MONTANA FISH AND GAME DEPARTMENT
FISHERIES DIVISION

JOB PROGRESS REPORT

State Montana

Project No. F-5-R-20 Title Central Montana Fisheries Study

Job No. I-b Title Fish Management Surveys

Period Covered July 1, 1970 to June 30, 1971

ABSTRACT

Fish management surveys were conducted on Pishkun Reservoir and Lake Frances. A tagging study of northern pike was initiated in Pishkun Reservoir to determine approximate population size, angler harvest and age and growth. Other information obtained includes data on water temperature, reproduction and spearing. General physical and biological data was collected on Lake Frances along with attempts to determine the success of a walleye introduction and the location and distribution of kokanee.

The North and South Forks of the Musselshell River were surveyed. Upper and lower sections of both streams were electrofished and population estimates made. Thermographs were located on both streams, condition of the habitat was evaluated and invertebrate samples were collected. Tributaries of both streams were electrofished to determine size and abundance of species present.

Background information and recommendations are presented with the findings.

OBJECTIVES

To obtain information needed for fisheries management and information on the success of various management procedures.

PROCEDURES

Fish were collected using 4-foot by 6-foot frame nets (1-inch and $\frac{1}{2}$-inch mesh) with 60-foot leads; 3-foot by 4-foot frame nets ($\frac{1}{4}$-inch mesh) with 35-foot leads, 125-foot experimental gill nets; and a 300-volt DC shocker. Northern pike were tagged with a Floy tagging gun using a T-tag and the left pelvic fin was clipped to help determine tag loss in future years. Scale samples were secured from a representative number of fish. Fish measure-

ments included total length to the nearest tenth of an inch and weights to the nearest hundredth of a pound. Water temperatures were recorded on Taylor thermographs.

FINDINGS

Pishkun Reservoir

Pishkun Reservoir is a 1,550 surface acre irrigation storage reservoir in Teton County with a maximum depth of 80 feet. The reservoir consists of an east and west lake connected by a channel. The east lake is largest and also has the greatest depth. Water is supplied by a canal from Diversion Dam on the Sun River. Fluctuations of 10-15 feet are not unusual throughout the summer months as irrigation demand lowers the reservoir. The reservoir is filled to capacity during early spring, generally in April and May.

Pishkun Reservoir had a history of being a very good trout lake until northern pike were illegally introduced sometime in the 1950's. A few trout still enter the reservoir through the diversion canal and provide a limited fishery. Other species found in the reservoir include yellow perch and white sucker. Grayling have been planted in the past but none were taken during the present study; however, they are caught in the fall of the year in the irrigation canals approximately 30-40 miles downstream from Pishkun Reservoir. Kokanee were introduced in May, 1970.

Trapping and Tagging Operations

Frame net traps were used from April 9, 1970 to May 5, 1970 to capture northern pike on their spawning run. A total of 519 northern pike were taken during this period, of which 498 were classified as mature fish and the remaining 21 as immature fish. Other fish taken in the traps in decreasing order of abundance include white sucker, yellow perch and rainbow trout.

Traps were checked every other day and the northern pike were separated by sex and maturity. Mature fish were then measured, tagged, fin clipped and scales taken from a representative sample. A total of 498 northern pike (311 males and 187 females) were tagged and released (Table 1). The males averaged 20.7 inches total length (range 16.1-28.3) while the females averaged 21.7 inches (range 16.8-39.5). Immatures averaged 10.7 inches (range 4.1-15.8). Immature fish were not tagged.

Table 1. Number of northern pike tagged per inch group and number of tags returned in Pishkun Reservoir, 1970. (Mature fish only).

Inch Group	Number per inch group Male	Female	Total
16.0 - 16.9	13	2	15
17.0 - 17.9	15	4	19
18.0 - 18.9	37	15	52
19.0 - 19.9	44	23	67
20.0 - 20.9	64	23	87
21.0 - 21.9	54	38	92
22.0 - 22.9	42	32	74
23.0 - 23.9	26	30	56
24.0 - 24.9	11	7	18
25.0 - 25.9	2	5	7
26.0 - 26.9	1	1	2
27.0 - 27.9	1	2	3
28.0 - 28.9	1	1	2
35.0 - 35.9		1	1
38.0 - 38.9		1	1
39.0 - 39.9		2	2
No. tagged	311	187	498
No. returned	92	83	178*
% return	29.6	44.4	35.7

* 3 tags returned with no sex differentiation

Angler Harvest

Anglers returned 178 tags during the study period for a return of 35.7 percent (Table 1). This is one of the highest returns known for northern pike for any one year. Ridenhour (1957) reported 33.5 percent return in Clear Lake, Iowa, and Duerre (1966) reported 48.4 percent return in Jamestown Reservoir, North Dakota. Of the tags returned, 92 were males and they account for 29.6 percent of all males tagged, while 83 were females and they represent 44.4 percent of all females tagged. Table 2 breaks down the returns by month, with June and July accounting for the majority of the tags returned. This undoubtedly also reflects the time of the year that the greatest number of fishermen are out.

Table 2. Angler returns of tagged northern pike, Pishkun Reservoir, May, 1970 - February, 1971.

Month	Male		Female		Combined	
	No.	%	No.	%	No.	%
May	7	7.6	10	12.1	17	9.6
June	42	45.7	41	49.4	83	46.6
July	32	34.8	18	21.7	53*	29.8
August	7	7.6	4	4.8	11	6.2
September	0	0.0	2	2.4	2	1.1
October	0	0.0	0	0.0	0	0.0
November	1	1.1	2	2.4	3	1.7
December	0	0.0	0	0.0	0	0.0
January	1	1.1	2	2.4	3	1.7
February	2	2.2	4	4.8	6	3.4
Totals	92		83		178*	

* 3 tags returned with no sex differentiation.

Tag returns are voluntary; however, articles appeared in local newspapers and tagging information signs are strategically posted around the reservoir requesting anglers to turn in tags. It would be difficult to estimate how many tags removed from fish were not turned in.

Whenever possible, anglers were contacted as to the number of untagged fish they caught along with the tagged ones. From this source of information, a total of 256 northern pike were taken, of which 68 were tagged, or 26.6 percent.

Population Estimate

The basic Schnabel method as described by Rounsefell and Everhart (1960) was used to estimate the northern pike population in Pishkun Reservoir. Data compiled 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 3). From this information, a population estimate of 1,645 northern pike was calculated. The Schnabel estimate, based on 428 tagged fish, indicates 27.9 percent of the fish were tagged. Of 256 angler caught fish, 68 or 26.6 percent were tagged.

Table 3. Population estimates of northern pike in Pishkun Reservoir, 1970. (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)	Cum. E	Cum. D	G/H
A	B	C	D	E	F	G	H	I
1	134							
2	203	78	1	10,452	10,452	10,452	1	10,452
3	231	42	9	8,526	947	18,978	10	1,897
4	361	157	17	36,267	2,133	55,245	27	2,046
5	428	93	22	30,573	1,389	85,818	49	1,751
6		130	37	55,640	1,504	141,458	86	1,645
			86	141,458	1,645			

Number of recaptures is 86 + 9.274
1.96 standard error is 18.2
Population at P of 0.05 is 1,645 (confidence limits 1,204 to 2,086)

These estimates indicate approximately one northern pike per surface acre of water, based on the reservoir size of 1,550 acres. Actually, the northern pike habitat is much less than this, about 500 acres is considered good habitat. The rest of the water area is too deep for normal pike inhabitation.

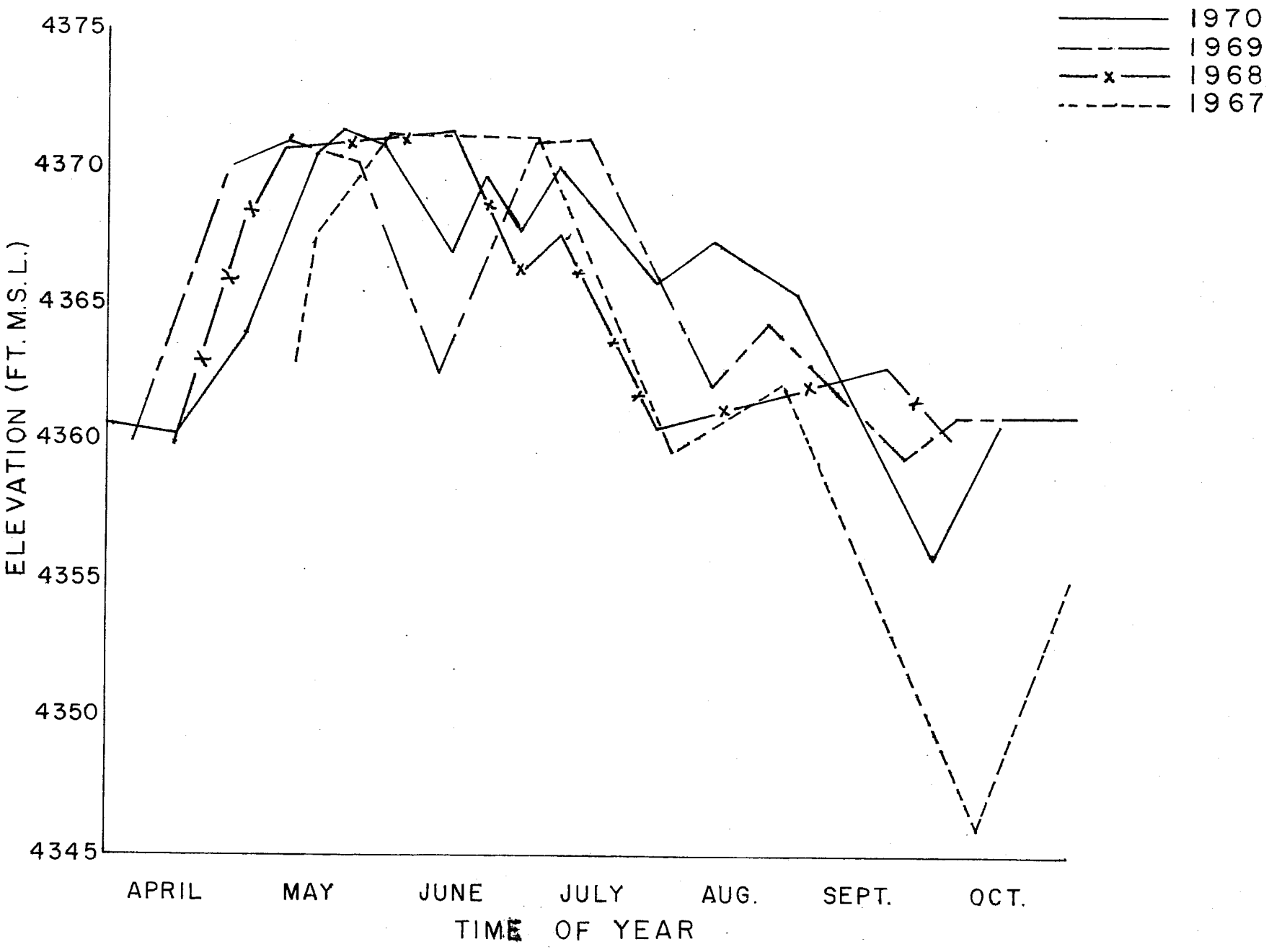
Temperature and Water Levels

Temperatures were recorded from April 22 to May 19 with a maximum of 61° F. experienced on May 17 and a minimum of 37° F. on April 29.

The supply canal to Pishkun Reservoir generally begins to flow around the middle of April and fills the reservoir to capacity (elevation 4,371 feet msl) by the middle or end of May. When trapping began on April 9, 1970, the reservoir was at elevation 4,360.4 (Figure 1). Maximum elevation of 4,371.1 was reached May 20, 1970 and the minimum September 29, 1970. This pattern is typical of preceding water years as noticed in Figure 1.

It is felt that the increasing water levels at this time of year corresponds with spawning of northern pike, and the levels hold long enough to permit successful hatching of eggs and development of fry. Throughout the summer and fall, water levels recede due to irrigation demand. Spawning areas are exposed and terrestrial and semi-aquatic vegetation starts to grow.

FIG. 1. WATER LEVELS - PISHKUN RESERVOIR, 1967 - 1970.



This seems to be desirable, however, livestock around the reservoir graze and trample any vegetation that comes up. Agreements have been reached with the Greenfields Irrigation District to fence a potential northern pike spawning area, thus keeping livestock out and allowing the vegetation to come back.

Age and Growth

A total of 165 scale samples from northern pike were analyzed for age and growth studies (Table 3). Growth is considered below average when compared to surrounding areas. The oldest male taken was six years old (28.3 inches at capture) while the oldest female was eight years old (39.5 inches at capture). Of the scales analyzed, 53.3 percent of the males and 64.0 percent of the females were classified as four year old fish. Of the scales taken during the study period (April 9 to May 5), 24.4 percent of the males and 26.7 percent of the females had already laid down a new annulus. Additional scale samples from 21 immature fish were analyzed and found to represent age groups I through III. Age group I averaged 6.1, age group II - 10.6, and age group III - 15.2 inches.

Reproduction

Young-of-the-year northern pike averaged 4.1 inches total length on July 17, 1970. Reproduction is rated average as fingerling pike were observed to be quite numerous wherever vegetation was present along the shoreline. Young-of-the-year yellow perch and white sucker were also found in good numbers and should serve as forage for pike.

Test Netting Surveys

Three gill nets were fished on July 17, 1970 and captured 10 northern pike, 61 yellow perch and 13 white sucker. Average lengths (inches) and weights (pounds) respectively are as follows: Northern pike - 19.7, 1.99; yellow perch - 6.3, 0.14; and white sucker - 18.4, 2.80.

Spearing

In 1969, legislation was passed allowing the Fish and Game Commission to set open seasons in certain waters for taking northern pike, walleye, sauger and rough fish by spear or gig. This season runs from December 15 through March 31. The sport is new to most fishermen but is rapidly gaining in popularity. A dark house is used to spear from and a decoy is placed in the water to attract the fish. Attempts were made to contact spearfishermen and determine their success in Pishkun Reservoir. Few spearers were contacted and their success rated from poor to fair.

Table 4. Average calculated total length (TL) in inches of northern pike in Pishkun Reservoir, 1970. (Mature fish only).

Year	Age Group	Number M	Number F	Avg. TL at Capture M	Avg. TL at Capture 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	8 M
1967	III	15	15	17.0	18.6	7.1	7.0	12.2	13.2	16.9	18.3									
1966	IV	48	48	20.5	22.2	6.7	6.6	12.9	14.1	17.5	18.8	20.3	22.0							
1965	V	25	6	23.8	25.1	6.2	6.0	12.3	12.2	18.7	18.2	21.9	22.6	23.7	25.1					
1964	VI	2	3	26.2	30.5	7.7	7.2	13.5	14.0	18.3	20.1	22.1	25.2	24.7	28.0	26.2	30.5			
1963	VII	--	1	--	38.5	--	12.3	--	23.4	--	28.7	--	31.7	--	34.3	--	36.3	--	38.5	
1962	VIII	--	2	--	39.3	--	8.0	--	14.0	--	20.4	--	26.5	--	31.9	--	34.8	--	37.3	--39.
Averages		90	75			6.7	6.8	12.6	13.9	17.7	18.9	20.9	22.6	23.8	27.7	26.2	32.9	--	37.7	--39.
Average increments						6.7	6.8	5.9	7.1	5.1	5.0	3.2	3.7	2.9	5.1	2.4	5.2	--	4.8	-- 1.

Summary

A total of 498 northern pike were tagged in Pishkun Reservoir during April and May of 1970. Anglers returned 178 tags for a return of 35.7 percent. A population estimate of 1,645 northern pike was made using the Schnabel method. Temperatures ranged from 37° F. to 61° F. during the study period. Water levels reached their maximum on May 20, 1970 and held long enough to insure hatching and development of eggs and fry. A total of 186 northern pike scales were analyzed and were found to represent age groups I through VIII. Reproduction of northern pike was rated fair. Few spearers were contacted and they reported limited success.

Similar investigations in the future should emphasize monitering trends in the northern pike population. Approximately 500 fish will be tagged each year and angler harvest will be determined along with changes in the age and growth structure, population size, water levels, reproduction, etc.

Lake Frances

Lake Frances is a 5,536 surface acre irrigation storage reservoir in Pondera County. Maximum depth is approximately 45 feet, with water being supplied by canal from Birch Creek and Dupuyer Creek. Water levels are lowered 8-10 feet throughout the course of the irrigation season.

Lake Frances has a history similar to Pishkun Reservoir in that it produced good trout fishing until northern pike were illegally introduced in the late 1950's. Planting of rainbow trout was discontinued in 1964 when it was evident that northern pike were established in the lake. Rainbow trout are still caught occasionally and presumably enter the lake via the inlet canal. Other species present in the lake include yellow perch, white and longnose sucker and kokanee. Kokanee fry are stocked annually each spring. Walleye fry were introduced in May of 1969.

Netting Surveys

Gill nets (surface and bottom sets) and frame net traps were fished to determine species composition and relative abundance. Species taken in decreasing order of abundance include: white sucker, yellow perch, northern pike, longnose sucker, rainbow trout and kokanee (Table 5). Various aspects were investigated for the above mentioned species and will be discusses individually.

White and Longnose Sucker

Periodic requests are received from sportsmen and the people of Valier to remove suckers from Lake Frances. In the spring, the inlet canal is filled with suckers and the general consensus is to remove these fish and solve the problem. Frame net traps were fished in the reservoir to determine how many suckers were spawning in the lake at the same time large numbers were in the inlet canal. On May 7-8, 1970, a total of 700 suckers were taken in 3 traps, and on May 19-20, 1970, 374 suckers were taken in 6 traps. It is felt that removal of suckers from the inlet canal wouldn't decrease the population significantly, since large numbers are also present in the lake at the same time.

Table 5. Gill net and frame net trap catch data for Lake Frances, 1970.

Type of Gear	No. of Nets	Species	No.	Ave. Length (Range)	Ave. Weight (Range)
Surface gill	4	NP	3	23.9(20.6-27.9)	4.04(1.98-7.25
		KOK	1	12.4	0.68
Sinking gill	15	CSu	219	15.5(8.0-17.8)	1.71(0.23-2.50)
		YP	197	7.2(5.3-11.4)	0.20(0.07-0.68)
		NP	51	17.5(11.0-28.8)	1.63(0.26-7.50)
		FSu	18	14.4(11.1-17.4)	1.09(0.57-1.77)
		KOK	9	14.4(11.4-16.1)	1.09(0.52-1.80)
1" Trap	5	CSu	818		
		NP	40		
		Rb	10	19.7(18.1-20.8)	3.29(2.73-4.12)
		FSu	5		
½" Trap	4	CSu	251		
		Rb	9	20.3(19.1-21.5)	3.01(2.55-3.78)
		YP	2		
¼" Trap	2	NP	4	Young-of-the-year	
		YP	2	Young-of-the-year	

Species abbreviations: NP-northern pike; KOK-kokanee; CSu-white sucker; YP-yellow perch; FSu-longnose sucker; Rb-rainbow trout

Northern Pike

Attempts were made in May to capture northern pike on their spawning run for purposes of tagging and also to gather age and growth data. Due to greater efforts spent at Pishkun Reservoir, the spawning run was almost over at Lake Frances when this survey was made and no fish were tagged.

A total of 52 scale samples were analyzed for age and growth and were found to represent age groups I through IV (Table 6). No differentiation was made to sex. Growth rate is good and considerably better than Pishkun Reservoir.

Yellow perch

Yellow perch were collected during test netting surveys conducted throughout the summer. Forty-two scale samples were secured and analyzed and they represent age groups II through VII (Table 6). Growth is poor when compared to surrounding areas.

Rainbow trout

Rainbow trout were taken incidentally during netting surveys and no specific data was gathered other than lengths and weights as presented in Table 5.

Table 6. Average calculated total length (TL) in inches of northern pike and yellow perch in Lake Frances, 1970.

	Year	Age Group	No.	Average TL at end of year of life						
				I	2	3	4	5	6	7
N. pike	1969	I	16	10.8						
	1968	II	18	8.3	17.1					
	1967	III	9	11.4	19.6	23.8				
	1966	IV	9	12.6	21.8	25.5	27.3			
	Averages		52	10.4	18.9	24.7	27.3			
Y. perch										
	1968	II	1	1.6	4.2					
	1967	III	21	1.5	3.5	5.4				
	1966	IV	11	1.5	3.6	5.7	6.9			
	1965	V	7	1.9	3.6	6.0	7.6	8.7		
	1964	VI	1	2.1	3.4	5.0	7.2	8.9	10.1	
	1963	VII	1	2.3	3.4	4.7	7.0	9.3	10.7	11.1
	Averages		42	1.6	3.6	5.6	7.2	8.8	10.4	11.1

Kokanee

Attempts were made to determine the summer location and distribution of kokanee. Gill nets were set on the bottom and at the surface in and over depths ranging from 15 to 43 feet. A total of nine kokanee were taken in bottom nets while only one was taken at the surface. Temperatures ranged from 72°F. at the surface to 62° F. at the bottom. Dissolved oxygen exceeded 10 ppm at all depths and secchi disk readings ranged from 5 to 7 feet.

In the fall, kokanee run up the inlet canal and congregate below an irrigation drop. This is probably the only area that fishermen harvest kokanee to any extent since they can be snagged at this time of year. A voluntary creel census box was placed at the irrigation drop asking fishermen to record hours fished and numbers of fish snagged. During the 1970 snagging season, 263 fishermen took 1,561 kokanee in 354 hours (Table 7).

Table 7. Numbers of kokanee taken during the 1970 snagging season, Lake Frances. (Voluntary creel census).

Month	No. Fishermen	Hours Fished	Fish Snagged	Hrs./Man	Fish/Man	Fish/Hr.
Sept.	120	157.7	1,111	1.3	9.3	7.1
Oct.	106	147.7	374	1.4	3.5	2.5
Nov.	37	48.7	76	1.3	2.1	1.6
Totals	263	354.2	1,561	1.3	5.9	4.4

A total of 172 kokanee were weighed and measured at the irrigation drop: 66 males ranged from 12.6 to 17.1 inches in total length (average 15.6) and 0.60 to 1.34 pounds (average 1.10), while 106 females ranged from 12.3 to 16.5 inches (average 15.2) and 0.58 to 1.30 pounds (average 1.05).

Walleye

A total of 500,000 walleye fry were introduced into Lake Frances in May of 1969. Survival of this stocking is undetermined as yet, since none were taken during regular netting surveys.

Summary

Test netting surveys were conducted throughout the summer of 1970 in Lake Frances. It was determined that suckers spawn in the lake at the same time as in the inlet canal. General biological data was collected on all species including age and growth information on northern pike and yellow perch. No concentrations of kokanee could be found in relation to depth, temperature or dissolved oxygen. Based on a voluntary creel census, fishermen snagged 1,561 kokanee during September, October and November. Walleye introduced in 1969 have not been taken in any type of netting gear to date.

Future surveys will include tagging northern pike along with harvest, age and growth information, reproduction and

population size. Additional data is needed on the summer distribution of kokanee as well as the harvest by snagging. Further attempts will be made to determine the survival of the walleye introduction.

Data collected on Hauser Reservoir, Holter Reservoir and the Missouri River during this reporting period will be included in Job Progress Report F-5-R-21, Job I-b.

South Fork of the Musselshell River

The South Fork of the Musselshell River is a small stream arising in the Crazy Mountains of central Montana. It receives numerous small tributaries draining the Castle and Crazy Mountains before reaching its confluence with the North Fork near the town of Martinsdale and flowing east and north to the Missouri River. It has long enjoyed a reputation among local residents of good trout fishing, although fishing pressure is light. The stream is also important locally as a supply of irrigation water. A short distance above Martinsdale, a headgate diverts water from the South Fork through a 408 cfs capacity canal for irrigation and storage in Martinsdale Reservoir. During much of the summer, the stream is completely de-watered below this point.

Survey Work

An upper section of the stream, approximately three miles below Lennep, was electrofished in August, 1970. Brook trout were the predominant species present; rainbow were abundant and a few brown trout and white and longnose suckers were captured. Number and average size are given in Table 8.

Table 8. Species, number, average length and weight of fishes electrofished from the South Fork of the Musselshell River near Lennep in 1970.

Species	Number	Avg. Length(in.)	Ave. Weight(lbs.)
Brook trout	92	8.1	.25
Rainbow trout	66	7.3	.24
Brown trout	6	12.5	.95
White sucker	5	8.0	.22
Longnose sucker	5	9.2	.42

A section (4,668 feet in length), approximately three miles above the town of Martinsdale, was electrofished and a population estimate made (Table 9). Ninety-six percent of the trout caught were browns, with the remainder being rainbow. Both

white and longnose suckers were also taken. In contrast to the upper section, no brook trout were taken.

Table 9. Population estimate, 95% confidence limits, species, average length and weight of fishes electrofished from the South Fork of the Musselshell River above Martinsdale in 1970.

	Ave. Length(in.)	Ave. Weight(lbs.)
Brown trout	11.3	.70
Rainbow trout	11.3	.65
White sucker	14.8	1.36
Longnose sucker	14.5	1.26

All trout

Total per section	690
95% confidence limits	528 - 852
Number per acre	172

Habitat on the South Fork is good although there has been some channelization in the Lennep area. For the most part, there is sufficient brush cover along the streambank and streambed, silt is heavy only for a short distance above Martinsdale. The influence of the North Fork diversion canal (105 cfs capacity) causes problems here, due to the silt load it often carries. There are some banks which are eroding and causing cottonwood trees to fall, changing the patterns of flow in the lower section.

Two bottom fauna samples were taken from the upper and lower sections of the stream. Invertebrates were most abundant at the lower section. Caddis flies were the predominant organisms from both sections (Table 10).

A thermograph was located on the Galt Ranch about three miles above Martinsdale (Sec. 17, T8N, R11E) from July 8 through October 31, 1970. Temperature extremes were 35° F. and 69° F.

According to USGS records, the 1968 average flow from the South Fork above Martinsdale was 89 cfs, with extremes of 840 cfs and 14 cfs. For the water year 1969, the average flow was 62.4 cfs, with extremes of 313 and 10 cfs.

Table 10. Number of organisms taken from two square foot bottom samples from upper and lower sections of the North and South Forks of the Musselshell River, August, 1970.

Invertebrates	North Fork		South Fork	
	Upper	Lower	Upper	Lower
Trichoptera				
Brachycentridae	5	133	158	338
Leptoceridae	--	1	--	6
Glossosomatidae	--	1	18	62
Hydrosychidae	1	13	--	28
Limnephilidae	--	--	--	5
Ephemeroptera	51	18	9	76
Plecoptera	7	--	6	75
Diptera				
Tendipedidae	33	22	6	27
Simulidae	67	--	--	13
Tipulidae	--	--	--	4
Unknown	--	10	--	--
Coleoptera	8	--	54	113
Mollusca				
Physidae	--	2	--	--
Total number	172	200	251	747

Tributaries

A 332-foot section of Cottonwood Creek was electrofished in August. The section is located five miles upstream on the Martinsdale - Lennep highway. Fish present were predominantly brook trout, but rainbow and brown trout were also taken (Table 11). Portions of the stream are dried up every summer and fall by water users above the Martinsdale highway.

Three hundred feet of stream were electrofished on Alabaugh Creek, approximately four miles above Lennep. Nearly all the fish taken were brook trout (Table 11).

A short section (275 feet) was electrofished on Bozeman Fork Creek approximately seven miles above Lennep on the Orville Rostad Ranch. Brook trout were the most abundant species present but rainbow were also taken (Table 11).

A 300-foot section of Warm Springs Creek, approximately nine miles above Lennep, was electrofished. Small brook trout were the only species of trout taken, (Table 11).

Table 11. Species, number, average length and weight of trout electrofished from tributaries of South Fork of the Musselshell River, 1970.

	Length Shocked(ft.)	Number of Fish	Average Length(in.)	Average Weight(lbs.)
Cottonwood Creek	332			
Brook trout		82	6.1	.11
Rainbow trout		25	7.4	.25
Brown trout		12	7.3	.26
Sculpins		Numerous	--	--
Alabaugh Creek	300			
Brook trout		67	6.7	.09
Rainbow trout		3	5.1	.06
Sculpins		Abundant	--	--
Bozeman Creek	275			
Brook trout		45	6.2	.14
Rainbow trout		17	5.7	.08
Sculpins		Common	--	--
Warm Springs Creek	300			
Brook trout		118	5.4	.08
Sculpins		Numerous	--	--

The South Fork of the Musselshell should not be stocked with any fish, as it contains an adequate wild trout population in the portion that is not de-watered. A creel census should be conducted to determine success of fishermen, most popular areas fished, and species of fish most abundant in the creel.

An attempt should be made to curb the State Water Board's practice of completely de-watering the stream near Martinsdale. The stream is dried up every year below the headgate that carries water from the South Fork to Martinsdale Reservoir.

North Fork Musselshell River

The North Fork of the Musselshell River is a small stream arising in the Little Belt Mountains. It receives numerous small tributaries from Castle and Little Belt Mountain drainages. The stream is fished more heavily than the South Fork

and is dependent to a great degree on plants of hatchery rainbow trout to help sustain this fishery. This fork is also important for irrigation. Water is stored in Bair (Harris) Reservoir near its upper end and water is diverted to the South Fork to augment flow into Martinsdale Reservoir.

Survey Results

Three sections were electrofished in June and July, 1970 and population estimates made for two of them. The North Fork above Harris Reservoir was electrofished in June, 1971. Thirty-five brook trout and 10 rainbow were caught in the 300 foot section. The brook trout averaged 5.6 inches in length and .09 pounds. The averages for the rainbow trout were 5.9 inches and .11 pounds.

The middle section (4,017 feet) was located on the Christianson Ranch a short distance below Checkerboard. Brook trout were the predominant species of trout, with brown trout nearly as abundant. Rainbow trout, whitefish and numerous white suckers were also caught. Population estimates and average size of fishes are given in Table 12.

Table 12. Population estimates, average length and weight of trout and whitefish electrofished from 4,077 feet of North Fork of the Musselshell, near Checkerboard, 1970.

		Average Length(in.)	Average Weight(lbs.)
Brown trout			
Total per section	217	9.9	.52
95% confidence interval	137-297		
Number per acre	136		
Brook trout			
Total per section	236	7.5	.22
95% confidence interval	180-292		
Number per acre	148		
Rainbow trout			
Total per section	88	8.1	.26
95% confidence interval	32-144		
Number per acre	55		
Whitefish			
Total per section	14	10.9	.58
95% confidence interval	24-104		
Number per acre	40		

Table 12 Continued.

All trout	
Total per section	187
95% confidence interval	494-562
Number per acre	330

The lower section (4,400 feet) electrofished was located on the Bair Company Ranch two miles north of Martinsdale. Ninety-eight percent of the trout taken were browns, with the remainder being rainbow. No brook trout or whitefish were caught. Population estimate and average size of fish are given in Table 13.

Table 13. Population estimate, average length and weight of brown trout electrofished from 4,400 feet of the North Fork of the Musselshell River near Martinsdale, 1970.

		Length(in.)	Weight(lbs.)
Brown trout			
Total per section	283	13.0	.84
95% confidence interval	219-347		
Number per acre	105		

Bank brush cover is abundant on the North Fork. However, heavy silt deposits are present, especially in the lower section near its confluence with the South Fork.

The fluctuating discharge from Harris Reservoir is detrimental to fish production. A continuous stable flow would help the creek considerably.

Two bottom fauna samples were collected from the upper and lower sections of the stream. As was observed in the South Fork, invertebrates were more abundant in the lower section (Table 10).

A thermograph was located on the North Fork just below the confluence of Spring Creek from July 8 through October 29, 1970. Temperature extremes were from 38° F. to 69° F. Average

daily minimum and maximum temperatures for July 8 through September 30 were 52° F. and 63° F., respectively.

According to USGS records for the calendar year 1968, the average flow of the North Fork near Delpine was 16.3 cfs with extremes of 51 and 4 cfs. For the water year 1969, the mean flow was 11.7 cfs with extremes of 140 and 4 cfs.

Tributaries

A short section of Checkerboard Creek at Checkerboard was electrofished in September, 1970. Rainbow and brook trout were the predominant species. Several brown trout, whitefish and white suckers were also caught.

Seventeen rainbow trout averaged 6.4 inches in length and .12 pounds. Brook trout (16) were 5.7 inches and .13 pounds. Six brown trout averaged 7.9 inches and .35 pounds.

Flagstaff Creek is a small stream (14 cfs near the headwaters), 3½ miles southeast of Checkerboard. The stream was closed to fishing by the Montana Fish and Game Commission years ago due to landowner-fisherman problems. There is a small reservoir located two miles upstream from the mouth which is open for fishing during the months of January and February annually, however. Irrigation water is withdrawn above and below the reservoir.

Three sections were electrofished on the stream, two above the reservoir (475 feet and 300 feet) and one below (350 feet). Brook, rainbow, cutthroat and rainbow-cutthroat hybrids were found in the two upper sections. No other species of fish were caught above the reservoir. Brook and brown trout were the predominant species in the stream below the reservoir. Rainbow and a few sculpins were also taken.

Population estimates for the three sections are given in Table 14.

Fifteen hundred catchable rainbow trout should be stocked annually in areas of highest use in the North Fork of the Musselshell.

An agreement should be made with the State Water Board to release water from Harris (Durand) Reservoir at a stable and continuous flow.

Pollution from private homes (sewage), dumping of livestock manure along streambanks, and silt from irrigation ditches leading back into the streams should be stopped.

Flagstaff Creek near Checkerboard offers an excellent opportunity for studies of various types, since the stream is closed to fishing. Research work on fish populations could be conducted on the small stream.

Table 14. Number and size of trout caught in Flagstaff Creek and estimated populations for three sections, 1970.

	Species of Trout		
	Rainbow	Brook	Brown
Upper Section			
No. of fish captured	130	162	--
Average length (inches)	7.7	7.4	--
Average weight (pounds)	.24	.20	--
Population estimates	221	287	--
95% confidence limits	191-251	251-323	--
Number per acre	2,009	2,609	--
Middle section			
No. of fish captured	32	145	--
Average length(inches)	7.1	6.9	--
Average weight (pounds)	.19	.17	--
Population estimate	45	175	--
95% confidence limits	35-55	159-191	--
Number per acre	1,125	4,375	--
Lower Section			
No. of fish captured	11	91	43
Average length (inches)	9.4	6.2	8.2
Average weight (pounds)	.43	.15	.38
Population estimate	18	217	84
95% confidence limits	15-21	165-269	58-110
Number per acre	300	3,617	1,400

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Prepared by William Hill, Richard Baldes

Date _____

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

20-7950
14-7440
18-8610
18-1380
18-0060
18-6480
18-0660
18-1080
18-2580

MONTANA FISH AND GAME DEPARTMENT
FISHERIES DIVISION

JOB PROGRESS REPORT

State Montana

Project No. F-5-R-20 Title Central Montana Fisheries Study

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

Period Covered July 1, 1970 to June 30, 1971

ABSTRACT

Inventory surveys were conducted on many lakes and streams during the report period. Information obtained includes species composition, growth rates versus stocking rates, success of a rehabilitation project and survival of hatchery fish following rehabilitation, amount of natural reproduction, age and growth, habitat evaluation and population estimates.

Construction on the Big Spring Creek Watershed project was begun. New headgates were put in the mill ditch (by-pass channel) and improvement of the ditch begun. Work on the dams which will be built on five tributaries above Spring Creek are scheduled to start in 1972.

Pollution sources, turbidity measurements and insect samplings were continued for information prior to construction of the five dams. Study of erosion caused by a channel change on lower Big Spring Creek was continued and a slide series was prepared which documents the effect. The city of Lewistown continued to dump snow in Big Spring Creek and Little Casino Creek.

Brown trout were planted in the Judith River from Utica to Hobson and Wolf Creek near Denton. Running Wolf Creek near Stanford was electrofished and a population estimate made.

Background information and recommendations for individual waters are presented with the findings.

OBJECTIVES

To collect physical and chemical data which can be related to the well-being of fishes as well as information on fish populations, fish food organisms and other pertinent biological features.

PROCEDURES

Fish were collected using 125-foot experimental nylon gill nets, 3-foot by 4-foot frame nets ($\frac{1}{4}$-inch mesh) with 35-foot leads, 4-foot by 6-foot frame nets ($\frac{1}{2}$-inch mesh) with 60-foot leads, a 50-foot seine with $\frac{1}{4}$-inch mesh, a D-C electrofish shocker, and by hook and line. Measurements include total length to the nearest tenth of an inch and weights to the nearest hundredth of a pound. Scale samples were taken for age and growth studies.

FINDINGS

Table 1 summarizes species composition, length and weight for fish collected in the lakes surveyed, while Table 8 gives similar data for streams.

Lakes

Fey Lake

Fey Lake is a 30 surface acre stockwater-irrigation reservoir in the Sweetgrass Hills of Toole County. The lake has a maximum depth of 26 feet and receives water from springs and runoff. Rainbow trout planted in 1966 exhibited good growth but subsequent plants failed to show anticipated growth rates.

Following reports of small size and poor condition of angler-caught trout, a survey was conducted on June 25, 1970. Only the 1969 age group of rainbow trout was taken in the gill net. A few white suckers were also taken in the gill net (Table 1). In addition, a 3-foot by 4-foot frame net captured several thousand fathead minnow, longnose dace, white sucker and a few fingerling trout from a plant made only days prior to the survey.

Stocking rates have varied from 500 per surface acre in 1966 to 250 in 1970. The present fishing pressure doesn't seem to be able to keep the trout population in balance with the available food and there may also be direct competition with the increasing numbers of rough fish. The lake should be removed from the stocking program for 1971, and if growth continues to be poor or if rough fish continue to increase, rehabilitation may be necessary.

Fitzpatrick Lake

Fitzpatrick Lake in Toole County is a 75 surface acre natural lake that has a maximum of 20 feet and receives water from runoff. The lake is located near the Canadian border and accomodates anglers from Alberta along with residents of the local and surrounding area. Rainbow trout first planted in 1968 and subsequent plants show very good growth.

Table 1. Gill net catch data of lakes surveyed between April 1, 1970 and March 31, 1971.

Area	Acres	No. of Nets	Species*	No.	Avg. Length (Range)	Avg. Weight (Range)
Fey Lake	30	1	Rb	7	9.2(8.3-9.6)	0.22(0.15-0.28)
			CSu	5	13.4(13.0-14.2)	1.00(0.91-1.16)
Fitzpatrick Lake	75	1	Rb	22	16.3(15.8-16.7)	2.04(1.70-2.56)
			Rb	3	14.3(12.5-15.8)	1.27(0.79-1.56)
Eureka Reservoir	408	5	Eb	19	11.8(8.4-14.5)	0.65(0.25-1.46)
			Rb	11	12.7(12.1-13.3)	1.03(0.92-1.20)
			LL	1	16.0	1.75
			CSu	10	11.9	0.68
			FSu	2	14.4	1.40
Arod Lakes	228	3	NP	9	18.8(8.5-29.5)	2.05(0.15-5.80)
			YP	20	10.0(9.0-13.5)	0.77(0.34-1.60)
			CSu	6	13.6(6.5-18.3)	1.32(0.10-2.42)
			GE	3	14.6(14.3-14.9)	1.15(1.07-1.20)
Priest Butte L.	298	1	Rb	6	15.8(14.8-16.6)	1.80(1.28-2.10)
			Rb	64	10.7(9.0-12.5)	0.55(0.33-1.00)

* Species abbreviation: Rb-rainbow trout; Eb-brook trout; LL-brown trout; NP-northern pike; YP-yellow perch; CSu-white sucker; FSu-longnose sucker; GE-goldeye.

Gill netting captured rainbow trout from both the 1968 and 1969 plants (Table 1). Frame nets picked up fingerling trout a few days earlier. No rough fish were taken with either sampling method.

The lake has received stocking rates ranging from 200 per surface acre in 1968 to 240 in 1970. Good growth of the trout is attributed to low stocking rates and adequate fishing pressure. The lake should continue to be stocked at similar rates and surveys should be made periodically to determine if the good growth is being maintained.

Eureka Reservoir

Eureka Reservoir is a 408 surface acre irrigation storage reservoir in Teton County fed by a canal from the Teton River. Rough fish (white and longnose suckers) enter the system by a canal and it is necessary to rehabilitate the lake every few years. The last rehabilitation project was carried out October 13, 1969 and the reservoir was restocked with fingerling rainbow trout April 21, 1970.

Success of the rehabilitation project was checked April 12, 1970. Two gill nets caught 19 brook trout, 1 brown trout and 10 small white suckers (Table 1). The above mentioned species occur in the Teton River and are presumed to have entered the reservoir via the canal.

One gill net on November 18, 1970 and two gill nets on February 9, 1971 were employed to check growth and survival of stocked rainbow trout (Table 1). Growth was good but survival poor (11 trout taken in 3 nets). Rainbow trout growth should continue to be monitered as well as increases in the rough fish population.

Eyraud (Arod) Lakes

The Eyraud Lakes are made up of a series of three irrigation reservoirs in Teton County and vary from 24 to 170 surface acres. Maximum depth ranges from 11 to 21 feet and water is supplied by a diversion from Muddy Creek.

Test netting of the lakes on August 5-6, 1970, indicates the following species composition in decreasing order of abundance: yellow perch, northern pike, white sucker, carp and goldeye (Table 1). Yellow perch, although a non-game species, are probably the most sought after fish due to their large size. Yellow perch growth is considered very good, while that of the northern pike is rated fair (Table 2).

Table 2. Average calculated total lengths for yellow perch and northern pike from Eyraud Lakes, August 5-6, 1970.

Age Group	No. of Fish	Total Length (inches) for Each Year of Life							
		1	2	3	4	5	6	7	8
Y. perch									
I	13	3.1							
II	13	2.7	5.5						
III	26	3.4	5.6	8.1					
IV	6	3.2	6.1	8.5	10.2				
V	3	2.7	5.0	7.4	9.5	11.0			
VI	2	3.2	5.7	7.8	9.9	11.5	12.3		
VII	1	2.2	4.3	6.7	8.7	10.5	12.0	12.8	
VIII	1	3.1	4.7	6.6	8.4	9.8	11.3	12.3	12.9
Averages		3.1	5.6	8.0	9.7	10.9	12.0	12.6	12.9
N. pike									
I	4	9.5							
II	2	8.4	15.4						
III	3	8.7	15.4	19.9					
IV	1	12.5	19.5	25.8	28.2				
Averages		9.3	16.1	21.4	28.2				

Reproduction of yellow perch and northern pike was sampled using frame nets, seines and by visual observation. Young-of-the-year yellow perch were picked up in good numbers in all three lakes, while northern pike were found only in the middle and main lakes. On the date of the survey, yellow perch young-of-the-year averaged 2.7 inches and northern pike 8.1 inches.

The Eyraud Lakes should be checked periodically to moniter trends in species composition and to determine success of natural reproduction along with growth patterns for northern pike and yellow perch.

Priest Butte Lake

Priest Butte Lake in Teton County is a 298 surface acre body of water that serves as a catch basin and as a transfer of irrigation return water from Freezout Lake to the Teton River. The lake is saucer shaped and has a maximum depth of 17 feet. Prior to 1955, the lake was an isolated body of water and sulphates and total dissolved solids were extremely high. In August of 1953, the Montana Fish and Game Department began management of Freezout Lake (which receives irrigation return water from the Fairfield Bench). A channel had to be cut from Freezout Lake to Priest Butte Lake and to the Teton River to prevent inundation of the highway, railroad tracks and farmland from the increasing amounts of irrigation return. The continual exchange of water through the system since July, 1955 has considerably lowered the former high levels of sulphates, total dissolved solids and other chemicals (Table 3).

Table 3. Changes in the chemical composition (ppm) of Priest Butte Lake from August 2, 1955 to January 25, 1971.

	Aug. 2 1955	Aug. 1 1959	July 25 1969	Jan. 26 1970	July 23 1970	Jan. 25 1971
Iron		0.2	0	0.46	0.1	0
Calcium		56	52	56	68	88
Magnesium		625	383	398	510	480
Sodium & Potass. Calc.		1,233	901	976	970	980
Carbonate radical		72	54	30	18	0
Bicarbonate radical		427	293	566	500	560
Sulphate radical		4,396	2,969	2,977	3,010	2,990
Chloride		233	165	195	170	170
Fluorine			1.0	1.46	3.2	3.2
Nitrates		0.07	0.6	1.0	0.4	3.1
Total hardness ($CaCO_3$)		2,702	1,700	1,700	2,270	2,200
Total dissolved solids	17,000	7,045	4,960	5,370	5,240	5,480

It has been reported that the banks of the Teton River have been coated with a white alkaline scum 15 miles below the point where the Freezout-Priest Butte Lake overflow is discharged. Photographs were taken during 1970 and no evidence of the white alkaline scum were noted. Foaming does occur at the outlet but is dissipated within a short distance. Table 4 gives a breakdown of total dissolved solids of water going through the system from the initial source at Pishkun Reservoir until it enters the Teton River.

Table 4. Total dissolved solids (mg/l $CaCO_3$) of water entering and leaving Freezout and Priest Butte Lakes and above and below discharges to the Teton River from Jan. 13, 1970 to October 22, 1970.

Area	Total Dissolved Solids Average	Range
Pishkun Reservoir Outlet	261	
Supply Ditch-Fairfield	261	
Freezout Lake		
Inlet #1*	3,405	739 - 5,665
" #2	7,157	575 -10,835
" #3**	1,128	523 - 4,262
" #4*	2,245	834 - 4,350
" #5	3,615	3,130 - 4,175
" #6	3,035	2,780 - 3,130
" #7	2,385	1,614 - 3,130
" #8*	1,155	348 - 4,175
" #9*	815	348 - 1,570
" #10*	3,780	558 - 6,620
Main Body Freezout Lake	4,370	2,435 - 5,665
Freezout Outlet	4,790	3,828 - 5,753
Priest Butte Lake		
Inlet #1	40,870	15,700 -57,170
" #2	1,378	782 - 3,130
" #3	2,735	1,434 - 4,262
Main Body Priest Butte Lake	5,070	3,654 - 5,925
Priest Outlet	5,525	3,130 - 6,950
Spring Creek		
Above Priest Outlet	878	765 - 1,001
Below Priest Outlet	4,965	2,780 - 6,100
Teton River		
Above Priest Outlet	523	365 - 739
Below Priest Outlet	1,039	479 - 1,740

* Irrigation return
** Fairfield Sewage Lagoon

Total dissolved solids are accumulated from the irrigated lands and attain very high levels when the return ditches experience low flows or after the returns enter a standing body of water. Lower total dissolved solids were noticed when the return ditches carried greater amounts of water. The total dissolved solids are diluted considerably when the discharge is thoroughly mixed with the Teton River.

White and longnose sucker were found to survive in the lake. Based on the reduced levels of sulphates and total dissolved solids, experiments were conducted with rainbow trout in July and September of 1969. Favorable results of these experiments prompted stocking of 14,420 rainbow trout (4-inch) on October 21, 1969 and 25,025 (3-inch) on June 4, 1970. Fast growing and large size trout were anticipated, based on the low stocking rates and the abundance of fish-food organisms found in the lake.

Growth of rainbow trout was checked monthly from May through October, 1970 and also in January, 1971. The greatest increments in length and weight were found from May through the first part of July and then growth decreased until late September, when increases were again noted. Curtailment of growth during July, August and September is thought to be related to temperature extremes. Temperatures on the bottom of the lake averaged 67.8°F. (range 65-70) in July and 68.5°F. (range 67-71) in August. On the last sampling date, January 20, 1971, rainbow trout planted in October, 1969 averaged 15.8 inches and 1.80 pounds, while those planted in June, 1970 averaged 10.7 inches and 0.55 pounds (Table 1).

Rainbow trout from Priest Butte Lake were tested for mercury and other pesticides and were found in trace amounts. These tests were felt necessary prior to opening the lake to public fishing because there was a possibility of pesticides being present in the irrigation return water.

Priest Butte Lake should continue to be monitered for growth of rainbow trout, summer temperature extremes and periodic checks of the water chemistry. Plans are to open the lake to fishing January 1, 1971 and to manage as a trophy fishery. Seasons and limits are to be drawn up prior to the opening.

Ackley Lake

Snagging for kokanee was poor to good the past winter (November, 1970 to January, 1971) as compared to excellent snagging the previous winter. Catches of kokanee by fishermen and in gill nets have progressively decreased the last four years. Number of rainbow trout caught in gill nets has dropped considerably since 1968 and 1969. Both white and longnose suckers have increased considerably since 1968 (Table 5).

Table 5. Number of fish taken in three gill nets from Ackley Lake in 1968 through 1971.

	Species			
	Rainbow	Kokanee	White Sucker	Longnose Sucker
1968	60	48	47	62
1969	89	45	173	78
1970	13	31	38	210
1971	25	12	370	232

Rainbow have remained practically the same size the last four years (Table 6). Kokanee have had two spawning runs since they were planted in 1966 after the lake was rehabilitated. Average size of kokanee and rainbow are given in Table 6.

Table 6. Average length and weight of rainbow and kokanee caught in gill nets from Ackley Lake, 1968 - 1971.

	Rainbow		Kokanee	
	Length(in.)	Weight(lbs.)	Length(in.)	Weight(lbs.)
1968	13.2	.85	9.2	.32
1969	13.2	.82	11.5	.53
1970	13.1	.93	14.0	.94
1971	13.1	1.00	10.6	.50

Ackley Lake should be rehabilitated within the next two years. Suckers have been increasing at a rapid rate the last three years.

Martinsdale Reservoir

It appears that the plant of larger fingerling rainbow trout helped produce better angling in the reservoir last fall (1970) and spring (1971). Yellow perch were caught in gill nets for the first time and abundance should be monitered in the future. They were reportedly caught by fishermen last fall, also. Results of gill netting in 1969 and 1971 are given in Table 7. Numerous crayfish were caught in the gill nets in 1969. Only 7 were taken in 1971, however.

A rural Agricultural Development (RAD) committee is looking into the feasibility of constructing an irrigation canal from Martinsdale Reservoir to Big Elk Creek. This would allow increased use of the existing water supply in the reservoir, create more drastic fluctuation of water levels, and be detrimental to the fishing.

Plants of larger size fingerling rainbow should be continued in Martinsdale Reservoir.

Table 7. Number, average length and weight of fish caught in four gill nets in 1969 and 1971, Martinsdale Reservoir.

	Number	Length(in.)	Weight(lbs.)
1969			
Rainbow trout	21	13.4	1.14
Brown trout	3	21.4	5.06
White Sucker	340	--	--
Longnose sucker	38	--	--
1970			
Rainbow trout	32	12.2	.74
Brown trout	7	18.8	2.56
Yellow perch	4	10.8	.58
White sucker	150	--	--
Longnose sucker	17	--	--

Yellow Water Reservoir

Two gill nets were set overnight in May, 1971. No rainbow trout from the 1970 plant were taken. Fifteen rainbow from this year's plant and one large rainbow were collected, along with three bullheads and 44 large white suckers. By comparison, two nets were set in 1969 and there were 46 rainbow (representing three age classes), 210 black bullheads and 104 white suckers caught. Commercial fishermen have apparently reduced the bullhead population. A fish kill of several hundred large (3 to 4 pound) rainbow trout was checked in August. The fish had been dead for some time and the cause of death was not determined.

Larger size fingerling rainbow should be planted and the number doubled to 50,000 per year. Commercial fishermen should be allowed to continue fishing for black bullheads.

War Horse Reservoir

Commercial fishermen are no longer permitted to fish the reservoir for black bullheads. They were unable to catch sufficient numbers to sell, and sport fishermen do very well, especially in the spring. Bass fishing in the reservoir is excellent, although most fish are small. The possibility of introducing northern pike should be given serious consideration.

Stafford Reservoir

The reservoir winter-killed the past winter (1970-71), probably due to the lowering of the water level by the State

Water Board. A gill net set overnight captured no fish. The Water Board had planned to build a new spillway and riprap in the front of the dam this past summer (1971). However, they were cut short of funds and the project was indefinitely postponed. The reservoir is used primarily for fishing, so the Water Board is reluctant to do any work on it.

Forest Lake

One gill net was set overnight in August, 1970. Fifty-six native cutthroat trout were netted. Average length and weight of the fish, respectively, was 9.4 inches and .30 pounds.

The Forest Service is contemplating disallowing the use of boats with motors on the lake.

Petrolia Reservoir

Three gill nets were set overnight in April, 1971. Only 14 small carp and 6 white suckers were caught. No walleye were caught despite fair catches in past years. No crappie were taken from a plant of 129 fish in September, 1968.

Ponds

Fish losses due to winter-kill were light the past winter (1970-71). Seven ponds were gill netted to determine fish species present, growth rate and abundance. Ponds should be sampled periodically to determine management needs.

Streams

Cut Bank Creek

Cut Bank Creek was electrofished to check survival of planted brown trout and also to determine if natural reproduction has occurred. Brown trout have been planted in 1965, 1968, and 1970. Survival appears to be good and some natural reproduction is taking place. Permission should be obtained from the Blackfeet Indians to electrofish the stream on the Reservation and further check natural reproduction and distributions.

Teton River

The Teton River was sampled at three locations to determine changes in species composition. The Box Canyon is a mountain section and is composed of cutthroat trout and a few rainbow trout and rainbow-cutthroat hybrids. The section above Choteau is dominated by brook trout and an occasional rainbow trout, while the section below Choteau is composed of brown trout followed by mountain whitefish, rainbow trout and brook trout.

Additional areas of the Teton River should be spot checked to determine its fishery potential. Much of the river is dewatered due to irrigation demand, but a number of beaver dams on the upper and mountainous portions do or could support fish.

Sun River

Surveys of the forks of the Sun River in the Bob Marshall Wilderness Area were limited to hook and line, due to prohibition of motorized gear and remoteness of the area. Rainbow trout dominated the catch in all areas. More information should be obtained on the fishery in this area, as well as numbers of people utilizing the resource.

Beaver Creek-Blacktail Creek

Beaver Creek and Blacktail Creek were electrofished in conjunction with the stream survey made by the U. S. Forest Service. Both streams are small tributaries of the main Sun River and contain small brook trout and rainbow trout.

Barr Creek-Rose Creek

Barr Creek and Rose Creek on the Sun River Game Range were electrofished for species composition and found to be composed of only brook trout.

Sampling results of the streams listed in the preceding paragraphs appear in Table 8. Additional work should be done on the streams listed in this report as well as other streams in the area, as recent information is quite limited. Topics to explore include species composition, relative abundance, fishing pressure, habitat, fish food organisms and stream flows.

Table 8. Species composition of streams surveyed between April 1, 1970 and March 31, 1971.

Area	Method*	Species**	No.	Avg. Length (Range)	Avg. Weight (Range)
Cut Bank Creek (Below city water plant	EF	LL	42	9.6(4.5-23.0)	0.57(0.04-4.96
		HRb	17	10.2(8.8-11.3)	0.40(0.26-0.54
		Rb	10	7.8(6.6-9.0)	0.18(0.10-0.29
Teton River Box Canyon (Mountain section)	HL	RbXCT	1	9.3	0.35
		CT	6	11.3(10.3-12.5)	0.60(0.40-0.80
Crawford Ranch (Above Choteau)	EF	Eb	26	5.9(3.9-9.3)	0.11(0.02-0.31
		Rb	2	5.0(4.8-5.1)	0.06(0.05-0.06
		LL	1	8.8	0.26

Table 8 Continued

Area	Method*	Species**	No.	Avg. Length (Range)	Avg. Weight (Range)
Corbett Ranch (Below Choteau)	EF	LL	34	10.6(5.1-20.1)	0.63(0.06-2.6
		Wf	15	8.8(4.9-14.2)	0.26(0.07-0.9
		Rb	13	7.5(4.8-13.3)	0.26(0.06-0.8
		Eb	10	7.4(6.3-8.7)	0.17(0.02-0.2
West Fork Sun River (Mouth)	HL	Rb	2	14.1(14.0-14.2)	0.78(0.75-0.8
		Eb	1	4.0	
South Fork Sun River (Pretty Prairie)	HL	Rb	3	11.3(9.5-12.5)	
North Fork Sun River (Cabin Creek)	HL	Rb	36	11.4(4.0-16.4)	
		Eb	2	8.1(7.2-8.9)	
Beaver Creek	EF	Rb	28	4.8(2.6-6.9)	0.06(0.01-0.1
		Eb	27	4.9(3.1-7.8)	0.06(0.02-0.2
Blacktail Creek	EF	Rb	14	4.7(3.3-6.8)	0.40(0.01-0.1
Barr Creek	EF	Eb	24	6.0(3.1-9.7)	
Rose Creek	EF	Eb	32	5.0(3.0-7.1)	

* EF-Electrofishing HL-Hook and Line

** Species Abbreviations: LL-brown trout; HRb-Hatchery rainbow trout; Rb-rainbow trout; RbXCT-rainbow-cutthroat trout hybrid; CT-cutthroat trout; Eb-brook trout; Wf-mountain whitefish.

Big Spring Creek

Work on the first phase of the Big Spring Creek Watershed project was started this spring. Electrically controlled headgates were constructed in the Mill Ditch by-pass channel. Work on improving the Mill Ditch is progressing at the present time and expected to be completed in 1972. Plans are to begin construction work on the five dams on upper Spring Creek in 1972. Some preliminary, minor work on the East Fork site could possibly begin this fall, however.

The city of Lewistown continues to pollute the stream by dumping snow and other material from city streets into it. There might be a chance to have their permit (which allows them to dump in the creek) revoked. They are permitted to dump only snow and ice into Big Spring Creek. The past winter (1971)

petroleum products, sand, salt, debris, etc. were dumped in the stream along with the snow and ice. They were also dumping into Little Casino Creek within the city limits.

Raw sewage pollution from private homes is continually being checked, in cooperation with the City-County sanitarian. Several sources have been identified and some have been corrected. Others are in the process of being rectified.

The Big Spring Creek Chapter of Trout Unlimited and the local Rod and Gun Club are in favor of opening Big Spring Creek to fishing all year. Since the stream doesn't freeze over in the winter, considerable recreation is lost by not having the stream open all year.

Bottom fauna samples from eight locations continue to be taken of Big Spring Creek to use as an index of the streams productivity for comparison of productivity after watershed dams are constructed on tributaries.

Again, as reported in Job Completion Report F-5-R-19, organisms from 2 square-foot samples were consistently more numerous in the areas above the city of Lewistown, as shown in Table 9. Lowest numbers of organisms were found in the East Fork tributary and sections within the city, below the sewage effluent, and near the mouth of Big Spring Creek.

In February 1961, 4200 feet of naturally meandering Big Spring Creek below Lewistown was bulldozed into a 2200 foot channel by a private landowner. Considerable damage occurred to habitat and private land downstream, and the straightened area was effectively destroyed. In addition, detrimental effects were noticed directly upstream. The straightening caused an increase in water velocity and a head-cutting effect in the upstream bank area.

In the 15 year period from 1938 to 1953 in the area above the channel alteration, only three feet of bank was lost to erosion and the stream flowed at bank full. However, in the same area in only one year, 15 feet of bank was washed downstream after the channelization. From 1962-1967 nearly 90 additional feet of bank was gone. By June, 1971 the amount of bank lost in the area measured 140 feet. Another similar section upstream from the channelization lost 126 feet within the same period of time.

A slide series was prepared and an article written (published in Montana Outdoors; July-August, 1971 issue) depicting the effects of the channel straightening.

Table 9. Total number of organisms taken from two square foot bottom samples from Big Spring Creek and East Fork, July, 1970. Average number of organisms per square foot are in Parenthesis.

Invertebrates	Fish Hatchery	East Fork	Burleigh's	Mont. Power	St. Leo Hi S.	Above Sewer	Below Sewer	R.R. Trestle	Falls
Trichoptera									
Brachycentridae	410	6	1,024	1,202	54	182	35	1	--
Leptoceridae	793	4	68	743	49	399	83	--	--
Glossosomatidae	118	2	324	70	5	11	2	1	--
Limnephilidae	14	--	41	11	--	--	--	--	--
Hydropsychidae	1	1	12	2	--	1	5	--	2
Ephemeroptera	116	11	59	52	25	270	135	653	249
Plecoptera	6	3	2	4	--	--	1	--	--
Diptera									
Tendipedidae	8	2	--	1	36	107	29	24	1
Simulidae	349	--	--	3	--	2	12	3	3
Tipulidae	--	12	--	--	--	1	3	--	--
Rhagionidae	--	--	--	2	--	2	1	--	--
Unknown	2	12	--	--	--	3	--	1	--
Odonata									
Gomphidae	--	1	--	--	--				
Coleoptera	1	1	1	8	2	4	4	8	1
Mollusca									
Physidae	6	--	--	--	--	--	--	--	--
Lymnaeidae	3	--	--	--	--	--	--	--	--
Planorbidae	--	--	--	--	--	--	--	1	--
Parasitengona	--	--	1	--	--	16	--	--	--
Total Number	1,827(914)	55(28)	1,532(766)	2,098(1,049)	171(86)	998(499)	310(155)	692(346)	256(128)

Big Spring Creek should be open to fishing all year. Estimate of young-of-the-year trout, bottom fauna data and turbidity measurements should continue to be taken on Big Spring Creek to determine what effect the five dams will have. Pollution sources should continue to be checked and an effort made to eliminate the sources. Areas of excessive erosion need to be located and the problems corrected. The permit issued the city to dump snow and ice into Big Spring Creek should be looked at closely to determine if they are in violation of it.

Running Wolf Creek

Running Wolf Creek near Stanford is a small stream that receives considerable fishing pressure, especially early in the season. The fish population consists predominantly of brook trout, but a few rainbow are also present.

The stream was electrofished in April, 1970 and a population estimate made. A section of the stream was also electrofished and a population estimate made in October, 1968 (Table 10.) However, the section shocked in 1968 was in an area with less streambank cover and with a lower population estimate.

Table 10. Population estimates of brook trout from Running Wolf Creek.

	1968	1970
Brook trout		
Total per section	329	557
95% confidence interval	283-375	493-621
Number per acre	1,218	2,063

Judith River

Brown trout were planted in the Judith River from six miles above the town of Utica downstream to Hobson. Eighteen thousand 5 to 6 inch fish were stocked in an attempt to establish a population of this species in this area.

Wolf Creek

Five thousand brown trout were planted in Wolf Creek near Denton in an effort to establish a trout species that would

spawn in the small stream. Seven hundred and fifty catchable size rainbow should continue to be planted in the stream near Denton.

Yogo Creek

Mining for Yogo sapphires continues to be performed in the Yogo Creek Canyon area. Catch basins for mine tailings have been built for some distance down the canyon and some stream straightening has been done. Tailings have been piled along the channel and wash into the stream in the spring and during rainy periods. There is a plan to re-use the catch basins and pile the tailings around them.

Prepared by William Hill, Richard Baldes

Date _____

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

14-1120
14-6000
14-6040
14-6840
14-7320
14-7330
14-7370
14-8540
20-0350
20-0450
20-0900
20-4400
20-5150
20-5750
20-6400

16-0300
16-1340
16-1820
16-3160
16-4200
16-4260
16-4300
16-7340
16-8380
18-7510
18-8380
18-8720
18-9440
18-9500

MONTANA FISH AND GAME DEPARTMENT
FISHERIES DIVISION

JOB PROGRESS REPORT

Duplicate copy

State Montana

Project No. F-5-R-20 Title Central Montana Fisheries Study

Job No. I-b Title Fish Management Surveys

Period Covered July 1, 1970 to June 30, 1971

ABSTRACT

Fish management surveys were conducted on Pishkun Reservoir and Lake Frances. A tagging study of northern pike was initiated in Pishkun Reservoir to determine approximate population size, angler harvest and age and growth. Other information obtained includes data on water temperature, reproduction and spearing. General physical and biological data was collected on Lake Frances along with attempts to determine the success of a walleye introduction and the location and distribution of kokanee.

The North and South Forks of the Musselshell River were surveyed. Upper and lower sections of both streams were electrofished and population estimates made. Thermographs were located on both streams, condition of the habitat was evaluated and invertebrate samples were collected. Tributaries of both streams were electrofished to determine size and abundance of species present.

Background information and recommendations are presented with the findings.

OBJECTIVES

To obtain information needed for fisheries management and information on the success of various management procedures.

PROCEDURES

Fish were collected using 4-foot by 6-foot frame nets (1-inch and ½-inch mesh) with 60-foot leads; 3-foot by 4-foot frame nets (¼-inch mesh) with 35-foot leads, 125-foot experimental gill nets; and a 300-volt DC shocker. Northern pike were tagged with a Floy tagging gun using a T-tag and the left pelvic fin was clipped to help determine tag loss in future years. Scale samples were secured from a representative number of fish. Fish measure-

ments included total length to the nearest tenth of an inch and weights to the nearest hundredth of a pound. Water temperatures were recorded on Taylor thermographs.

FINDINGS

Pishkun Reservoir

Pishkun Reservoir is a 1,550 surface acre irrigation storage reservoir in Teton County with a maximum depth of 80 feet. The reservoir consists of an east and west lake connected by a channel. The east lake is largest and also has the greatest depth. Water is supplied by a canal from Diversion Dam on the Sun River. Fluctuations of 10-15 feet are not unusual throughout the summer months as irrigation demand lowers the reservoir. The reservoir is filled to capacity during early spring, generally in April and May.

Pishkun Reservoir had a history of being a very good trout lake until northern pike were illegally introduced sometime in the 1950's. A few trout still enter the reservoir through the diversion canal and provide a limited fishery. Other species found in the reservoir include yellow perch and white sucker. Grayling have been planted in the past but none were taken during the present study; however, they are caught in the fall of the year in the irrigation canals approximately 30-40 miles downstream from Pishkun Reservoir. Kokanee were introduced in May, 1970.

Trapping and Tagging Operations

Frame net traps were used from April 9, 1970 to May 5, 1970 to capture northern pike on their spawning run. A total of 519 northern pike were taken during this period, of which 498 were classified as mature fish and the remaining 21 as immature fish. Other fish taken in the traps in decreasing order of abundance include white sucker, yellow perch and rainbow trout.

Traps were checked every other day and the northern pike were separated by sex and maturity. Mature fish were then measured, tagged, fin clipped and scales taken from a representative sample. A total of 498 northern pike (311 males and 187 females) were tagged and released (Table 1). The males averaged 20.7 inches total length (range 16.1-28.3) while the females averaged 21.7 inches (range 16.8-39.5). Immatures averaged 10.7 inches (range 4.1-15.8). Immature fish were not tagged.

Table 1. Number of northern pike tagged per inch group and number of tags returned in Pishkun Reservoir, 1970. (Mature fish only).

Inch Group	Number per inch group		
	Male	Female	Total
16.0 - 16.9	13	2	15
17.0 - 17.9	15	4	19
18.0 - 18.9	37	15	52
19.0 - 19.9	44	23	67
20.0 - 20.9	64	23	87
21.0 - 21.9	54	38	92
22.0 - 22.9	42	32	74
23.0 - 23.9	26	30	56
24.0 - 24.9	11	7	18
25.0 - 25.9	2	5	7
26.0 - 26.9	1	1	2
27.0 - 27.9	1	2	3
28.0 - 28.9	1	1	2
35.0 - 35.9		1	1
38.0 - 38.9		1	1
39.0 - 39.9		2	2
No. tagged	311	187	498
No. returned	92	83	178*
% return	29.6	44.4	35.7

* 3 tags returned with no sex differentiation

Angler Harvest

Anglers returned 178 tags during the study period for a return of 35.7 percent (Table 1). This is one of the highest returns known for northern pike for any one year. Ridenhour (1957) reported 33.5 percent return in Clear Lake, Iowa, and Duerre (1966) reported 48.4 percent return in Jamestown Reservoir, North Dakota. Of the tags returned, 92 were males and they account for 29.6 percent of all males tagged, while 83 were females and they represent 44.4 percent of all females tagged. Table 2 breaks down the returns by month, with June and July accounting for the majority of the tags returned. This undoubtedly also reflects the time of the year that the greatest number of fishermen are out.

Table 2. Angler returns of tagged northern pike, Pishkun Reservoir, May, 1970 - February, 1971.

Month	Male		Female		Combined	
	No.	%	No.	%	No.	%
May	7	7.6	10	12.1	17	9.6
June	42	45.7	41	49.4	83	46.6
July	32	34.8	18	21.7	53*	29.8
August	7	7.6	4	4.8	11	6.2
September	0	0.0	2	2.4	2	1.1
October	0	0.0	0	0.0	0	0.0
November	1	1.1	2	2.4	3	1.7
December	0	0.0	0	0.0	0	0.0
January	1	1.1	2	2.4	3	1.7
February	2	2.2	4	4.8	6	3.4
Totals	92		83		178*	

* 3 tags returned with no sex differentiation.

Tag returns are voluntary; however, articles appeared in local newspapers and tagging information signs are strategically posted around the reservoir requesting anglers to turn in tags. It would be difficult to estimate how many tags removed from fish were not turned in.

Whenever possible, anglers were contacted as to the number of untagged fish they caught along with the tagged ones. From this source of information, a total of 256 northern pike were taken, of which 68 were tagged, or 26.6 percent.

Population Estimate

The basic Schnabel method as described by Rounsefell and Everhart (1960) was used to estimate the northern pike population in Pishkun Reservoir. Data compiled 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 3). From this information, a population estimate of 1,645 northern pike was calculated. The Schnabel estimate, based on 428 tagged fish, indicates 27.9 percent of the fish were tagged. Of 256 angler caught fish, 68 or 26.6 percent were tagged.

Table 3. Population estimates of northern pike in Pishkun Reservoir, 1970. (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)	Cum. E	Cum. D	G/H
A	B	C	D	E	F	G	H	I
1	134							
2	203	78	1	10,452	10,452	10,452	1	10,452
3	231	42	9	8,526	947	18,978	10	1,897
4	361	157	17	36,267	2,133	55,245	27	2,046
5	428	93	22	30,573	1,389	85,818	49	1,751
6		130	37	55,640	1,504	141,458	86	1,645
			86	141,458	1,645			

Number of recaptures is 86 + 9.274
1.96 standard error is 18.2
Population at P of 0.05 is 1,645 (confidence limits 1,204 to 2,086)

These estimates indicate approximately one northern pike per surface acre of water, based on the reservoir size of 1,550 acres. Actually, the northern pike habitat is much less than this, about 500 acres is considered good habitat. The rest of the water area is too deep for normal pike inhabitation.

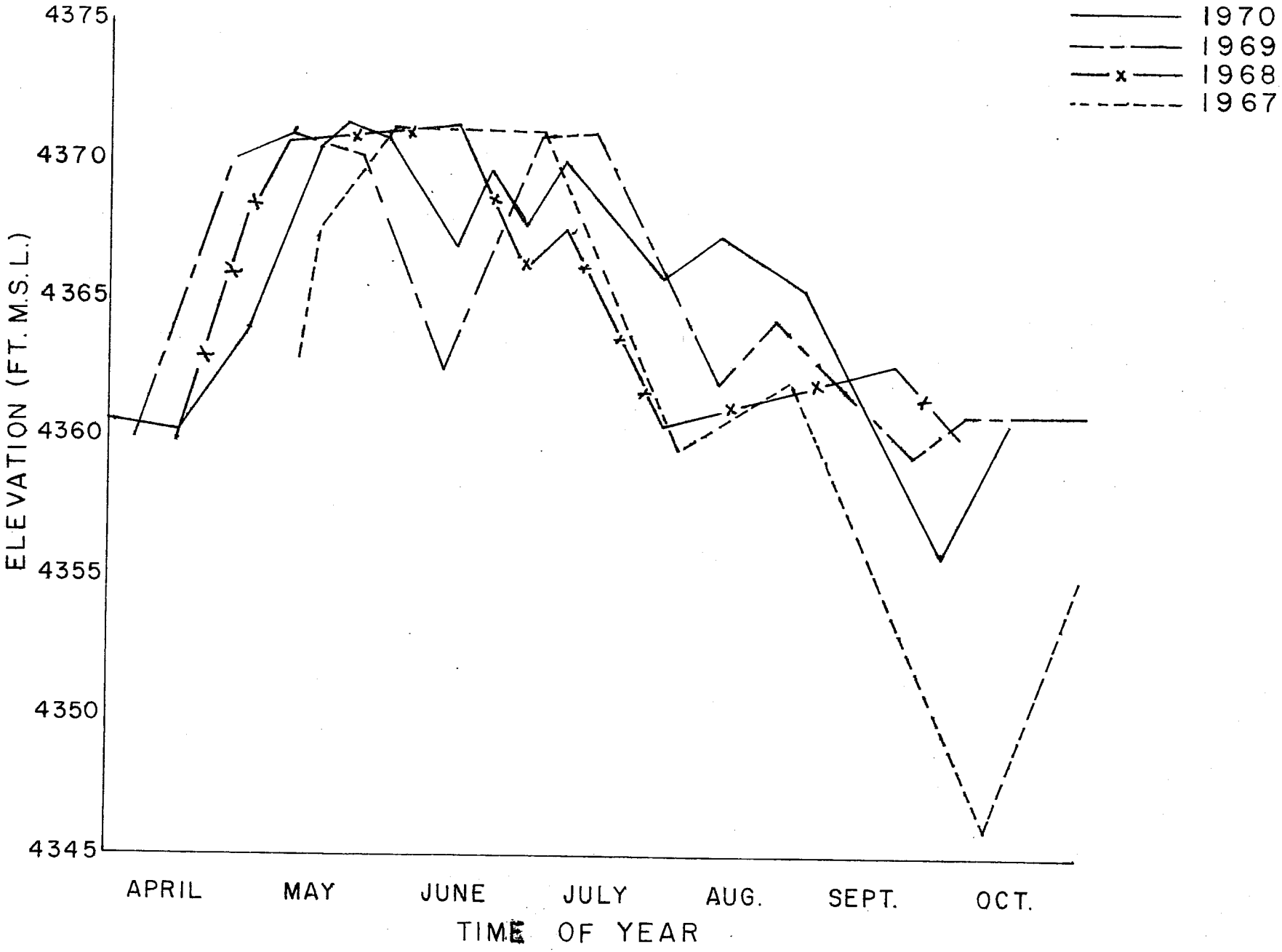
Temperature and Water Levels

Temperatures were recorded from April 22 to May 19 with a maximum of 61° F. experienced on May 17 and a minimum of 37° F. on April 29.

The supply canal to Pishkun Reservoir generally begins to flow around the middle of April and fills the reservoir to capacity (elevation 4,371 feet msl) by the middle or end of May. When trapping began on April 9, 1970, the reservoir was at elevation 4,360.4 (Figure 1). Maximum elevation of 4,371.1 was reached May 20, 1970 and the minimum September 29, 1970. This pattern is typical of preceding water years as noticed in Figure 1.

It is felt that the increasing water levels at this time of year corresponds with spawning of northern pike, and the levels hold long enough to permit successful hatching of eggs and development of fry. Throughout the summer and fall, water levels recede due to irrigation demand. Spawning areas are exposed and terrestrial and semi-aquatic vegetation starts to grow.

FIG. 1. WATER LEVELS - PISHKUN RESERVOIR, 1967 - 1970.



This seems to be desirable, however, livestock around the reservoir graze and trample any vegetation that comes up. Agreements have been reached with the Greenfields Irrigation District to fence a potential northern pike spawning area, thus keeping livestock out and allowing the vegetation to come back.

Age and Growth

A total of 165 scale samples from northern pike were analyzed for age and growth studies (Table 3). Growth is considered below average when compared to surrounding areas. The oldest male taken was six years old (28.3 inches at capture) while the oldest female was eight years old (39.5 inches at capture). Of the scales analyzed, 53.3 percent of the males and 64.0 percent of the females were classified as four year old fish. Of the scales taken during the study period (April 9 to May 5), 24.4 percent of the males and 26.7 percent of the females had already laid down a new annulus. Additional scale samples from 21 immature fish were analyzed and found to represent age groups I through III. Age group I averaged 6.1, age group II - 10.6, and age group III - 15.2 inches.

Reproduction

Young-of-the-year northern pike averaged 4.1 inches total length on July 17, 1970. Reproduction is rated average as fingerling pike were observed to be quite numerous wherever vegetation was present along the shoreline. Young-of-the-year yellow perch and white sucker were also found in good numbers and should serve as forage for pike.

Test Netting Surveys

Three gill nets were fished on July 17, 1970 and captured 10 northern pike, 61 yellow perch and 13 white sucker. Average lengths (inches) and weights (pounds) respectively are as follows: Northern pike - 19.7, 1.99; yellow perch - 6.3, 0.14; and white sucker - 18.4, 2.80.

Spearing

In 1969, legislation was passed allowing the Fish and Game Commission to set open seasons in certain waters for taking northern pike, walleye, sauger and rough fish by spear or gig. This season runs from December 15 through March 31. The sport is new to most fishermen but is rapidly gaining in popularity. A dark house is used to spear from and a decoy is placed in the water to attract the fish. Attempts were made to contact spearfishermen and determine their success in Pishkun Reservoir. Few spearers were contacted and their success rated from poor to fair.

Table 4. Average calculated total length (TL) in inches of northern pike in Pishkun Reservoir, 1970. (Mature fish only).

Year	Age Group	Number M	Number F	Avg. TL at Capture M	Avg. TL at Capture 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	8 M
1967	III	15	15	17.0	18.6	7.1	7.0	12.2	13.2	16.9	18.3									
1966	IV	48	48	20.5	22.2	6.7	6.6	12.9	14.1	17.5	18.8	20.3	22.0							
1965	V	25	6	23.8	25.1	6.2	6.0	12.3	12.2	18.7	18.2	21.9	22.6	23.7	25.1					
1964	VI	2	3	26.2	30.5	7.7	7.2	13.5	14.0	18.3	20.1	22.1	25.2	24.7	28.0	26.2	30.5			
1963	VII	--	1	--	38.5	--	12.3	--	23.4	--	28.7	--	31.7	--	34.3	--	36.3	--	38.5	
1962	VIII	--	2	--	39.3	--	8.0	--	14.0	--	20.4	--	26.5	--	31.9	--	34.8	--	37.3	--39.
Averages		90	75			6.7	6.8	12.6	13.9	17.7	18.9	20.9	22.6	23.8	27.7	26.2	32.9	--	37.7	--39.
Average increments						6.7	6.8	5.9	7.1	5.1	5.0	3.2	3.7	2.9	5.1	2.4	5.2	--	4.8	-- 1.

Summary

A total of 498 northern pike were tagged in Pishkun Reservoir during April and May of 1970. Anglers returned 178 tags for a return of 35.7 percent. A population estimate of 1,645 northern pike was made using the Schnabel method. Temperatures ranged from 37° F. to 61° F. during the study period. Water levels reached their maximum on May 20, 1970 and held long enough to insure hatching and development of eggs and fry. A total of 186 northern pike scales were analyzed and were found to represent age groups I through VIII. Reproduction of northern pike was rated fair. Few spearers were contacted and they reported limited success.

Similar investigations in the future should emphasize monitering trends in the northern pike population. Approximately 500 fish will be tagged each year and angler harvest will be determined along with changes in the age and growth structure, population size, water levels, reproduction, etc.

Lake Frances

Lake Frances is a 5,536 surface acre irrigation storage reservoir in Pondera County. Maximum depth is approximately 45 feet, with water being supplied by canal from Birch Creek and Dupuyer Creek. Water levels are lowered 8-10 feet throughout the course of the irrigation season.

Lake Frances has a history similar to Pishkun Reservoir in that it produced good trout fishing until northern pike were illegally introduced in the late 1950's. Planting of rainbow trout was discontinued in 1964 when it was evident that northern pike were established in the lake. Rainbow trout are still caught occasionally and presumably enter the lake via the inlet canal. Other species present in the lake include yellow perch, white and longnose sucker and kokanee. Kokanee fry are stocked annually each spring. Walleye fry were introduced in May of 1969.

Netting Surveys

Gill nets (surface and bottom sets) and frame net traps were fished to determine species composition and relative abundance. Species taken in decreasing order of abundance include: white sucker, yellow perch, northern pike, longnose sucker, rainbow trout and kokanee (Table 5). Various aspects were investigated for the above mentioned species and will be discusses individually.

White and Longnose Sucker

Periodic requests are received from sportsmen and the people of Valier to remove suckers from Lake Frances. In the spring, the inlet canal is filled with suckers and the general consensus is to remove these fish and solve the problem. Frame net traps were fished in the reservoir to determine how many suckers were spawning in the lake at the same time large numbers were in the inlet canal. On May 7-8, 1970, a total of 700 suckers were taken in 3 traps, and on May 19-20, 1970, 374 suckers were taken in 6 traps. It is felt that removal of suckers from the inlet canal wouldn't decrease the population significantly, since large numbers are also present in the lake at the same time.

Table 5. Gill net and frame net trap catch data for Lake Frances, 1970.

Type of Gear	No. of Nets	Species	No.	Ave. Length (Range)	Ave. Weight (Range)
Surface gill	4	NP	3	23.9(20.6-27.9)	4.04(1.98-7.25
		KOK	1	12.4	0.68
Sinking gill	15	CSu	219	15.5(8.0-17.8)	1.71(0.23-2.50)
		YP	197	7.2(5.3-11.4)	0.20(0.07-0.68)
		NP	51	17.5(11.0-28.8)	1.63(0.26-7.50)
		FSu	18	14.4(11.1-17.4)	1.09(0.57-1.77)
		KOK	9	14.4(11.4-16.1)	1.09(0.52-1.80)
1" Trap	5	CSu	818		
		NP	40		
		Rb	10	19.7(18.1-20.8)	3.29(2.73-4.12)
		FSu	5		
½" Trap	4	CSu	251		
		Rb	9	20.3(19.1-21.5)	3.01(2.55-3.78)
		YP	2		
¼" Trap	2	NP	4	Young-of-the-year	
		YP	2	Young-of-the-year	

Species abbreviations: NP-northern pike; KOK-kokanee; CSu-white sucker; YP-yellow perch; FSu-longnose sucker; Rb-rainbow trout

Northern Pike

Attempts were made in May to capture northern pike on their spawning run for purposes of tagging and also to gather age and growth data. Due to greater efforts spent at Pishkun Reservoir, the spawning run was almost over at Lake Frances when this survey was made and no fish were tagged.

A total of 52 scale samples were analyzed for age and growth and were found to represent age groups I through IV (Table 6). No differentiation was made to sex. Growth rate is good and considerably better than Pishkun Reservoir.

Yellow perch

Yellow perch were collected during test netting surveys conducted throughout the summer. Forty-two scale samples were secured and analyzed and they represent age groups II through VII (Table 6). Growth is poor when compared to surrounding areas.

Rainbow trout

Rainbow trout were taken incidentally during netting surveys and no specific data was gathered other than lengths and weights as presented in Table 5.

Table 6. Average calculated total length (TL) in inches of northern pike and yellow perch in Lake Frances, 1970.

	Year	Age Group	No.	Average TL at end of year of life						
				I	2	3	4	5	6	7
N. pike	1969	I	16	10.8						
	1968	II	18	8.3	17.1					
	1967	III	9	11.4	19.6	23.8				
	1966	IV	9	12.6	21.8	25.5	27.3			
	Averages		52	10.4	18.9	24.7	27.3			
Y. perch										
	1968	II	1	1.6	4.2					
	1967	III	21	1.5	3.5	5.4				
	1966	IV	11	1.5	3.6	5.7	6.9			
	1965	V	7	1.9	3.6	6.0	7.6	8.7		
	1964	VI	1	2.1	3.4	5.0	7.2	8.9	10.1	
	1963	VII	1	2.3	3.4	4.7	7.0	9.3	10.7	11.1
	Averages		42	1.6	3.6	5.6	7.2	8.8	10.4	11.1

Kokanee

Attempts were made to determine the summer location and distribution of kokanee. Gill nets were set on the bottom and at the surface in and over depths ranging from 15 to 43 feet. A total of nine kokanee were taken in bottom nets while only one was taken at the surface. Temperatures ranged from 72°F. at the surface to 62° F. at the bottom. Dissolved oxygen exceeded 10 ppm at all depths and secchi disk readings ranged from 5 to 7 feet.

In the fall, kokanee run up the inlet canal and congregate below an irrigation drop. This is probably the only area that fishermen harvest kokanee to any extent since they can be snagged at this time of year. A voluntary creel census box was placed at the irrigation drop asking fishermen to record hours fished and numbers of fish snagged. During the 1970 snagging season, 263 fishermen took 1,561 kokanee in 354 hours (Table 7).

Table 7. Numbers of kokanee taken during the 1970 snagging season, Lake Frances. (Voluntary creel census).

Month	No. Fishermen	Hours Fished	Fish Snagged	Hrs./Man	Fish/Man	Fish/Hr.
Sept.	120	157.7	1,111	1.3	9.3	7.1
Oct.	106	147.7	374	1.4	3.5	2.5
Nov.	37	48.7	76	1.3	2.1	1.6
Totals	263	354.2	1,561	1.3	5.9	4.4

A total of 172 kokanee were weighed and measured at the irrigation drop: 66 males ranged from 12.6 to 17.1 inches in total length (average 15.6) and 0.60 to 1.34 pounds (average 1.10), while 106 females ranged from 12.3 to 16.5 inches (average 15.2) and 0.58 to 1.30 pounds (average 1.05).

Walleye

A total of 500,000 walleye fry were introduced into Lake Frances in May of 1969. Survival of this stocking is undetermined as yet, since none were taken during regular netting surveys.

Summary

Test netting surveys were conducted throughout the summer of 1970 in Lake Frances. It was determined that suckers spawn in the lake at the same time as in the inlet canal. General biological data was collected on all species including age and growth information on northern pike and yellow perch. No concentrations of kokanee could be found in relation to depth, temperature or dissolved oxygen. Based on a voluntary creel census, fishermen snagged 1,561 kokanee during September, October and November. Walleye introduced in 1969 have not been taken in any type of netting gear to date.

Future surveys will include tagging northern pike along with harvest, age and growth information, reproduction and

population size. Additional data is needed on the summer distribution of kokanee as well as the harvest by snagging. Further attempts will be made to determine the survival of the walleye introduction.

Data collected on Hauser Reservoir, Holter Reservoir and the Missouri River during this reporting period will be included in Job Progress Report F-5-R-21, Job I-b.

South Fork of the Musselshell River

The South Fork of the Musselshell River is a small stream arising in the Crazy Mountains of central Montana. It receives numerous small tributaries draining the Castle and Crazy Mountains before reaching its confluence with the North Fork near the town of Martinsdale and flowing east and north to the Missouri River. It has long enjoyed a reputation among local residents of good trout fishing, although fishing pressure is light. The stream is also important locally as a supply of irrigation water. A short distance above Martinsdale, a headgate diverts water from the South Fork through a 408 cfs capacity canal for irrigation and storage in Martinsdale Reservoir. During much of the summer, the stream is completely de-watered below this point.

Survey Work

An upper section of the stream, approximately three miles below Lennep, was electrofished in August, 1970. Brook trout were the predominant species present; rainbow were abundant and a few brown trout and white and longnose suckers were captured. Number and average size are given in Table 8.

Table 8. Species, number, average length and weight of fishes electrofished from the South Fork of the Musselshell River near Lennep in 1970.

Species	Number	Avg. Length(in.)	Ave. Weight(lbs.)
Brook trout	92	8.1	.25
Rainbow trout	66	7.3	.24
Brown trout	6	12.5	.95
White sucker	5	8.0	.22
Longnose sucker	5	9.2	.42

A section (4,668 feet in length), approximately three miles above the town of Martinsdale, was electrofished and a population estimate made (Table 9). Ninety-six percent of the trout caught were browns, with the remainder being rainbow. Both

white and longnose suckers were also taken. In contrast to the upper section, no brook trout were taken.

Table 9. Population estimate, 95% confidence limits, species, average length and weight of fishes electrofished from the South Fork of the Musselshell River above Martinsdale in 1970.

	Ave. Length(in.)	Ave. Weight(lbs.)
Brown trout	11.3	.70
Rainbow trout	11.3	.65
White sucker	14.8	1.36
Longnose sucker	14.5	1.26

All trout

Total per section	690
95% confidence limits	528 - 852
Number per acre	172

Habitat on the South Fork is good although there has been some channelization in the Lennep area. For the most part, there is sufficient brush cover along the streambank and streambed, silt is heavy only for a short distance above Martinsdale. The influence of the North Fork diversion canal (105 cfs capacity) causes problems here, due to the silt load it often carries. There are some banks which are eroding and causing cottonwood trees to fall, changing the patterns of flow in the lower section.

Two bottom fauna samples were taken from the upper and lower sections of the stream. Invertebrates were most abundant at the lower section. Caddis flies were the predominant organisms from both sections (Table 10).

A thermograph was located on the Galt Ranch about three miles above Martinsdale (Sec. 17, T8N, R11E) from July 8 through October 31, 1970. Temperature extremes were 35° F. and 69° F.

According to USGS records, the 1968 average flow from the South Fork above Martinsdale was 89 cfs, with extremes of 840 cfs and 14 cfs. For the water year 1969, the average flow was 62.4 cfs, with extremes of 313 and 10 cfs.

Table 10. Number of organisms taken from two square feet bottom samples from upper and lower sections of the North and South Forks of the Musselshell River, August, 1970.

Invertebrates	North Fork		South Fork	
	Upper	Lower	Upper	Lower
Trichoptera				
Brachycentridae	5	133	158	338
Leptoceridae	--	1	--	6
Glossosomatidae	--	1	18	62
Hydrosychidae	1	13	--	28
Limnephilidae	--	--	--	5
Ephemeroptera	51	18	9	76
Plecoptera	7	--	6	75
Diptera				
Tendipedidae	33	22	6	27
Simulidae	67	--	--	13
Tipulidae	--	--	--	4
Unknown	--	10	--	--
Coleoptera	8	--	54	113
Mollusca				
Physidae	--	2	--	--
Total number	172	200	251	747

Tributaries

A 332-foot section of Cottonwood Creek was electrofished in August. The section is located five miles upstream on the Martinsdale - Lennep highway. Fish present were predominantly brook trout, but rainbow and brown trout were also taken (Table 11). Portions of the stream are dried up every summer and fall by water users above the Martinsdale highway.

Three hundred feet of stream were electrofished on Alabaugh Creek, approximately four miles above Lennep. Nearly all the fish taken were brook trout (Table 11).

A short section (275 feet) was electrofished on Bozeman Fork Creek approximately seven miles above Lennep on the Orville Rostad Ranch. Brook trout were the most abundant species present but rainbow were also taken (Table 11).

A 300-foot section of Warm Springs Creek, approximately nine miles above Lennep, was electrofished. Small brook trout were the only species of trout taken, (Table 11).

Table 11. Species, number, average length and weight of trout electrofished from tributaries of South Fork of the Musselshell River, 1970.

	Length Shocked(ft.)	Number of Fish	Average Length(in.)	Average Weight(lbs.)
Cottonwood Creek	332			
Brook trout		82	6.1	.11
Rainbow trout		25	7.4	.25
Brown trout		12	7.3	.26
Sculpins		Numerous	--	--
Alabaugh Creek	300			
Brook trout		67	6.7	.09
Rainbow trout		3	5.1	.06
Sculpins		Abundant	--	--
Bozeman Creek	275			
Brook trout		45	6.2	.14
Rainbow trout		17	5.7	.08
Sculpins		Common	--	--
Warm Springs Creek	300			
Brook trout		118	5.4	.08
Sculpins		Numerous	--	--

The South Fork of the Musselshell should not be stocked with any fish, as it contains an adequate wild trout population in the portion that is not de-watered. A creel census should be conducted to determine success of fishermen, most popular areas fished, and species of fish most abundant in the creel.

An attempt should be made to curb the State Water Board's practice of completely de-watering the stream near Martinsdale. The stream is dried up every year below the headgate that carries water from the South Fork to Martinsdale Reservoir.

North Fork Musselshell River

The North Fork of the Musselshell River is a small stream arising in the Little Belt Mountains. It receives numerous small tributaries from Castle and Little Belt Mountain drainages. The stream is fished more heavily than the South Fork

and is dependent to a great degree on plants of hatchery rainbow trout to help sustain this fishery. This fork is also important for irrigation. Water is stored in Bair (Harris) Reservoir near its upper end and water is diverted to the South Fork to augment flow into Martinsdale Reservoir.

Survey Results

Three sections were electrofished in June and July, 1970 and population estimates made for two of them. The North Fork above Harris Reservoir was electrofished in June, 1971. Thirty-five brook trout and 10 rainbow were caught in the 300 foot section. The brook trout averaged 5.6 inches in length and .09 pounds. The averages for the rainbow trout were 5.9 inches and .11 pounds.

The middle section (4,017 feet) was located on the Christianson Ranch a short distance below Checkerboard. Brook trout were the predominant species of trout, with brown trout nearly as abundant. Rainbow trout, whitefish and numerous white suckers were also caught. Population estimates and average size of fishes are given in Table 12.

Table 12. Population estimates, average length and weight of trout and whitefish electrofished from 4,077 feet of North Fork of the Musselshell, near Checkerboard, 1970.

		Average Length(in.)	Average Weight(lbs.)
Brown trout			
Total per section	217	9.9	.52
95% confidence interval	137-297		
Number per acre	136		
Brook trout			
Total per section	236	7.5	.22
95% confidence interval	180-292		
Number per acre	148		
Rainbow trout			
Total per section	88	8.1	.26
95% confidence interval	32-144		
Number per acre	55		
Whitefish			
Total per section	14	10.9	.58
95% confidence interval	24-104		
Number per acre	40		

Table 12 Continued.

All trout	
Total per section	187
95% confidence interval	494-562
Number per acre	330

The lower section (4,400 feet) electrofished was located on the Bair Company Ranch two miles north of Martinsdale. Ninety-eight percent of the trout taken were browns, with the remainder being rainbow. No brook trout or whitefish were caught. Population estimate and average size of fish are given in Table 13.

Table 13. Population estimate, average length and weight of brown trout electrofished from 4,400 feet of the North Fork of the Musselshell River near Martinsdale, 1970.

		Length(in.)	Weight(lbs.)
Brown trout			
Total per section	283	13.0	.84
95% confidence interval	219-347		
Number per acre	105		

Bank brush cover is abundant on the North Fork. However, heavy silt deposits are present, especially in the lower section near its confluence with the South Fork.

The fluctuating discharge from Harris Reservoir is detrimental to fish production. A continuous stable flow would help the creek considerably.

Two bottom fauna samples were collected from the upper and lower sections of the stream. As was observed in the South Fork, invertebrates were more abundant in the lower section (Table 10).

A thermograph was located on the North Fork just below the confluence of Spring Creek from July 8 through October 29, 1970. Temperature extremes were from 38° F. to 69° F. Average

daily minimum and maximum temperatures for July 8 through September 30 were 52° F. and 63° F., respectively.

According to USGS records for the calendar year 1968, the average flow of the North Fork near Delpine was 16.3 cfs with extremes of 51 and 4 cfs. For the water year 1969, the mean flow was 11.7 cfs with extremes of 140 and 4 cfs.

Tributaries

A short section of Checkerboard Creek at Checkerboard was electrofished in September, 1970. Rainbow and brook trout were the predominant species. Several brown trout, whitefish and white suckers were also caught.

Seventeen rainbow trout averaged 6.4 inches in length and .12 pounds. Brook trout (16) were 5.7 inches and .13 pounds. Six brown trout averaged 7.9 inches and .35 pounds.

Flagstaff Creek is a small stream (14 cfs near the headwaters), 3½ miles southeast of Checkerboard. The stream was closed to fishing by the Montana Fish and Game Commission years ago due to landowner-fisherman problems. There is a small reservoir located two miles upstream from the mouth which is open for fishing during the months of January and February annually, however. Irrigation water is withdrawn above and below the reservoir.

Three sections were electrofished on the stream, two above the reservoir (475 feet and 300 feet) and one below (350 feet). Brook, rainbow, cutthroat and rainbow-cutthroat hybrids were found in the two upper sections. No other species of fish were caught above the reservoir. Brook and brown trout were the predominant species in the stream below the reservoir. Rainbow and a few sculpins were also taken.

Population estimates for the three sections are given in Table 14.

Fifteen hundred catchable rainbow trout should be stocked annually in areas of highest use in the North Fork of the Musselshell.

An agreement should be made with the State Water Board to release water from Harris (Durand) Reservoir at a stable and continuous flow.

Pollution from private homes (sewage), dumping of livestock manure along streambanks, and silt from irrigation ditches leading back into the streams should be stopped.

Flagstaff Creek near Checkerboard offers an excellent opportunity for studies of various types, since the stream is closed to fishing. Research work on fish populations could be conducted on the small stream.

Table 14. Number and size of trout caught in Flagstaff Creek and estimated populations for three sections, 1970.

	Species of Trout		
	Rainbow	Brook	Brown
Upper Section			
No. of fish captured	130	162	--
Average length (inches)	7.7	7.4	--
Average weight (pounds)	.24	.20	--
Population estimates	221	287	--
95% confidence limits	191-251	251-323	--
Number per acre	2,009	2,609	--
Middle section			
No. of fish captured	32	145	--
Average length(inches)	7.1	6.9	--
Average weight (pounds)	.19	.17	--
Population estimate	45	175	--
95% confidence limits	35-55	159-191	--
Number per acre	1,125	4,375	--
Lower Section			
No. of fish captured	11	91	43
Average length (inches)	9.4	6.2	8.2
Average weight (pounds)	.43	.15	.38
Population estimate	18	217	84
95% confidence limits	15-21	165-269	58-110
Number per acre	300	3,617	1,400

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

20-7950
14-7440
18-8610
18-1380
18-0060
18-6480
18-0660
18-1080
18-2580