MONTANA DEPARTMENT OF FISH AND GAME
FISHERIES DIVISION

JOB PROGRESS REPORT

State: Montana

Project No.: F-5-R-21 Title: Central Montana Fisheries Study

Job No.: I-a Title: Inventory of Waters of the Project Area

Period Covered: June 1, 1971 to June 30, 1972

ABSTRACT

The 1970 stocking of rainbow trout in Bynum, Eureka, Nilan and Willow Creek Reservoirs provided a below average fishery. Gill net sampling revealed poor survival of the plants but the reason was not determined. Gill net surveys were also conducted on Martinsdale and Yellow Water Reservoirs and on Fitzpatrick, Priest Butte, Tunnel and Ackley Lakes. Two mountain lakes containing cutthroat trout were sampled by hook and line. The walleye population of Petrolia Reservoir was sampled with hoop nets and a low abundance was observed. A general survey of Tiber Reservoir was conducted to determine species composition and relative abundance of fish, plankton and bottom organisms. White sucker in Swazee Lake and white and longnose sucker in Harris Reservoir were chemically removed. Walleye were introduced into Tiber Reservoir to try to start a self-sustaining fishery and kokanee were introduced into Bynum Reservoir to augment the sport fishery.

Four streams of the Marias River system in the Rocky Mountain Front were surveyed for natural barriers and the presence of cutthroat trout. Three streams near Lewistown were electrofished to determine suitability for fish plants. Invertebrate samples were collected from Big Spring Creek, Judith River and Warm Spring Creek. A portion of the North Fork of the Musselshell River above Harris Reservoir was chemically treated to remove suckers; study sections were established to determine the rate of re-invasion by brook trout from upstream areas. Five streams in the Sun River drainage were monitered to determine the effects of spraying grasshoppers with dieldrin.

Background information and recommendations are discussed in the findings section.

OBJECTIVES

To obtain physical, chemical and biological information which will aid in developing fishery management plans for waters in the study area.

To conduct follow-up surveys where additional information is needed to evaluate management practices.

PROCEDURES

Fish were sampled with 6-foot by 125-foot graduated mesh (3/4-inch to 2-inch) nylon gill nets, 30-inch hoop nets with 1-3/8 inch mesh, 3-foot by 4-foot frame net traps (¼inch mesh), 4-foot by 6-foot frame net traps (½-inch and 1-inch mesh), a 300 volt D.C. electro-fish shocker and by hook and line. Measurements taken were total length to the nearest tenth of an inch and weights to the nearest hundredth of a pound. Lake rehabilitation was carried out using rotenone. Invertebrate samples from streams were taken with a one square foot Surber stream bottom sampler and organisms were preserved in a 50 percent alcohol solution for later enumeration. Scale samples were taken in individual envelopes and later impressed in plastic for analysis.

FINDINGS

Lakes and Reservoirs

Irrigation Storage Reservoirs - Four irrigation storage reservoirs near Choteau were gill netted. These reservoirs, Bynum, Eureka, Nilan and Willow Creek range in size from 408 to 4,120 surface acres; all contain rainbow trout and white sucker. Kokanee were introduced into Bynum Reservoir in 1971 and 1972. These lakes experience fluctuating water levels depending on irrigation demand.

Extremely poor fishing resulted from the 1970 plant in all of the above reservoirs and the gill net surveys verified fishermen's complaints (Table 1). No possible explanation could be determined for the failure of the plants. Bynum Reservoir was sampled only once, but the other three reservoirs were sampled twice. Trout from the 1970 plant were taken in limited numbers during each of the sampling periods. Some of these fish, however, were taken quite regularly during the late fall and winter fishing seasons. Good fishing has developed in all four reservoirs from the 1971 plant.

Periodic surveys should be conducted to check survival and growth of stocked rainbow trout. Survival of the kokanee introductions into Bynum Reservoir should be determined. If irrigation demand lowers any of the reservoirs sufficiently, consideration should be given to eradication of the large numbers of suckers present.

Table 1. Gill net catch data of lakes surveyed, 1971.

Area (Date Sampled)	Surface Acres	No. of Nets	Year Stocked	Species*	No.	Avg. Length (Range)	Avg. Weight (Range)
Bynum Reservoir (May 20)	4,120	2	1970	Rb	3	12.4(11.1-13.7)	0.71(0.56-0.87)
				CSu	225	(6.6-15.5)	(0.10-1.61)
Eureka Reservoir (May 5, July 23)	408	4	1970	Rb	5	17.5(15.5-19.7)	2.63(2.10-3.60)
			1971	Rb	11	9.0(6.9- 11.0)	0.41(0.14-0.68)
				LL	4	14.5(5.2- 17.4)	1.79(0.05-2.93)
				CSu	1		
Nilan Reservoir (May 26, Sept. 3)	520	4	1970	Rb	4	15.5(14.9-16.3)	1.45(1.30-1.68)
			1971	Rb	22	8.5(6.7-10.0)	0.23(0.10-0.35)
				CSu	219	9.7(6.9-13.5)	0.43(0.13-1.00)
Willow Creek Reservoir (May 18, Sept. 3)	1,530	4	1970	Rb	2	17.4(16.6-18.2)	2.13(1.78-2.48)
			1971	Rb	18	11.5(9.3-13.1)	0.63(0.32-0.77)
				CSu	385	(9.1-14.2)	(0.30-1.13)
Tiber Reservoir (June 23-24, July 7)	22,180	10		Rb	9	16.6(10.9-20.9)	1.41(0.47-2.40)
				YP	297	7.0(5.3-12.2)	0.14(0.06-0.74)
				Burbot	5	16.7(15.1-17.9)	1.10(0.83-1.31)
				CSu	56	10.5(6.3-14.1)	0.50(0.09-1.08)
				FSu	6	12.2(10.2-13.9)	0.59(0.35-0.88)
				Carp	8	10.4(7.8-23.3)	1.69(0.25-10#ca)
				F Chub	2	6.5(5.9- 7.1)	0.10(0.07-0.12)
Fitzpatrick Lake (Sept. 16)	75	1	1969	Rb	1	16.5	2.08
			1970	Rb	6	14.6(12.8-15.8)	1.33(0.91-1.74)
			1971	Rb	17	11.2(10.1-12.4)	0.61(0.50-0.79)
Priest Butte Lake (May 21, July 27, Sept. 10)	299	5	1969	Rb	5	18.2(15.9-20.3)	2.50(1.70-3.40)
			1970	Rb	55	14.2(11.3-17.4)	1.22(0.59-2.30)
			1971	Rb	15	10.2(8.8-11.8)	0.50(0.36-0.79)
				CSu	4		

Table 1. Continued

Area (Date Sampled)	Surface Acres	No. of Nets	Year Stocked	Species*	No.	Avg. Length (Range)	Avg. Weight (Range)
Tunnel Lake (April 30)	16	1	1970	YCT	9	7.0(6.6-7.5)	
Martinsdale Reservoir (May 26)	985	4		Rb	1	20.2	3.75
			1970	Rb	39	11.9(10.2-13.6)	0.65(0.40-0.82)
				LL	7	18.8(16.8-24.5)	2.56(1.66-5.37)
				YP	4	10.8(10.5-11.0)	0.58(0.54-0.62)
				CSu	150		
				FSu	17		
Ackley Lake (April 6)	247	3	1969	Rb	1	17.3	2.10
			1970	Rb	25	14.4(11.2-15.4)	0.92(0.52-1.62)
			1969	Kok	1	6.4	0.08
			1968	Kok	11	10.9(9.8-11.6)	0.54(0.37-0.72)
				MWf	1	13.0	0.82
				CSu	370		
				FSu	244		
Yellow Water Res. (May 28)	600	2	1969	Rb	1	20.4	3.00
			1970	Rb	15	7.9(6.1-10.8)	
				BBL	3	10.8(10.7-10.9)	0.84(0.80-0.92)
				CSu	44		

* Species abbreviations = Rb-rainbow trout; LL-brown trout; YCT-yellowstone cutthroat trout; CSu-white sucker; FSu-longnose sucker; YP-yellow perch; F Chub-Flathead chub; Kok-kokanee; MWf-mountain whitefish; BBL-black bullhead.

Tiber Reservoir - Tiber Reservoir is a 22,180 surface acre impoundment behind an earth-fill dam. Closure date was October, 1955. The reservoir was built for irrigation, but to date, the only use of the reservoir has been flood control and limited recreation. The drainage above the dam was chemically rehabilitated in August and September, 1955 to remove carp and goldeye. Rainbow trout planted after the rehabilitation project showed average growth for a few years, but then growth became very poor. Poor growth is related in part to a scarcity of bottom fauna and plankton. The morphometry of the reservoir is characterized by steep, easily eroded banks and a small percentage of littoral area.

In 1971, a survey of Tiber Reservoir was conducted to determine species composition of fish present, and to sample the bottom fauna and plankton. It was felt that if the shoreline had stabilized, food organisms may have increased, making it feasible to again plant trout. A total of seven fish species were taken in gill nets (Table 1) and an additional three minnow species (silvery minnow, emerald shiner and Hybognathus, sp.) were taken in frame net traps. Bottom samples and plankton samples revealed few organisms and it is doubtful whether rainbow trout would do any better now than in the past. Yellow perch are the most abundant fish in the reservoir and appear to be in good condition. Walleye were introduced in 1971 in hopes of creating a self-sustained fishery. The majority of the walleye fry were stocked in the Willow Creek arm which contains more littoral zone than the rest of the reservoir. This area also has the best potential for walleye spawning sites in the form of gravel and rubble.

Success of the walleye introduction will be determined during future surveys, and if possible, more walleye should be introduced. Planting of rainbow trout in Tiber Reservoir should be discouraged based on present findings and past experience.

Fitzpatrick and Priest Butte Lakes - Two natural lakes, Fitzpatrick and Priest Butte, experienced similar problems in 1971. Extremely hot, calm, dry weather prevailed during July and August. Temperatures on the bottom of Priest Butte Lake averaged 67.9°F. during the last 2 weeks of July and 69.1°F. for the first 2 weeks of August. Thermoclines developed, oxygen depletion occurred below the thermocline and fish kills took place. Approximate estimates of rainbow trout killed are 20% for Fitzpatrick Lake and 60-70% for Priest Butte Lake. These estimates are based on past netting history and visual numbers of dead fish. Table 1 shows the numbers of fish taken in gill nets from the lakes (the September 10 netting for Priest Butte Lake took only seven rainbow trout).

Priest Butte Lake opened to fishing for the first time on January 1 despite the summer kill. It is recommended that the

season be limited to the period from January 1 to March 31 of each year to avoid conflicts with nesting waterfowl in the spring and summer and waterfowl hunters in the fall. Also, palatability of the fish is thought to be better during the winter months. Rainbow trout caught opening day ranged from 9.1 to 20.4 inches and 0.40 to 3.84 pounds. Fishing success was poor throughout the season as was anticipated. Of the people contacted concerning the palatability of the fish, 75% said the flesh was good.

Fitzpatrick and Priest Butte Lakes should continue to be stocked and monitered for rainbow trout growth and survival. If summer kill continues to be a problem in either lake, it should be removed from the planting program.

Kiyo, Hidden (Our), and Tunnel Lakes - These are mountain lakes and have yellowstone cutthroat trout populations.1/ Kiyo Lake and Hidden Lake were sampled by hook and line. No fish were caught in Kiyo Lake, although small fish were observed along the shoreline and some were caught in the outlet stream below a beaver dam. Hidden Lake cutthroat ranged in size from 7.7 to 15.5 inches. The fish population in Kiyo Lake is sustained naturally in small inlet streams, whereas Hidden Lake receives a plant every two years. A gill net set in Tunnel Lake April 30, 1971 captured nine yellowstone cutthroat trout with an average length of 7.0 inches (Table 1). These trout were planted in August, 1970 as 3-inch fish. Another plant of 5-inch fish was made in July, 1971 and they averaged 7.7 inches by March, 1972. These lakes should be checked periodically to moniter growth and, if necessary, alter the stocking rate.

Swazee Lake - Swazee Lake on the Sun River Game Range was chemically treated on June 7, 1971 to eradicate white suckers. A wier and screen were installed in the inlet stream to prevent suckers from entering the lake. This device should be adequate since flows in the inlet are low and leaves and other debris will be minimal.

Martinsdale Reservoir - A spring gill net survey was made of Martinsdale Reservoir, a 985-acre irrigation impoundment in Meagher County (Table 1). Four gill nets left overnight caught a total of 40 rainbow trout, 7 brown trout, 150 white sucker, 17 longnose sucker and 4 yellow perch. The catch of rainbow trout was greater than the average of past surveys and good fishing was experienced during the summer. This probably resulted from the larger (6-inch) fish planted in 1970 exhibiting

1/ Unless otherwise specified, all cutthroat in this report are upper Missouri River strain.

greater survival than the smaller fish planted in the past. The number of brown trout was also greater than usual. These fish enter the reservoir with the water drawn from the South Fork of the Musselshell River and augment the fishery of the reservoir, occasionally providing a fish of 5 pounds or larger. The sucker population appears to be at or slightly above previously recorded levels. The catch of yellow perch was the first ever made during a gill net survey, although they have been taken previously by anglers. They are undoubtedly the result of an introduction by a thoughtless fisherman, as none are present naturally in the area.

This reservoir should be watched for the development of the perch population and its effect on the fishery. Four to six inch trout should continue to be planted.

Petrolia Reservoir - Petrolia Reservoir is a 515-acre State Water Resources Division Reservoir in Petroleum County that provides limited fishing opportunity. Walleye represent the only game fish species present, although an introduction of black crappie was made in 1969. Three gill nets were left overnight in late April. The catch consisted of numerous carp and white sucker. The failure to catch any walleye may have been due to the timing of the survey in relation to spawning acitivity. Two hoop nets were placed in the reservoir on October 15 and removed on November 2. A total of nine walleye were taken with the largest weighing just over 9 pounds. The average length and weight was 19.6 inches and 3.52 pounds, respectively. Numerous carp and white sucker were also caught. No crappie were captured and it appears the plant was not successful. An introduction of burbot is proposed. It is apparent that the walleye population has stabilized at a low level and will not support a significant fishery.

Ackley Lake - Ackley Lake is a 247-acre irrigation reservoir in Judith Basin County. The lake was rehabilitated in the fall of 1966 to eradicate populations of carp and sucker. Such a treatment can be considered only temporary in this reservoir because rough fish continually enter the lake with the water drawn from the Judith River. The sucker population has returned to the level existing prior to rehabilitation and this is reflected by trout survival and growth. The lake was sampled in April, 1971 with three gill nets set overnight. Two nets were set on the bottom near the shore and one was set on the surface in the middle. The catch consisted of 370 white sucker, 244 longnose sucker, 26 rainbow trout, 12 kokanee and one 13-inch whitefish (Table 1). The standing crop of rainbow, as indicated by gill net catches, has declined to about one-fourth of levels existing immediately following rehabilitation, despite comparable

magnitude of plants. The sucker catch was far the largest of any taken in the annual surveys of this lake since 1968.

An attempt should be made to draw this reservoir down to a low enough level for rehabilitation.

Yellow Water Reservoir - Yellow Water Reservoir is a 600-surface acre State Water Resources Division reservoir in Petroleum County. Two gill nets were set in the lake overnight in late May. Fifteen rainbow (17.9 inches) from the 1971 plant were taken along with one larger individual rainbow (Table 1). The larger trout (20.4 inches, 3.00 pounds) appeared to be from the 1969 plant. The complete lack of trout from the 1970 plant is probably due to a summer kill that occurred during August of that year. Three black bullhead and 44 white sucker were also captured.

In the fall of 1968, commercial fishing for black bullhead was permitted because the population had reached a high level of abundance and growth was impaired. In August of 1971, it appeared that the population had been reduced to the point where fish were again large enough to be attractive to sport fishermen. Therefore, all commercial fishing was removed from the lake.

The plant of rainbow trout was doubled to 50,000 in 1971. This level of planting should continue at least long enough to determine the effect on the fishery. No commercial fishing should be allowed until the bullhead population increases to the point where growth is again reduced.

War Horse Lake - Cursory examination was made of this large, shallow Montana Water Resources Division reservoir in Petroleum County with respect to its suitability for northern pike. It would appear to be the most ideal reservoir in the area for this species. More extensive observations were not made as the Water Resources Division has indicated it is going to drain the reservoir during the period of 1972-73 to repair the outlet structure. Furthermore, it is conducting a soil survey in the drainage to determine the feasibility of activating this as an irrigation reservoir; preliminary indications are negative. The reservoir has a maximum depth of about 10 feet and would not support fish through the winter if drawn down for irrigation. Further action awaits the completion of these two projects. Because the water was to be lowered and all fish lost, commercial fishing for bullheads and suckers was allowed through the winter. Northern pike should be planted in War Horse Lake if it is not to be used as an irrigation water source.

Bair Reservoir - This reservoir, belonging to the Montana Water Resources Division, is located on the North Fork of the Musselshell River and is 272 surface acres in area. It was

built in 1939. The reservoir was drawn very low during the summer of 1971 and, since the sucker population had increased to a very high level following rehabilitation in 1961, the opportunity was used to rehabilitate the reservoir again. In an attempt to prevent suckers from re-invading the reservoir, all known tributaries were treated upstream from the lake until no suckers were observed. Four gill nets left overnight in the reservoir and considerable fish shocking in the upstream area captured no suckers. The reservoir was replanted with 90,720 rainbow trout (1,080 pounds) about 3 inches long the following spring.

Farm Ponds

Twenty farm ponds were gill-netted during the year to determine growth rate and abundance of fish species present (Table 2). Management recommendations were made for many of these based on the results. Several new reservoirs were checked for feasibility of adding to the trout stocking program. One reservoir near Winifred (Benes') was fished with a hoop net. It was found that a plant of black crappie was growing very well. A reservoir on the Martin Norman Ranch was stocked with fingerling largemouth bass. One private pond was rehabilitated for the owner at his expense.

Farm ponds should continue to be gill netted about every 3 years to check on growth and abundance of trout and other species present. Creel checks should be made occasionally on the more important ones.

Streams

Limited surveys were conducted on four streams in the Marias River drainage east of the Continental Divide and south of Glacier Park. They are: North Fork of Birch Creek, North and South Forks of Badger Creek, and South Fork of Two Medicine River. Travel in this area is limited to horseback or back-packing. The area is included in the Rocky Mountain Front Study being conducted by the U. S. Forest Service and is part of the proposed Continental Divide Wilderness Candidate Study Area.

Remnant populations of endemic cutthroat trout are thought to exist in this drainage as well as other drainages along the east slopes of the Rocky Mountain Front. Preliminary surveys conducted July 12-15, 1971 (by hook and line) indicate cutthroat to be present in all of the streams listed above, but in some cases, populations of brook trout, rainbow trout or hybrids occur in the same stream. Natural barriers exist on all of the streams.

TABLE 2. Summary of results of sampling of farm ponds.

Pond	No. Nets	No. Hrs.	Net Type	Species	Length Ave.	Length Min.	Length Max.	Weight Ave.	Weight Min.	Weight Max.	No. Fish
Box Elder	1	22	Gill net	Rb	10.6	7.6	13.3	.47	.16	.85	30
Bene's #2	1	192	Hoop	BC	10.4	9.3	12.7	.71	.46	1.27	37
Brook #2	1	5	Gill net	Eb	9.2	6.9	13.3	.34	.12	.99	44
C-1	1	5	Gill net	Rb	16.6	15.1	17.8	2.43	1.93	3.00	10
				Eb	8.0	5.3	12.2	.47	.13	1.19	55
Deerfield #1	1	18	Gill net	C	--	--	--	--	--	--	8
Deerfield #2	1	8	Gill net	BL	--	--	--	--	--	--	2
Drag Cr.	1	22	Gill net	Rb	14.4	12.9	15.8	1.22	.94	1.52	6
Holgate	1	17	Gill net	Eb	7.9	6.7	14.1	.25	.12	1.28	14
				Rb	10.2	8.8	11.5	.43	.28	.62	7
Holliday	1	17	Gill net	Rb	14.4	6.8	19.3	1.17	.14	2.44	37
				Eb	11.4	8.3	15.0	.70	.26	1.52	16
Martin	1	21	Gill net	Eb	10.3	7.9	11.6	.55	.22	.80	57
Norman #1	1	24	Gill net	Gs	--	--	--	--	--	--	75
Norman #2	1	15	Gill Net	Rb	12.5	9.7	17.2	.85	.34	1.90	30
Peck	1	10	Gill net	Rb	9.0	7.4	14.0	.34	.16	1.08	21
Peterson	2	21	Gill net	Rb	13.7	5.4	17.6	1.55	.08	2.67	44
Porter	1	4	Gill net	Rb	13.6	11.4	19.8	1.30	.64	3.28	13
Rimers	1	6	Gill net	Rb	8.6	7.6	13.9	.25	.13	1.07	31
				Eb	9.0	6.9	10.5	.27	.10	.42	20
Snap #1	1	6	Gill net	Rb	22.2	--	--	5.04	--	--	1
Snap #2	1	21	Gill net	Rb	10.1	6.9	18.2	.53	.12	2.74	45
Stafford	1	18	Gill net		--	--	--	--	--	--	0
Urs	1	9	Gill net	Rb	10.8	7.8	17.0	.68	.21	2.43	50
Zahn	1	21	Gill net		--	--	--	--	--	--	0

Rb-rainbow trout; BC-black crappie; Eb-brook trout; C-carp;
BL-black bullhead; Gs-golden shiner

All of these streams show effects of the 1964 flood. The habitat was severely damaged but is slowly coming back in some areas. Seismograph roads found in the area were poorly constructed. Parts of the road are slipping and could cause considerable siltation in the streams with heavy rains or runoff.

Although cutthroat were sampled in these four streams, more work should be done on the other major streams and tributaries along the front to determine where cutthroat exist and where the waters have been invaded by other species. This data should be incorporated into the Forest Service Rocky Mountain Front Study pertaining to the Continental Divide Wilderness Candidate Study Area. Cutthroat should be given preference above interests such as logging, mineral exploration, roads or dams, or at least be highly considered. Future surveys will include locating and photographing natural barriers, determining species composition above and below the barriers and general characteristics of the stream habitat.

North Fork of Birch Creek - This stream has a barrier approximately ½ mile upstream from its confluence with Swift Reservoir. Cutthroat (7-11 inches) were sampled above the barrier for about 1 mile. Another barrier is located 4 miles upstream from the mouth.

South Fork of Badger Creek - Two barriers occur on this stream, ½ mile and 1 mile upstream from the confluence with the North Fork of Badger Creek. Cutthroat (9-16 inches) and hybrids were sampled below the barriers. Fish were observed above the barriers but none taken. Brook trout have been reported approximately 1 mile below the forks of Badger Creek.

North Fork of Badger Creek - Three barriers were found on this stream. Cutthroat (6-16 inches) and hybrids were taken from this stream below the lower barrier but, although observed above the barriers, none were collected. The barriers are located ½ mile, 1 mile, and 4½ miles upstream from the confluence with the South Fork.

South Fork Two Medicine River - One barrier was found, approximately 10 miles below the headwaters. Cutthroat, rainbow, hybrids and mountain whitefish were taken above and below this barrier.

Dieldrin Spray Project - Approximately 2,000 acres on the A. B. Cobb Ranch, west of Augusta in the Sun River drainage, were scheduled to be sprayed by the landowner with dieldrin for grasshoppers. Hay meadows and south-facing slopes were to be

band sprayed until about half of the 2,000 acres were covered. However, inclement weather prevented the project from taking place.

Streams that would have been affected in the area include Ford Creek, Big Willow Creek, Little Willow Creek, Cut Rock Creek and Rose Creek on the adjoining Sun River Game Range. The streams were monitered to obtain pre-spray information. Species of fish found in the streams include rainbow trout, brook trout, rainbow-cutthroat hybrids, sculpins, longnose sucker and white sucker. Whole fish samples were collected from each of the streams on August 28, 1971 and frozen. Fish were also placed in live cages in all streams on September 2, 1971. These fish were replaced with fresh specimens on September 10, 1971. Live cages were removed and fish released on September 16, 1971 when it appeared that the spray project would not occur.

Big Spring Creek - Construction of the Big Spring Creek Watershed Project was initiated with installation of the new diversion structure for the mill ditch. Work was also begun on enlarging and concrete lining the ditch. Condemnation proceedings continued against the two owners of the land to be occupied by the East Fork dam and reservoir. These proceedings are nearing completion and it is expected that construction may begin as early as the fall of 1972.

It was recommended that Spring Creek be opened to year-around fishing. This recommendation was approved by the Commission and became a part of the 1972-73 fishing regulations.

Bottom fauna samples were taken July 27-30 from the previously established stations on Big Spring Creek and the East Fork. The purpose of these is to serve as an index to changes in the streams productivity and to moniter possible changes following construction of the Watershed Plan dams. Additionally, the stations at the fish hatchery and the Montana Power substation were sampled on August 11. Two one-square foot samples were taken from each station. The two subsamples were counted individually and results are shown in Table 3. As in past years, the greatest number of organisms was found above town.

A serious erosion problem has been occurring just downstream of the city of Lewistown, resulting from channelizing a 4,200 foot section of Spring Creek in 1961 (see Completion Report F-5-R-18). The neck of one meander loop had eroded to a width of less than 3 feet and was nearly ready to cut through. If this happened, erosion problems would be compounded. The local chapter of Trout Unlimited and the Kiwanis Club wished to prevent this from occurring and successfully undertook a rip-rap project to

Table 3. Number of organisms taken in one square foot (2 at each station) bottom samples from Big Spring Creek and East Fork, July 27-30 and August 11, 1971.

Organism	July 27-30								August 11	
	Fish Hatchery	East Fork	Burleigh's	Montana Power	Above Sewer	Below Sewer	Trestle	Falls	Fish Hatchery	Montana Power
Trichoptera										
Brachycentridae	51-636	1-33	715-575	12-528	10- 14	1- 0	3- 3	1- 1	16- 16	269-295
Leptoceridae	6- 12	0- 0	137- 41	125-327	45- 1		3- 4		16- 16	193-559
Glossosomatidae	118-239	7-13	67-113	80-178	9- 11		2- 0	0- 2	104-177	253-247
Limnephilidae	6- 13	0- 0	14- 21	0- 5	0- 0				3- 16	3- 3
Hydropsychidae	0- 5	1- 0	6- 8	0- 4	0- 0				0- 0	0- 0
Hydroptilidae	0- 0	0- 0	0- 0	0- 1	0- 0				0- 0	0- 0
Ephemeroptera										
Heptageniidae	3- 13	1- 6	7- 15	8- 8	64- 44	24-37	34-131	13-17	3- 7	19- 7
Baetiscidae	0- 0	1- 0	0- 0		49- 3	5- 1	61-128	19- 7	0- 0	1- 1
Tricorythidae	0- 0	7-14	0- 0			0- 0			0- 0	0- 0
Baetidae	0- 0	0- 0	2- 2	1- 1	15- 10	9- 8	26- 46	13- 2	0- 0	36- 28
Plecoptera										
Perlodidae	0- 0	0- 0	6- 3				3- 9		1- 2	1- 2
Diptera										
Tendipedidae	11- 4	24-61	1- 0		4-392	16-31	17- 45	6- 9	0- 0	6- 7
Simuliidae	0- 0	1- 5	0- 0	0- 3		0- 3	2- 13		0- 0	49- 2
Tipulidae	0- 0	5- 2	1- 0	0- 1	7- 3	0- 0	4- 3	2- 0	1- 0	4- 9
Rhagionidae	0- 0	0- 1	0- 0	1- 0		1- 0			0- 0	2- 0
Culicidae	0- 0	0- 0	0- 0		7- 0			0- 1	0- 0	0- 0
Musidae	0- 0	0- 0	0- 0		0- 3				0- 0	0- 0
Heptageniidae	0- 0	0- 0	0- 0		0- 38				0- 0	0- 0
Coleoptera										
Hydraenidae	0- 1	0- 0	1- 0	0- 1			0- 2	0- 1	0- 0	0- 0
Dytiscidae	0- 0	0- 0	0- 0	0- 2	4- 1		5- 10		0- 0	1- 0
Mollusca										
Ancylidae	0- 1	0- 1	0- 0			0- 1			0- 1	0- 1
Physidae	2- 0	0- 0	0- 0			1- 0			0- 1	0- 1
Hydrachnae										
Hydrachidae	0- 0	0- 2	0- 0		59			4- 3	0- 0	1- 0
Tricladida										
Planariidae	0- 1	0- 0	0- 0	0- 0	1- 0	0- 0	0- 1	0- 0	0- 0	0- 0
Sample Totals	197-924	48-137	957-778	227-1059	273-517	57-81	160-394	58-43	144-236	840-1162
Station Total	491	185	1735	1286	790	138	554	101	380	2002

armor this bank. Assistance was lent by the Department in the form of advice, manpower and the use of a dump truck to haul rock.

One of the Department's responsibilities under the fishing access agreement with Gail Burleigh on Big Spring Creek was the construction of a parking area for fishermen. This was accomplished prior to the opening of fishing season.

An erosion problem was caused on the Les Foreman property by construction of the intake canal for the lower hatchery. The Department recognized its responsibilities for the damage and riprapped the eroding bank.

Fishing access sites should be sought and purchased, especially on Spring Creek above the city of Lewistown. The effect of year-around fishing on the trout population should be calculated.

Warm Spring Creek - Warm Spring Creek is unique for the area. It begins on the north side of the Judith Mountains but is relatively small until it reaches about 8 miles from its junction with the Judith River. Here it passes through a spring which contributes about 125 cfs of 68° F. water. Temperatures in the low to mid-seventies are common in the lower reaches during the summer. The stream is stocked annually with rainbow trout as there is no reproduction, apparently due to the high water temperature.

Bottom fauna samples were taken on August 12 at six locations from the spring to near the mouth. Two one-square foot samples were taken from each station. The totals of these two samples are presented in Table 4. Fairly good numbers of organisms were found, with the abundance just below the spring, about double that of downstream stations. The complete lack of any organisms except Diptera and Mollusca at the upper bridge on the Denton highway is unexplained. No known sources of pollution exist in the area.

Past attempts to obtain fish population information from Warm Spring Creek by shocking have failed because of the extremely high conductivity of the water. This should be attempted again with the latest equipment. Through 1969, catchable rainbow trout were planted annually; subcatchables have been planted subsequently. The growth of these fish should be determined as well as the effect of this change in policy on the fishery. If an attractive fishery cannot be sustained with sub-catchable rainbow trout, a brown trout plant should be made. These fish were planted in 1953 and 1954, and residents report they grew well. There is an abundance of forage fish to serve as food for larger individuals. Another management alternative is the introduction of a warm water species such as smallmouth bass. A comprehensive survey must be made to determine the potential benefit and impact before an introduction is attempted.

Table 4. Total numbers of organisms taken in two one-square foot bottom samples from Warm Spring Creek, August 12, 1971.

Organisms	Spring	Old Wendt Ranch	Upper Denton Highway Bridge	B. Gremaux Ranch	Woodey's Bridge	M.Lucas' Bridge
Trichoptera						
Brachycentridae	60	32	0	13	164	34
Glossosomatidae	191	22	0	19	1	0
Hydropsychidae	165	225	0	207	10	85
Ephemeroptera						
Heptageniidae	12	3	0	14	71	112
Baetiscidae	5	21	0	3	62	8
Baetidae	0	0	0	2	2	3
Diptera						
Tendipedidae	43	11	7	26	30	23
Simuliidae	87	35	43	0	0	33
Tipulidae	3	0	0	0	0	0
Rhagionidae	9	2	0	4	2	0
Heleidae	2	0	0	0	0	0
Coleoptera						
Hydrophilidae	65	35	0	8	13	8
Dytiscidae	1	7	0	4	3	5
Mollusca						
Physidae	3	0	7	0	4	1
Planorbidae	0	0	1	1	0	2
Hydrachnae						
Hydrachnidae	2	0	0	0	0	0
Odonata						
Gomphidae	0	0	0	0	0	1
Hemiptera						
Corixidae	0	1	0	0	0	0
Plecoptera						
Perlidae	0	0	0	0	0	2
Totals	648	394	58	301	362	317

Judith River - Judith River drains a large portion of the northeast part of the Little Belt Mountains and flows northward to the Missouri River. It receives several tributaries along the way, including Big Spring and Warm Spring Creeks.

Two erosion study areas were established on the Lost Fork of the Judith River in November, 1968. The stream has many raw, eroding banks, of which the two study areas represented about 570 linear feet. Measurements made in August, 1971 indicate that over 175 cubic yards of material have been eroded from just these two areas since November of 1968. Additional silt is contributed to the stream from slopes overgrazed by cattle and from the road which crosses the stream many times and uses the streambed for a road in some places.

Invertebrate samples were collected from the lower Judith River at five stations located between the bridge on Highway 235 and its confluence with the Missouri River. Abundance of organisms was found to be low as compared to other streams in the area (Table 5). Summer water temperatures in the mid-seventies were measured.

The road up Lost Fork of the Judith River should be closed to all vehicular traffic as serious erosion problems are occurring. Fish population samples should be taken from the lower reaches of the Judith River.

Table 5. Total number of organisms taken in two one-square foot bottom samples from Judith River, August 27 to September 1, 1971.

Organisms	Denton Highway	W. Adams Ranch	J. Brooks Ranch	Denton-Winifred Road	Mouth
Trichoptera					
Brachycentridae	0	2	15	14	7
Hydropsychidae	1	34	68	108	13
Ephemeroptera					
Heptageniidae	84	12	19	19	10
Baetiscidae	59	8	9	0	12
Baetidae	4	31	6	1	21
Plecoptera					
Perlodidae	25	2	5	0	5
Perlidae	3	0	2	1	0
Diptera					
Tendipedidae	1	1	1	11	4
Simuliidae	4	2	1	31	7
Tipulidae	6	0	2	1	11
Rhagionidae	0	0	0	0	2
Coleoptera					
Hydraenidae	0	1	0	10	0
Dytiscidae	0	0	0	2	0
Total	187	93	128	198	92

Small Streams - The rotenone treatment of the approximately two miles of the North Fork of the Musselshell River presented an opportunity to study the re-invasion of the affected area by the upstream population of brook trout. Three shocking sections were established in the treated area and one immediately above. These were shocked immediately after treatment and again the following spring. Observations will be continued periodically until stable populations have again been achieved and a report prepared.

A portion of Little Rock Creek in Fergus County was shocked to determine its suitability for a brook trout plant.

Four sections of the South Fork of McDonald Creek in Fergus County were shocked to determine size and composition of this stream's fish population. A similar survey was made on one of its tributaries, Duncan Creek. Both contained few trout and numerous suckers.

Foot surveys were made of numerous small streams in the area.

LITERATURE CITED

Baldes, Richard. 1970. Inventory of Waters of Project Area. Montana Fish and Game Department. Job Completion Report, F-5-R-18. Job No. 1. 17pp.

Prepared by: Duane Phinney

William J. Hill

Date: February 15, 1973

Code numbers of waters referred to in this report are as follows:

14-3800
14-3760
14-5360
14-5680
14-7080
14-7320
14-7370
14-8000
14-8440
14-8540
16-0300
16-0310
16-1800
16-1820
16-2140
16-2580
16-3040
16-3920
16-4300
16-4464
16-7286

18-4620
18-6540
18-7750
18-7860
18-8380
18-8720
18-9440
18-9500
20-1500
20-2150
20-3500
20-4450
20-5150
20-7900
20-8300
20-8400
20-8500

MONTANA DEPARTMENT OF FISH AND GAME
FISHERIES DIVISION

JOB PROGRESS REPORT

State Montana

Project No. F-5-R-21 Title Central Montana Fisheries Study

Job No. I-b Title Fish Management Surveys

Period Covered July 1, 1971 to June 30, 1972

ABSTRACT

Tagging studies of northern pike were conducted at Pishkun Reservoir and Lake Frances. A population estimate of 2,086 adult northern pike was computed for Pishkun Reservoir. Voluntary angler returns of tagged fish indicate a harvest of 20.9 and 15.0 percent for Pishkun Reservoir and Lake Frances, respectively. Growth of northern pike is poor in Pishkun and good in Lake Frances. Additional information gathered on these lakes include water temperatures, tag loss, reproduction, success of introductions and sex ratios. Approximately 8 acres of marsh area and shoreline were fenced at Pishkun Reservoir to improve northern pike spawning habitat.

Several lots of marked fish were planted in Hauser and Holter Reservoirs to determine movement of fish in the reservoir system. Creel clerks were employed to check marked fish in the creel and also obtain catch statistics. Observations were made on water flows in the Missouri River below Holter Reservoir.

Background information and recommendations are discussed in the section on findings.

OBJECTIVES

To determine the biological aspects of the northern pike populations in relation to population size, growth, harvest, reproduction, water levels and angling restrictions. To determine information needed to formulate a management plan for Holter and Hauser Reservoirs.

PROCEDURES

Fish were collected using 4-foot by 6-foot frame net traps (1-inch and $\frac{1}{2}$-inch mesh) with 60-foot leads; 3-foot by 4-foot frame net traps ($\frac{1}{4}$-inch mesh) with 35-foot leads; 125-foot experimental gill nets and a 20-foot minnow seine. Measurements of fish include

total length to the nearest tenth of an inch and weights to the nearest hundredth of a pound. Scale samples were secured for age and growth studies. Northern pike were tagged. The right pelvic fin was clipped to facilitate an estimate of tag loss. Water temperatures were registered on a Taylor maximum-minimum thermometer.

FINDINGS

Pishkun Reservoir

History - Pishkun Reservoir is a 1,550 surface acre irrigation storage reservoir in Teton County and has a maximum depth of 80 feet. Fluctuations of 10-15 feet are experienced during the summer months as irrigation demand lowers the reservoir. In early spring, the reservoir is filled to capacity with water supplied by a canal from Diversion Dam on the Sun River.

Species of fish found in Pishkun Reservoir include northern pike, yellow perch, rainbow trout, kokanee and white sucker. Arctic grayling were planted in the reservoir in the past but haven't been taken in recent years, however, they are known to be present in the irrigation drops below Pishkun.

Trapping and Tagging Operations - Northern pike were captured on their spawning run from April 2, 1971 to May 3, 1971. A total of 1,466 northern pike were taken in frame net traps along with the following estimates of other species of fish: 1,980 white sucker; 580 yellow perch; and 19 rainbow trout.

Of 1,466 northern pike taken in 1971, 642 were marked and released, 287 were recaptures, 115 were immature and 422 were trapped and released without tagging. Of 642 northern pike marked, 559 (356 males, 203 females) were marked with a numbered T-tag and the right pelvic fin clipped. The remaining 83 fish (56 males, 27 females) marked represent fish tagged in 1970 and the first capture of these fish in 1971 represent a mark and subsequent captures count as recaptures. Of 287 recaptures, 248 were fish tagged in 1971 and 39 were fish tagged in 1970. Several recaptures of the same fish were recorded as follows: 1971 tagged fish - 195 taken one time; 46 two times; 6 three times and 1 four times. 1970 tagged fish - 32 taken one time; 5 two times and 2 three times.

Tag Loss - It is felt that with proper care in handling fish and inserting tags, the tag loss should be quite low using the T-tag and tagging gun. The present study indicates a loss of 2.41 percent based on 2 tag losses out of 83 fin clipped fish observed.

Sex Ratios - Of the mature fish sampled (16 inches and larger) males outnumbered females approximately two to one (Table 1). The sex ratio of fish returned to the anglers creel, however, is much higher. Females apparently are more vulnerable to hook and line than are males.

Table 1. Sex ratios of northern pike, Pishkun Reservoir, 1971.

Number	Male (%)	Female (%)	Sex Ratio (M:F)
559 tagged fish	63.7	36.3	100:57
422 untagged fish	65.4	34.6	100:53
83 recaptures (1970 tags)	67.5	32.5	100:48
1064 all fish	64.6	35.4	100:55
143 angler returns (tagged fish)	56.6	43.4	100:77

Population Estimate - The northern pike population in Pishkun Reservoir was estimated at 2,086 fish using the basic Schnabel method as described by Rounsefell and Everhart (1960). Data used includes the number of recaptured tagged fish in relation to untagged fish taken on respective trapping days and also the number of tagged fish at large that were unaccounted for (Table 2).

This estimate is based on mature fish only which includes age group II and older. The Schnabel estimate, using 629 marked fish at large, indicates that 30.2 percent of the fish in the population were tagged. This agrees very closely with angler caught fish in which 29.8 percent of all fish taken were tagged.

Harvest - Anglers voluntarily returned 117 tags from northern pike for a harvest of 20.9 percent. In addition, 27 tags were returned from fish tagged in 1970 for which the accumulative harvest now is 213 tags returned or 42.8 percent (Table 3).

Tag returns in 1971 (20.9%) are considerably lower than 1970 (35.7%). Possible explanations are: 1. The novelty of turning in a tag is wearing off. 2. Change in limit from 15 fish to 10 pounds. In May 1972, this limit will be further changed to be three fish. Trends in the harvest should be monitored to measure the effects of these changes.

Of 117 tags returned from fish tagged in 1971, 61 of these were males which represents 17.1 percent of all males tagged and 55 were females and accounts for 27.1 percent of all females tagged (one tag return was not differentiated as to sex).

Angler returns by month are shown in Table 4. June and July accounted for the greatest number of returns in both 1970 and 1971 and may reflect the time of year that most fishermen are out.

Table 2. Population estimate of northern pike in Pishkun Reservoir, 1971. (Schnabel method).

Time Interval (t)	Marked Fish at Large M(t)	Fish Captured C(t)	Marked Fish Recaptured R(t)	M(t-1)C(t)	M(t-1)C(t) R(t)	Cumulative E	Cumulative D	G/H
A	B	C	D	E	F	G	H	I
1	33							
2	74	42	1	1,386	1,386	1,386	1	1,386
3	101	27	0	1,998	0	3,384	1	3,384
4	139	40	2	4,040	2,020	7,424	3	2,475
5	180	43	2	5,977	2,989	13,401	5	2,680
6	228	51	3	9,180	3,060	22,581	8	2,823
7	259	33	2	7,524	3,762	30,105	10	3,011
8	334	80	5	20,720	4,144	50,825	15	3,388
9	386	64	12	21,736	1,811	72,561	27	2,687
10	446	82	22	31,652	1,439	104,213	49	2,127
11	615	222	53	99,012	1,868	203,225	102	1,992
12	629	237	68	145,755	2,143	348,980	170	2,053
13		397	117	249,713	2,134	598,693	287	2,086
			287	598,693	2,086			

Number of recaptures - 287
1.96 standard error is 33.2
Population at P of 0.05 is 2,086 (confidence limits: 1,813 to 2,359)

Table 3. Northern pike tag returns, Pishkun Reservoir, 1970-71.

Year	Number tagged	No. Returns (%)*by Year Tagged 1970	1971
1970	498	178(35.7)	
1971	559	35**(10.9)	117(20.9)
Totals***	1,057	213(42.8)	117(20.9)

* % return based on tagged fish left in population.

** Includes 27 tag returns plus 8 tag losses computed as follows:
498 original tagged fish
178 tags returned in 1970 leaving 320 tagged fish in spring of 1971.
Observed 2 tag losses out of 83 fin clipped fish;
therefore $\frac{2}{83} = \frac{X}{320}$ $X = 8$ (rounded)

*** Accumulative return based on original tagged population.

Table 4. Northern pike tag returns by month, Pishkun Reservoir, 1970-71.

Month	1970		1971*	
	No.	%	No.	%
May	17	9.5	18	12.5
June	83	46.6	72	50.0
July	53	29.8	27	18.7
August	11	6.2	20	13.9
September	2	1.1	6	4.2
October	-	-	-	-
November	3	1.7	-	-
December	-	-	1	0.7
January	3	1.7	-	-
February	6	3.4	-	-
Totals	178	100.0	144	100.0

* Includes 1970 tags taken in 1971.

Anglers were contacted as to the number of untagged fish they caught along with the tagged ones. Fishermen sampled for this type of information indicated they caught 164 northern pike, of which 49 were tagged, or 29.8 percent.

Age and Growth - Growth of northern pike is considered poor (Table 5). A total of 196 scale samples were analyzed with age groups I - VI represented. Twenty-two of the scale samples analyzed were immature fish in age groups I and II and their calculated lengths at each year of life are 6.9 and 12.2 inches, respectively.

The total length of mature males at capture averaged 19.8 inches (range 12.8-36.0) while females averaged 21.7 inches (range 13.5-43.5). Males and females were represented in age groups II through VI. One male (36.0 inches total length) and three females (35.5, 43.0 and 43.5 inches total length) were not aged due to difficulties in recognizing the outer annuli. Analysis of the scales indicates that the majority of the fish are 3 and 4 years old with 68.2 percent of the males and 71.5 percent of the females appearing in this category. Scale analysis in 1971 compares favorably with the 1970 data.

Table 5. Average calculated total lengths (TL) in inches of northern pike, Pishkun Reservoir, 1971. (Mature fish only).

Year	Age Group	Number M	Number F	Average TL at end of year of life 1 M	1 F	2 M	2 F	3 M	3 F	4 M	4 F	5 M	5 F	6 M	6 F
1969	II	8	10	8.3	8.4	15.2	15.2								
1968	III	38	28	6.3	6.0	12.7	12.9	18.4	19.3						
1967	IV	24	32	6.5	6.7	11.6	12.2	16.7	17.2	21.3	22.1				
1966	V	16	13	6.5	6.6	12.6	13.9	17.3	18.9	20.6	22.3	23.3	25.5		
1965	VI	4	1	7.2	5.3	12.4	9.8	17.1	14.0	21.2	18.5	23.4	22.4	25.6	25.7
1971		90	84 Averages	6.6	6.6	12.6	13.0	17.6	18.2	21.0	22.1	23.3	25.3	25.6	25.7
1970		90	75 Averages	6.7	6.8	12.6	13.9	17.7	18.9	20.9	22.6	23.8	27.7	26.2	32.9

Reproduction - On July 29, 1971, northern pike young-of-the-year averaged 3.8 inches total length and 4.4 per seine haul. Young fish were observed wherever vegetation served as hiding places.

In an effort to improve spawning habitat for northern pike, approximately 8 acres of marsh area and shoreline was fenced to eliminate cattle. The entire fenced area has a very gradual slope and is exposed during early summer from drawdown due to irrigation demand. Prior to being fenced, cattle would graze any vegetation that came up in the area after water levels receded. The vegetation comeback is considered very good for the first growing season and should provide suitable sustrate for the 1972 spawning.

Water Temperatures and Levels - During trapping operations water remperatures ranged from a low of 35°F. on April 5 to a high of 54°F. on April 28.

The reservoir began to fill approximately April 20 and reached capacity on May 15 (Figure 1). Irrigation demand pulled the reservoir to the minimum level on July 28. The reservoir fluctuation pattern shown in Figure 1 is typical of past years. Also, the reservoir is filling at the same time the northern pike are spawning and the level generally holds until the eggs are hatched.

Introductions - Kokanee were introduced into Pishkun Reservoir in the spring of 1970 and 1971. It is anticipated that they will occupy the deep areas of the lake not normally inhabited by northern pike. A few kokanee were taken during regular test netting surveys. In June 1971, the first plant averaged 7.1 inches total length and the same plant taken in February 1972 averaged 9.0 inches. Further netting surveys will determine the success of the introduction.

Summary - During the 1971 spawning run, a total of 559 northern pike were tagged and released. Tag returns total 117 or 20.9 percent. Tags were also returned for fish tagged in 1970 and the accumulative return for 2 years is now 42.8 percent. Females appear to be more easily caught than males, although females are outnumbered. The greatest number of tags are returned during June and July. Tag loss is considered quite low - 2.41 percent. The northern pike population was estimated at 2,086 fish and approximately 30 percent of the population is tagged. Analysis of 196 scale samples reveals age groups I through VI and poor growth. Reproduction is fair with 4.4 young-of-the-year taken per seine haul. Water temperatures ranged from 35°F. to 54°F. during the spawning period. The reservoir was filled to capacity on May 15. Kokanee introduced in 1970 averaged 9.0 inches total length in February 1972.

The northern pike population should continue to be monitered for trends in population size, harvest, growth, reproduction and water levels. Changes in angling regulations should be carefully watched and recommendations made whenever necessary.

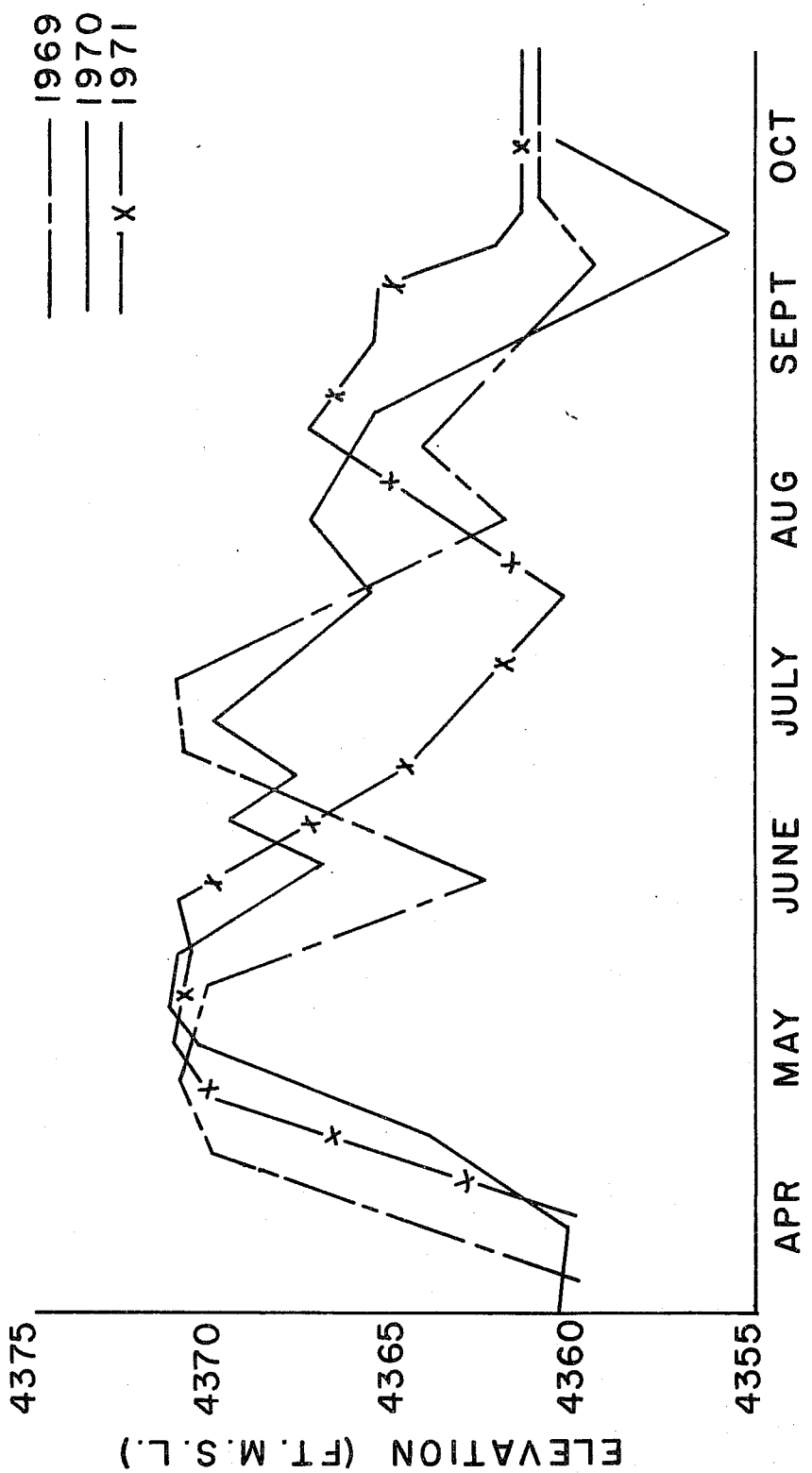

FIGURE 1. WATER LEVELS, PISHKUN RESERVOIR, 1969-1971.

Lake Frances

History - Lake Frances is a 5,536 surface acre irrigation storage reservoir in Pondera County with a maximum depth of 45 feet. Water is supplied by canal and diversions from Birch Creek and Dupuyer Creek. The reservoir fills in early spring and fluctuates approximately eight to ten feet due to summer irrigation demand. Fish present in the lake include northern pike, yellow perch, rainbow trout, walleye, kokanee, white sucker, longnose sucker and an occasional burbot.

Trapping and Tagging Operations - Northern pike on their spawning run were trapped between April 15 and May 4, 1971. Due to the slope of the shoreline only two traps could be fished successfully. A total of 173 adult northern pike (30 males, 143 females) were tagged and released and an additional 177 immatures were taken. Estimates of other species trapped include: 1,900 white and longnose sucker, 25 rainbow trout, 12 yellow perch, 11 walleye and 1 kokanee.

The data presented here does not give a complete picture since only two traps were fished and a major spawning area could exist in some other part of the lake. Plans for 1972 include trapping another area of the lake and possible use of a seine to obtain larger numbers of northern pike.

Sex Ratios - A very unusual male to female ratio of 100:478 was observed based on fish 16 inches and larger. This compares to 100:55 found at Pishkun Reservoir (see Table 1) and ratios of 100:60, 100:50 and 100:40 found for three North Dakota lakes (Hill, 1969). The sex ratio of fish returned to the creel, 100:550, shows females more vulnerable than males as was shown for Pishkun Reservoir (100:77).

Sex ratios will be observed again during 1972 trapping operations. Better results should be obtained if larger numbers of fish can be handled.

Harvest - A total of 26 tags have been returned for a harvest of 15.0 percent. Of the 26 tagged fish, 4 were males which accounts for 13.3 percent of all males tagged and 22 were females representing 15.4 percent of all females tagged. No definite conclusions can be made as to what time of the year would be best to fish for northern pike, but May and July accounted for the greatest number of returns.

Age and Growth - A total of 152 scale samples were analyzed for age and growth studies (Table 6) with age groups II through VII represented. Growth is good with approximately 11 inches being attained in the first year.

Table 6. Average calculated total lengths (TL) in inches of northern pike, Lake Frances, 1971. (Mature fish only).

Year	Age Group	Number M	Number F	Average TL at end of year of life 1 M	1 F	2 M	2 F	3 M	3 F	4 M	4 F	5 M	5 F	6 M	6 F	7 M	7 F
1969	II	12	31	11.9	11.4	17.4	17.5										
1968	III	8	37	9.1	8.2	17.3	17.6	22.3	22.7								
1967	IV	3	23	12.1	11.1	20.2	20.0	25.0	25.0	27.7	27.9						
1966	V	2	11	11.8	13.0	20.5	23.0	26.1	28.0	28.3	30.9	29.6	33.0				
1965	VI	1	5	13.2	15.0	22.4	25.8	26.9	31.6	28.9	34.5	30.0	36.6	30.9	38.1		
1964	VII	0	3	-	14.0	-	25.2	-	32.2	-	35.0	-	37.1	-	39.1	-	40.6
1971		26	110	11.1	10.7	18.1	19.2	23.8	25.0	28.1	30.0	29.7	34.6	30.9	38.5	-	40.6
1970*		52		10.4		18.9		24.7		27.3							

* Sexes combined.

The oldest male aged was 6 years and the oldest female was 7 years. Sixteen of the scale samples analyzed were immature fish (age group II) and their average total length at capture was 14.2 inches. Males averaged 21.5 inches total length (range 16.7-30.9) at capture and females averaged 24.1 inches (range 16.2-41.0).

Water Levels - Lake Frances water level operations and fluctuations (Figure 2) are similar to Pishkun Reservoir. The reservoir fills in early spring and recedes throughout the summer based on irrigation demand. The early spring rise facilitates northern pike spawning and hatching of eggs. In 1971, the reservoir began filling approximately April 18, was full by June 9, and then steadily declined to its low level on September 21.

Introductions - Walleye were first introduced into Lake Frances in the spring of 1969. Eleven of these were taken during trapping operations in the spring of 1971. These fish were 2 years old and averaged 10.7 inches total length. Larger numbers of walleye will probably be taken during spring trapping as they become mature (males generally at 3 and females at 4 years of age).

Another group of walleye were stocked in the spring of 1971. It is felt that if these plantings are successful, walleye should reproduce naturally since suitable spawning areas exist in the lake.

Kokanee - Kokanee are very little utilized throughout the year. The exception is in the fall when they congregate in the inlet canal below an irrigation drop. The run up the canal is dependent on the level of the lake and the amount of water flowing in the canal. In the fall of 1971, the lake was quite low and the inlet canal was shut off a number of times during the run. Consequently, few kokanee were taken during the 1971 snagging season. Based on voluntary creel census information, a total of 217 kokanee were snagged by 84 fishermen in 91 hours (Table 7). Table 7 shows the totals for the 1970 season to be considerably higher.

Summary - A total of 173 adult northern pike were tagged and released in the spring of 1971. First year returns (26) indicate a harvest of 15.0 percent. Females outnumbered males almost five to one. Northern pike show good growth with age groups II through VII represented. Water began filling the reservoir on April 18 and was filled by June 9. Walleye introduced in 1969 averaged 10.7 inches total length in April, 1971. During the snagging season 84 fishermen took 217 kokanee.

An estimate of the northern pike population wasn't made due to the low numbers of fish tagged and only two recaptures. An estimate will be made in 1972 if enough fish can be marked and recaptured. Other information to be obtained includes tag lossfrom fish marked in 1971, reproduction and temperatures during spawning. Additional data will be collected on sex ratios, harvest, age and growth and water levels. Survival of the walleye introductions will be determined.

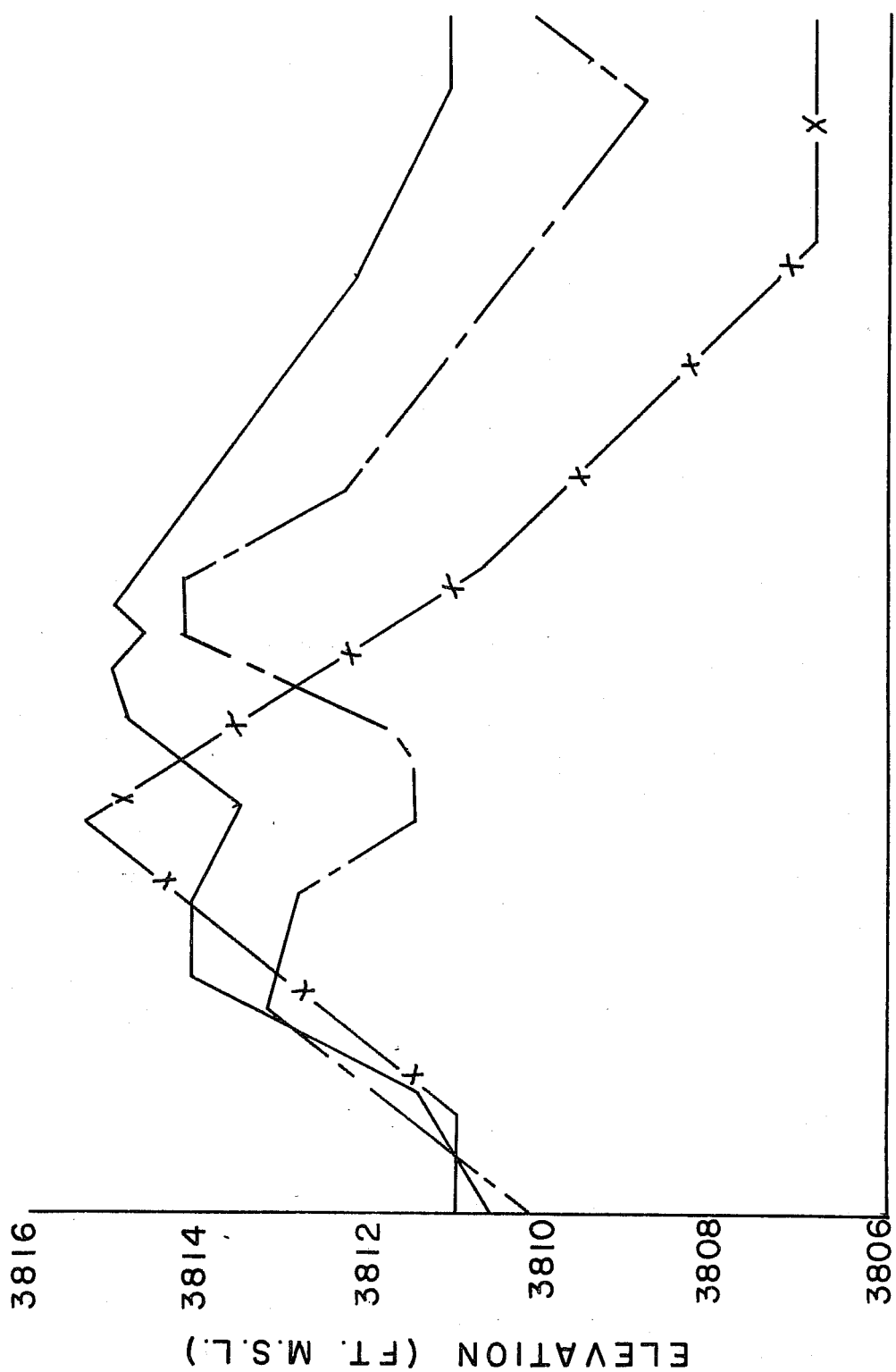

FIGURE 2. WATER LEVELS, LAKE FRANCES, 1969-1971.

Table 7. Numbers of kokanee taken during 1971 snagging season, Lake Frances. (Voluntary creel census).

Month	No. of Fishermen	Hours Fished	Fish Snagged	Hours/ Man	Fish/ Man	Fish/ Hour
Sept.	34	54.25	68	1.596	2.000	1.253
Oct.	50	37.00	149	0.740	2.980	4.027
Totals 1971	84	91.25	217	1.086	2.583	2.378
1970	263	354.20	1,561	1.347	5.935	4.407

FINDINGS

Hauser Reservoir, Holter Reservoir, Missouri River

History - Holter Reservoir and the Missouri River between Holter Dam and the town of Cascade are the two most important fishing waters in Region Four. The river portion in this area is the most heavily fished section of river in Montana, with slightly over 40,000 fisherman days per year, according to the 1965 pressure estimate.

Holter and Hauser Reservoirs are power producing reservoirs built by the Montana Power Company in the early 1900's. In addition to producing power, Holter is used to regulate flows in the Missouri River for five hydroelectric power generators at Great Falls.

Holter Reservoir is a 4,800 surface acre reservoir with a storage area of 240,000 acre feet. Water in the 24 mile long reservoir interchanges about 16 times in a normal year.

Hauser Reservoir is 3,800 surface acres in size and is about fifteen miles in length.

Recently the Department of Fish and Game has acquired and developed a number of fishing access sites along the river, improving access considerably. Private recreation development along the river is also increasing. A new interstate highway now parallels the river between Great Falls and Holter Reservoir, cutting the traveling time to fishing areas to less than one hour.

Access on Holter Reservoir has also improved greatly during the past two years. The Fish and Game Department has recently purchased the Beartooth Game Range, which puts an additional fifteen miles of the reservoir shoreline in public ownership. Several miles of this shoreline has good road access and, with some development for fishermen, will greatly enhance recreational use. The Bureau of Land Management is in the process of developing a large public campground with boat launching facilities. Three private marinas are operating on the reservoir and the number of private summer homes are increasing steadily.

Access along Hauser Reservoir is good. Much of the land is controlled by the Montana Power Company and is open to the public. There is one private marina and a number of unimproved campgrounds on the reservoir.

Very little data is available on the past history of the river or reservoir fishery. Kathrein (1950) completed an age and growth study on trout and suckers in the river. Some creel census and fish measurements are available, but information is limited.

Planting of the reservoirs has not been on any schedule until the last two years. Previously, plantings were made if and when fish were available. Size of the planted rainbow varied from 3 inches to catchable size. The Missouri River between Holter Reservoir and Cascade has received between 20,000 and 30,000 catchable rainbow per year.

Natural reproduction in both Holter and Hauser Reservoirs is limited. Several small streams enter the reservoirs but they are either dewatered part of the year or have a barrier of some type. There is approximately one mile of river above Holter Reservoir and no doubt some spawning takes place here.

Complaints of poor fishing in Holter Reservoir have been received at various times in the past. One complaint that has been consistant over the past few years is a decrease in size and number of rainbow spawning above the reservoir. Members of two Trout Unlimited Clubs have claimed that over-fishing has occurred on the rainbow spawning run out of Holter Reservoir and on the brown trout run in the river, especially at the mouth of Prickly Pear Creek.

Water fluctuations in the river below Holter Reservoir are severe at times. From September to December the fluctuation is approximately 5,000 cubic feet per second every twenty-four hours. What effect this has on the trout population, especially spawning brown trout and the insect population is unknown.

A limited study was started in 1969 to try to obtain enough data to formulate a management plan for Holter Reservoir and the Missouri River.

Marked Fish - Albino rainbow, tagged catchable rainbow trout and fin-clipped fingerling were planted in both Holter and Hauser Reservoirs to check on movement and growth in the reservoirs. Creel census clerks were employed during the summers of 1970 and 1971 to check for marked fish and to collect data on fisherman success.

In mid-July of 1969, about 2,000 seven to ten-inch albino rainbow trout were planted in Holter Reservoir approximately one mile above the dam. Water flows out of Holter Reservoir were running between thirteen to fifteen thousand second feet. The generators at Holter Reservoir can use approximately 7,000 cubic feet per second. Flows in excess of this go over the spillways.

Within three days after planting, reports of albinos being caught by fishermen in the Missouri River below Holter Reservoir were received. Albinos were common in the catch for approximately a month after planting, with the majority of the fish (85%) being taken in the river. The last report of an albino being caught was in February of 1970.

During 1970, both tagged and clipped rainbow trout were planted in Holter and Hauser Reservoirs. On April 27, 1970, 2,500 seven to nine-inch rainbow were planted at Gates of the Mountains boat dock near the upper end of Holter Reservoir. These fish were jaw-tagged with a green plastic bandette inscribed with a number 4. A similar number of fish, jaw-tagged with a green bandette inscribed with a number 8, were planted on May 5, 1970 at Indian Trail boat docks at the lower end of Holter Reservoir. Both of these plants were made before spring runoff.

After high water, on August 8, 1970, 5,175 seven to nine-inch rainbow were planted at the upper end of Hauser Reservoir, just below Canyon Ferry Dam. These fish were jaw-tagged with a blue plastic bandette inscribed with a number 4.

In addition to the above plants, approximately 195,000 six-inch rainbow were planted in Holter Reservoir on July 14, 1970. Of these, 47,000 were marked by removing the adipose fin.

On July 20, 1970, 185,000 six-inch rainbow were planted in Hauser Reservoir. The left pelvic fin was removed from 22,000 of these. Both of the plants of six-inch fish were made just after high water.

Jaw-tagged fish started showing up in the creel immediately after planting in both Holter Reservoir and in the river below. During May of 1970, water flows over the spillways at the dam were increasing. By June they had peaked at 17,000 cfs, dropping to 14,000 during early July, and back to normal (7,000 cfs) by mid-July. The catch of jaw-tagged fish in the river immediately below the dam followed this water pattern with more tagged fish being taken in this area than in the lake. This same pattern held true through August and then reversed, with the majority of fish being taken in the reservoir, Table 8.

Those tagged fish (green 8) planted in the lower end of Holter Reservoir showed up in the creel five times more frequently than the tagged fish (green 4) planted at the upper end. There were 518 green 8 tags returned, giving a 20 percent voluntary return on this plant by December 31, 1972. Two percent of the plant was caught in the reservoir above the planting site, 45 percent in the reservoir below the planting site and 53 percent in the river below the dam. Almost all the tagged fish caught in the river were taken within one mile of the dam.

Only 4 percent of the tagged fish planted in the upper end of Holter Reservoir were returned by fishermen. Of these, 45 percent were taken in the river below Holter and the remainder in the reservoir. There was also a tendency for these fish to move down the reservoir. Forty-five percent of those taken were caught in the lower end of the reservoir.

Table 8. Green No. 8 jaw tags returned from May, 1970 through December, 1972 and total tag returns for 1971 and 1972.

	Holter Reservoir	Missouri River
May*	11	5
June*	20	49
July*	14	98
August	9	30
September	30	11
October	24	11
November	20	7
December	12	2
Total	140	213
Tag Returns 1971	94	51
Tag Returns 1972	14	6
Total tag returns	248	270

* Denotes months water was being spilled from Holter Reservoir.

During 1970, 68 percent of the green 8 tags were returned with over half being returned during June, July and August, (Table 8). In 1971, 28 percent were returned with the remaining 4 percent returned during 1972.

There were 391 or 8 percent of tagged fish (blue 4) returned by fishermen. These fish were planted in the upper end of Hauser Reservoir just below Canyon Ferry Reservoir. The majority of these fish (65%) were caught in Hauser Reservoir, with half of the tag returns coming from the area where they were planted. Thirty-one percent of the tags were returned from the river immediately below Hauser Reservoir. Twelve tagged fish were caught in Holter Reservoir and four were taken in the Missouri River immediately below Holter. Fish from this plant stayed in the reservoir much better than those planted in Holter Reservoir.

The 6-inch adipose clipped rainbow trout planted in July of 1970 averaged 11.5 inches by late October, 1970, 12.8 inches by May of 1971 and 15.5 inches by September, 1971. During 1971 more of these fish (52%) were caught in the river immediately below Holter Reservoir than in the reservoir itself (Table 9).

Table 9. Adipose clipped trout observed in the creel during the summer of 1971.

	Holter Reservoir	Missouri R. Dam to Wolf Cr. Bridge	Missouri R. 1 Mile below Dam to Cascade
May	18	45	0
June	88	27	1
July	114	169	1
August	29	47	2
September	13	2	0
Total	262	290	4
Percent	47%	52%	1%

Very few of the fish marked with a left pelvic clip were reported. Creel census clerks did not work Hauser Reservoir and most fishermen probably were not observant enough to notice the fin clip.

Gill Netting Results - A series of eighteen overnight gill nets were set in Holter Reservoir in June of 1969. All but three of the nets were floating sets. Nine of the nets were set in the upper one-third of the reservoir and nine in the middle one-third of the reservoir.

A total of 782 fish were taken during this series; of these, 703 fish were taken in the middle one-third of the reservoir. Only one out of the 49 trout caught was taken in the upper one-third of the reservoir.

White and longnose suckers made up 80 percent of the catch, yellow perch 10 percent and trout, walleye and mountain whitefish 10 percent.

The average length of the 40 rainbow trout was 14.8 inches and 1.29 pounds. The nine brown trout averaged 18.8 inches and 2.89 pounds. The 21 walleye averaged 15.5 inches and 1.74 pounds and ranged from 11.1 inches to 26.0 inches.

On June 17 and 18, 1971, 13 surface sets and three bottom sets were made in the reservoir. Seven of the nets were in the upper one-third, four in the middle one-third and five in the lower one-third. Of the total catch, 56 percent was caught in the lower

one-third, 40 percent in the middle one-third, and 4 percent in the upper one-third of the reservoir. The five nets set in the lower one-third of the reservoir accounted for 88 percent of the trout catch. As in 1969, suckers and yellow perch made up the majority of the fish taken (83%), with rainbow trout, walleye, brown trout, and whitefish making up the remaining 17 percent. The 1970 plant of six-inch rainbow averaged 12.9 inches and 1.00 pounds.

During September 8 and 9, 1971, seventeen floating gill nets were set in Hauser Reservoir. Eight of the nets were set in the upper one-half of the reservoir and nine in the lower one-half of the reservoir. Coarse scale and longnose suckers made up 76 percent of the catch, trout (rainbow and brown) 17 percent, and yellow perch, walleye, whitefish and carp the remaining 7 percent.

Of the 57 rainbow trout caught from the 1970 plant, 46 of these were caught in the lower one-third of the reservoir. Rainbow from the 1971 plant were scattered throughout the reservoir but were more common in the upper one-half of the reservoir. The 1971 plant of rainbow were stocked between June 29 and July 8.

Rainbow from the 1970 plant averaged 14.2 inches and 1.15 pounds. The 1971 plant of rainbow averaged 8.9 inches and 0.29 pounds.

Creel Census - Creel census clerks were employed during the summer (June through August) of 1970 and 1971 to check fishermen on Holter Reservoir and the Missouri River between Holter Dam and Cascade. The primary objective of the clerks was to inspect as many fish as possible for fin clips and tags. In addition, the clerks recorded the number of fish caught, number of hours fished and location of the fishermen.

Table 10. Catch statistics for Holter Reservoir, 1970 and 1971.

Year	No. Fishermen Checked	Hours	Trout	Catch per Man Hour
1970	1,893	4,913	1,713	0.35
1971	1,537	6,150	1,755	0.29
		Missouri River		
1970	5,703	11,304	3,754	0.32
1971	2,151	6,393	2,260	0.35

During 1970 two census clerks were employed, and worked part-time during October and November. In 1971 only one clerk was employed until mid-September. This accounts for the larger number of fishermen checked in 1970 and is not an indication of change in fishing pressure (Table 10). The relatively low catch per hour is also somewhat misleading. During May and again in September and October, fishing is much better than indicated by the catch per man hour figure in Table 10.

Water fluctuations in the Missouri River below Holter Reservoir are drastic at times. From September through November, the river fluctuates generally between 4 to 6 thousand cfs every 24 hours. Low flows are from 1,000 to 1,500 cfs and the high flow is approximately 7,000 cfs. During December through February, the general pattern is to increase the low flows to 4 to 5 thousand cfs and maintain the high flow at about 7,000 cfs. Generally, during March and April, water flows increase to a high of 10,000 to 15,000 cfs and a low of 7,000 to 9,000 cfs. This increased flow is probably due to forecasts of runoff and is an attempt to lower Canyon Ferry Reservoir for flood control during June and July. During May, flows are somewhat stabilized and then increased during June and July, reaching a high of 15 to 20,000 cfs and a low of 9 to 10,000 cfs. During the latter part of July and August, water flows recede with the highs stabilizing at about 7,000 cfs and the lows dropping down to about 1,500 cfs by the first of September. This is only the general pattern and is greatly influenced by the runoff each year.

In general, though, the fall pattern is quite typical, with highs of about 7,000 cfs for 12 hours and then a quick reduction to between 1,000 and 1,5000 cfs for 12 hours. This pattern holds until about the first of December, when low flows are increased to 4 to 5,000 cfs.

Since most of these low flows occur at night, it is hard to get an idea of what the river looks like at these low flows. In an effort to observe the trout habitat during low flows, the Montana Power Company agreed to lower flows to 3,000 cfs, 2,000 cfs and 1,000 cfs. T he first two flows were for 24 hour periods and the latter for just a few hours.

Photos, both from a helicopter and the ground were made at various places to document flows. At flows of 3,000 cfs and below, many channels between islands were dry. In other areas water was pulled away from the brush vegetation, reducing habitat considerably. In several places fish were stranded on bars and islands. Numerous sculpins and young-of-the-year trout were found. Insect life was probably affected more drastically than anything.

Water releases from Canyon Ferry seem to be the major factor regulating fish movement in the reservoir. There is a noticeable current in both Holter and Hauser Reservoirs during the time Canyon Ferry is releasing over 10,000 cfs. This seems to trigger movement of fish down the reservoir and into the river below.

Based on the tagging data, it is estimated that about half of the planted trout leave the reservoirs each year during the time spilling occurs. In the past, fish planting usually occurred during this period. Many newly planted fingerling would be flushed through the reservoir and become unavailable to the fishery in the reservoir. They probably contribute little to the river fishery below the reservoir until the following year. Natural mortality would limit the number of these fish growing into the catchable range by the next year.

It is recommended that future planting be made after high water, usually after mid-July. Fish growth in the reservoir is considerably faster than in the river.

If six inch rainbow are planted about mid-July, they start entering the catch in the reservoir by late fall. By the following spring they are making a substantial portion of the fishery. During high water the year after they are planted, those that are flushed through the reservoir make up a substantial portion of the catch in the river just below the dam.

LITERATURE CITED

Rounsefell, George A. and Harry W. Everhart. 1960. Fishery Science, Its Methods and Applications. John Wiley and Sons, Inc., New York. pp 91-93

Hill, William J. 1969. Fish Tagging Studies. North Dakota Progress Report. Project F-2-R-16. Job No. 9.

Kathrein. 1950. Growth rate of four species of fish in a section of the Missouri River between Holter Dam and Cascade, Montana. Trans. Am. Fish. Soc., Vol. 80 (1950) pp 93-98.

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Date: May 24, 1973

Code numbers of waters referred to in this report are as follows:

20-7950
17-4896
17-9056
17-9136
14-7440