack of northern pike in this section in 1978 is surprising in that young-of-the-year were present in good numbers at both upstream and downstream locations in the East Fork (Table 7). Average numbers per mile for northern pike in all sections were 5 in 1977 and 134 in 1978.

Average numbers of young-of-the-year walleye per mile approximately doubled from 1977 to 1978 (Table 7). Increases were greatest in the East Fork (averages of 5 and 67 per mile for 1977 and 1978). Decreases were found only on the upper section of the East Fork where the few walleye present appeared to suffer severe winter mortality during early 1978 and on the Paulsen section of the main river. Although no dead adult walleye were found in the spring of 1978 in the Paulsen section, mortality may have occurred here also, as very few walleye were found in April 1978 (Table 4).

Two walleye marked in spring in the lower Poplar River were recaptured later in the year in Garrison Reservoir in North Dakota. No fish from upstream portions of the Poplar River drainage were ever recaptured outside the system. The lower Poplar River may have significant spawning runs of both sauger and walleye, but sufficient field work has not yet been done to determine this.

Table 9 is a summary of game fish movement. No significant spawning movements appear likely other than those already described.

Table 9. Movement of Poplar River walleye (WE), northern pike (NP) and sauger (S) from one location to another.

Location Recaptured		Location Tagged					
		East Fork	Middle Fork	West Fork	Upper Main River	Lower Main River	Outside Drainage
East Fork	WE	-	0	0	1	0	0
	NP	-	0	0	4	0	0
	S	-	0	0	0	0	0
Middle Fork	WE	0	-	0	1	0	0
	NP	0	-	0	1	0	0
	S	0	-	0	0	0	0
West Fork	WE	0	0	-	0	0	0
	NP	0	0	-	1	0	0
	S	0	0	-	0	0	0
Upper Main River	WE	0	2	0	-	0	0
	NP	1	0	0	-	0	0
	S	0	0	0	-	0	0
Lower Main River	WE	0	0	0	0	-	0
	NP	0	0	0	0	-	0
	S	0	0	1	1	-	1
Outside Poplar River Drainage	WE	0	0	0	0	2	-
	NP	1	0	0	0	2	-
	S	0	0	0	0	1	-

Fish for Metals Analysis

Small samples of fish for analysis of muscle tissue for metals were collected in June 1978. Samples were collected of both walleye and northern pike and frozen the same day. These fish were sent to Denver on dry ice by air freight for analysis at the Denver EPA laboratory. No results have been received as yet. Results will be shown in a future report.

Table 8. Recapture in 1978 of fish tagged in 1977 and 1978.[a]

Number Recaptured		No movement from location tagged				Moved from location tagged			
		Walleye		N. Pike		Walleye		N. Pike	
Walleye	N. Pike	No.	%[b]	No.	%[b]	No.	%[b]	No.	%[b]
		Recaptured in East Fork Poplar River							
50[c]	37[d]	49	98	34	92	1	2	3	8
		Recaptured in Middle Fork Poplar River							
30	6	29	97	6	100	1	3	0	0
		Recaptured in West Fork Poplar River							
18	6	18	100	5	80	0	0	1	20
		Recaptured in lower main river - Murphy Slab to Mouth							
11	2	11	100	2	100	0	0	0	0
		Recaptured in upper main river - East Fork to Crowley Slab							
21	29	20	95	28	97	1	5	1	3
		Totals							
130	80	127	98	75	94	3	2	5	6

a - Includes both electrofishing and angler recapture.
b - Percent of number recaptured.
c - Includes 27 tagged walleye found dead on East Fork streambank in April 1978.
d - Includes 4 northern pike found dead on East Fork streambank in April 1978.

Minimum Instream Flows

Tentative minimum instream flows are being formulated for the Poplar River drainage. Numbers for these flows are not yet finalized. These numbers will be shown in a later report.

Flows are being formulated using the dominant discharge (1.5 year flood) for a 24-hour period along with intermediate flows up to and down from this peak for the early spring period to coincide with natural runoff periods. The 1.5 year flood is the flow considered by hydrologists to be the channel forming and maintaining flow. Without it, gravel is not moved to form riffles and pools tend to fill. Flows for April and May are being chosen to ensure successful walleye and northern pike spawning and egg incubation. The low April-May flows in 1977, which produced weak year classes, and the higher April-May flows in 1978, which produced strong year classes, are providing a major tool for formulation of flows for this period. Recommended flows for the remainder of the year are low, only a few cubic feet per second, as walleye and northern pike appear to have done well with similar natural flows.

ADDITIONAL STUDIES NEEDED

Sufficient baseline information has been developed to monitor effects of development in the drainage. Future work on the Poplar River should consist of work on the East Fork and on the Middle Fork as a control. This work should include annual measurements of game fish reproductive success by larval fish sampling and fall young-of-the-year population estimates. Older ages should also be estimated. Monitoring spawning runs out of the Missouri into the lower Poplar should be continued.

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