FISH DISTRIBUTION OF THE TONGUE RIVER AND TONGUE RIVER RESERVOIR AS RELATED TO MAJOR HABITAT AREAS, INSTREAM FLOW NEEDS AND PROPOSED COAL DEVELOPMENT.

Al Elser
Montana Department of Fish and Game
June 1975

BACKGROUND

The headwaters of the Tongue River rise in the Bighorn Mountains of Wyoming. The river generally flows northeast out of Wyoming, to its confluence with the Yellowstone River at Miles City. Flows in Montana are controlled by the Tongue River Dam. This 3,500 acre impoundment was constructed in 1938 by the Montana Water Resources Board as an irrigation storage reservoir. Above the reservoir, the river meanders through a broad open valley with a wide floodplain. Turbid water, slow velocity, muddy bottoms and warm temperatures characterize the stream. Downstream from the dam, the river flows for 10 miles through a narrow, restrictive canyon. As gradient increases, water temperatures cool and gravel bottoms are common. From the canyon to the river's mouth, the valley again broadens and physical characteristics change from those of the canyon into a slow, meandering stream.

The Tongue River is important to the people of southeastern Montana. It provides water for domestic use by man and livestock, irrigates crops and offers recreation.

As coal development threatens the Tongue River drainage, the river takes on a new importance. The Decker-Birney Resource Study of April, 1974, identified strippable coal reserves underlying 359,333 acres of the planning unit in the Tongue River drainage. Approximately 285,000 acres of this planning unit is composed of superior reserves - containing 15 billion tons of coal - which are economically feasible to mine. Other coal reserves exist outside the Decker-Birney unit, yet are associated with the Tongue River.

The Tongue River and Tongue River Reservoir will become increasingly important in light of proposed coal development. While most coal mined in Montana now leaves the state, coal conversion complexes (steam-fired generation, gasification and liquefaction plants) close to the coal source loom on the horizon. Such energy complexes require great amounts of water and the Tongue is considered an important source of industrial water.

In 1972, a new Tongue River dam site was identified by the Montana-Wyoming Aqueduct Study. The new reservoir would inundate about 12 more miles of Tongue River country and provide an additional 60,000 acre-feet of water. The magnitude of the proposed industrial use of the Tongue River makes it imperative that fish populations are inventoried and that adequate flow levels are insured to protect the fishery.

Fish population studies in Montana have received far less attention in warm water streams than in cold water streams. Two important aspects

of warm water stream investigations are lacking: (1) few estimates of total fish population numbers have been made, and (2) fish collecting methods have not been devised and evaluated for warm-water environments (Larimore, 1961). Early interest in and high esteem placed on trout fishing has been the primary cause of differences. Another factor is the greater difficulties encountered in working warm-water streams with their more diversified habitats and larger, more varied fish populations.

OBJECTIVES

The objectives of this study are to inventory the fish populations of the Tongue River, its major tributaries and Tongue River Reservoir, to determine species composition, distribution and diversity indicies for various habitat areas occurring in the river system, to evaluate instream flow needs to determine flow levels adequate to protect the fishery, and to evaluate possible impacts of proposed coal development on the Tongue River Reservoir.

METHODS

Major habitat zones were delineated for the Tongue River through the use of aerial photos, U.S.G.S. quad maps, and on ground observations. Physical characteristics in each zone will be determined with the aid of the Water Surface Profile Program, developed by the Bureau of Reclamation. This program allows the users to predict and/or study various changes in stream characteristics at many different flows. The program model is calibrated to a specific stream section using one or two observed flows, the corresponding water surface elevations, and cross sectional data at various locations in the stream section (Dooley, 1975). These measurements are obtained through standard surveying methods.

Water temperatures were monitored utilizing a Taylor 30-day recording thermograph. The recording sheets were changed monthly. Daily maximum-minimum temperatures were tabulated. All water temperatures were recorded in Farenheit degrees.

Aquatic invertebrates were sampled by the Needham kick-screen method to evaluate species distribution. Samples were collected in September and November and were keyed by Robert Newell, Montana Department of Fish and Game.

Fish populations were sampled by several methods. Electrofishing gear with an output of 0-500 volts variable direct current was utilized to sample fish populations in the river and tributaries. The gear was fished either from a fiberglass boat as described by Vincent (1971) or from the banks of smaller streams. Baited hoop nets (3-foot hoops with 1-inch mesh webbing - and wire frame traps were fished for channel catfish. Trap nets with 4-foot by 6-foot frames (1/2-inch and 1/4-inch mesh) were utilized in the Tongue River Reservoir. A 100-foot, 1/4-inch mesh beach seine and a 4-inch bar mesh gill net was also utilized to sample fish populations. Numbered Floy filament tags were used to mark fish.

Fish population statistics were calculated by computer as described by Vincent (1974). Species diversity indicies were calculated according to the formula described by Shannon and Weaver (1964).

RESULTS

PHYSICAL PARAMETERS

Collection areas were established on 11 reaches of the river downstream from the Tongue River Dam (Figure 1). Primary sampling sections (IB, IIB, IIIA, IVB, VB, VC) were established in relation to irrigation diversion structures to evaluate fish distribution (Table 1). Section VB was established as a major sampling section since the New Tongue River Dam was located in the section. Sections ranged in length from 8,200 feet to 13,332 feet, while gradients varied from 2.94 feet/mile near the mouth to 6.67 feet/mile in the canyon. There was a decrease in gradient progressing downstream (Figure 2). Secondary sections (IA, IIA, IIIB, IVA, VA) were established to delineate fish distribution in the river.

Water temperatures were recorded at station IA from March - December. Temperatures greater than 70° were recorded for 92 days and 47.8% of those days the temperature exceeded 80°. The maximum temperature recorded was 90° in mid-August. The mean monthly maximum and minimum temperatures are shown in Figure 3. Thermographs were installed at stations IIIA and VC.

Table 1. Description of major sampling sections, Tongue River.

Section	Location (miles) 1/	Upstream Barrier	Length (ft)	Gradient (ft/mile)
IB	14.1	T and Y Diversion	12,650	2.94
IIB	70.5	S-H Diversion	11,669	3.57
IIIA	90.6	Mobley's Diversion	13,332	4.00
IVB	156.7	Brewster's Diversion	11,669	3.45
VB	177.5	Tongue River Dam	8,870	6.67
VC	186.6	Tongue River Dam	8,200	6.45

1/ River miles above the mouth

FISH POPULATION-TONGUE RIVER

Species Distribution- Twenty-nine species of fish representing 10 families were collected during 1974 on the Tongue River. Common names of fishes used in this report correspond to those presented by the American Fisheries Society (1970). Of these species, three (burbot, shovelnose sturgeon and blue suckers) were taken only during the spring sampling near the mouth and are considered to be migrant species.

The nature of the qualitative distribution is shown in Table 2. Grouping by sections obscures the variation encountered but illustrates broad trends of fish distribution. Six species ranged the length of the

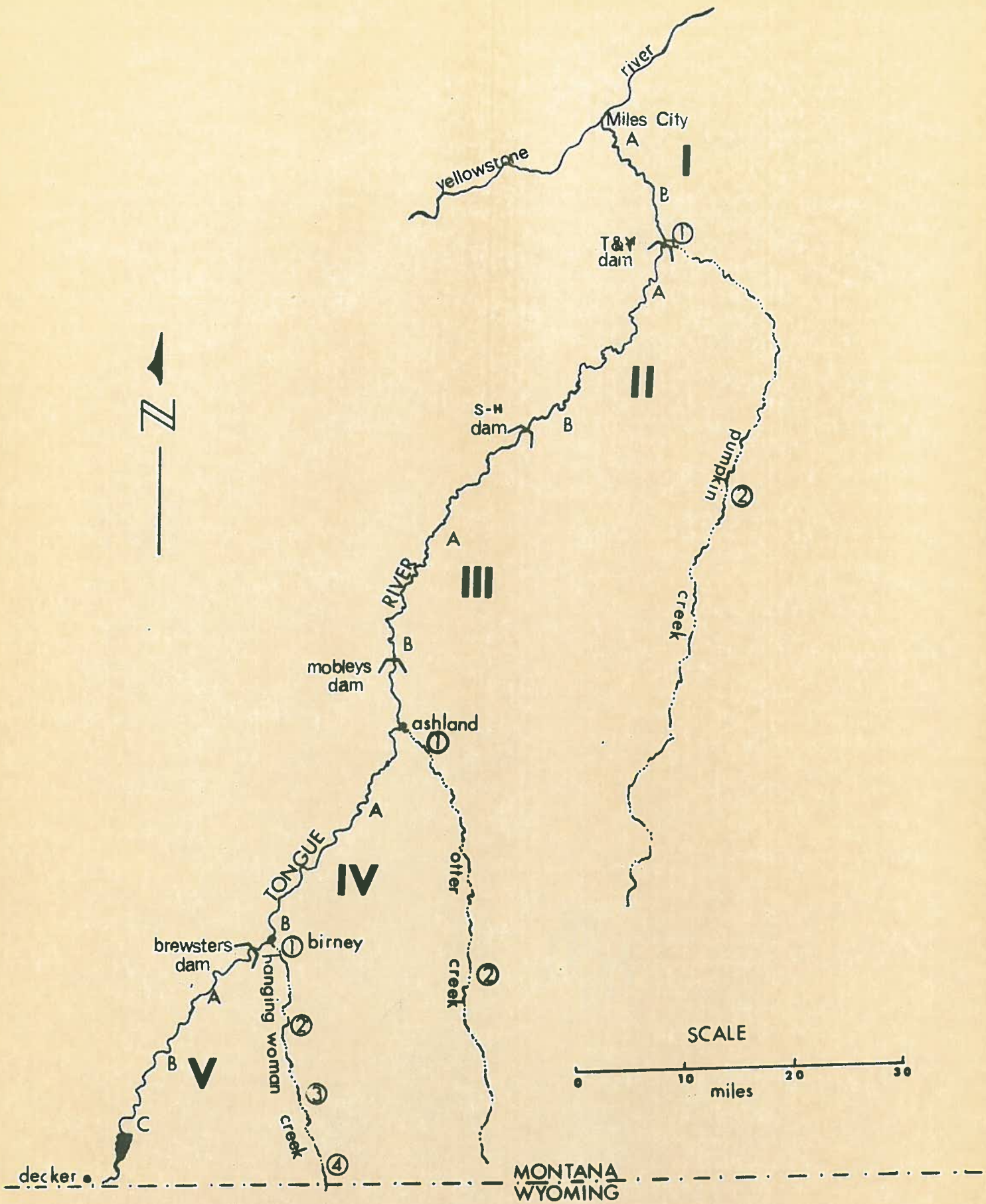

Figure 1. Map of the Tongue River, showing sampling sections and major tributaries.

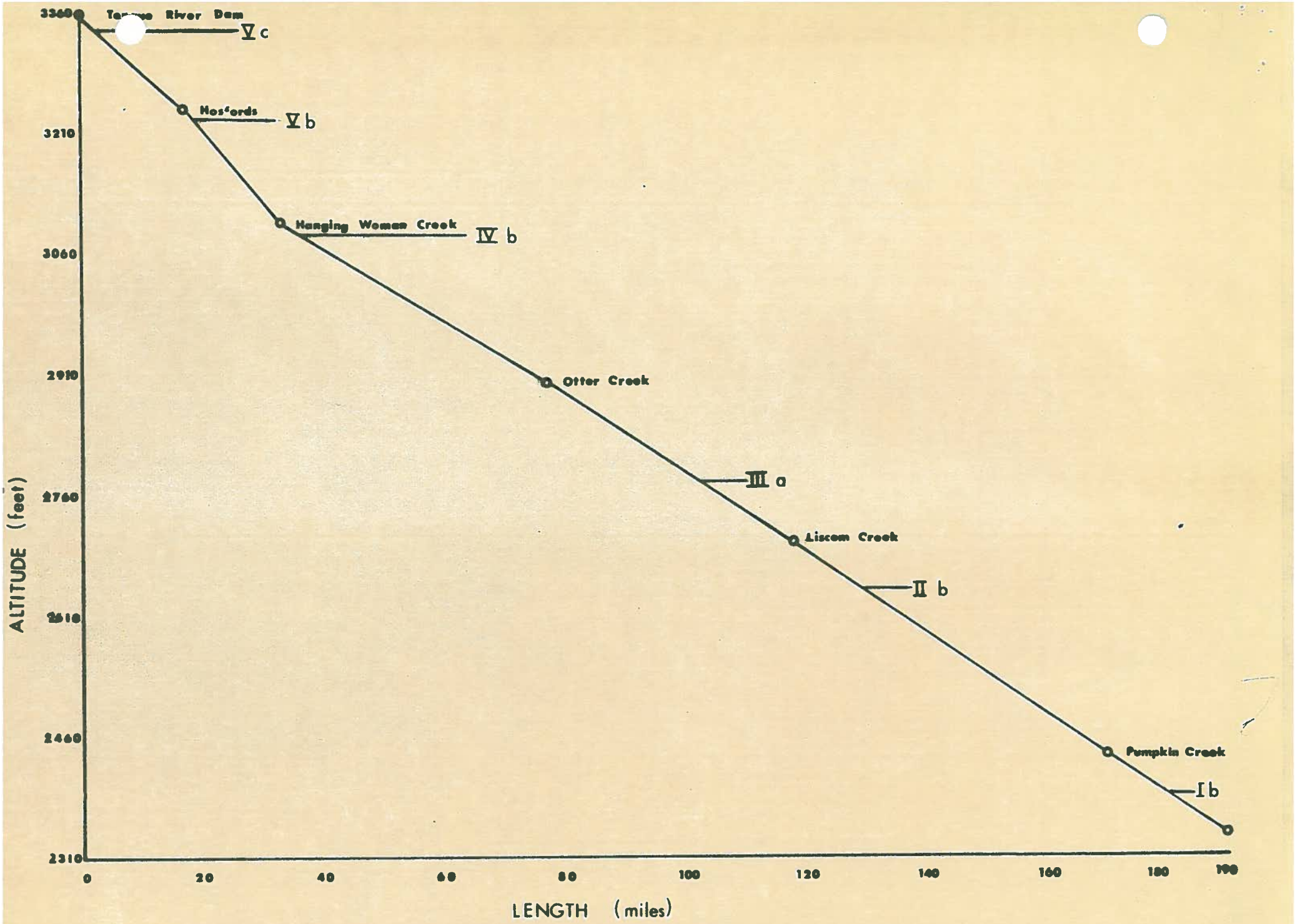

Figure 2. Longitudinal profile of the Tongue River from Tongue River Dam to its mouth.

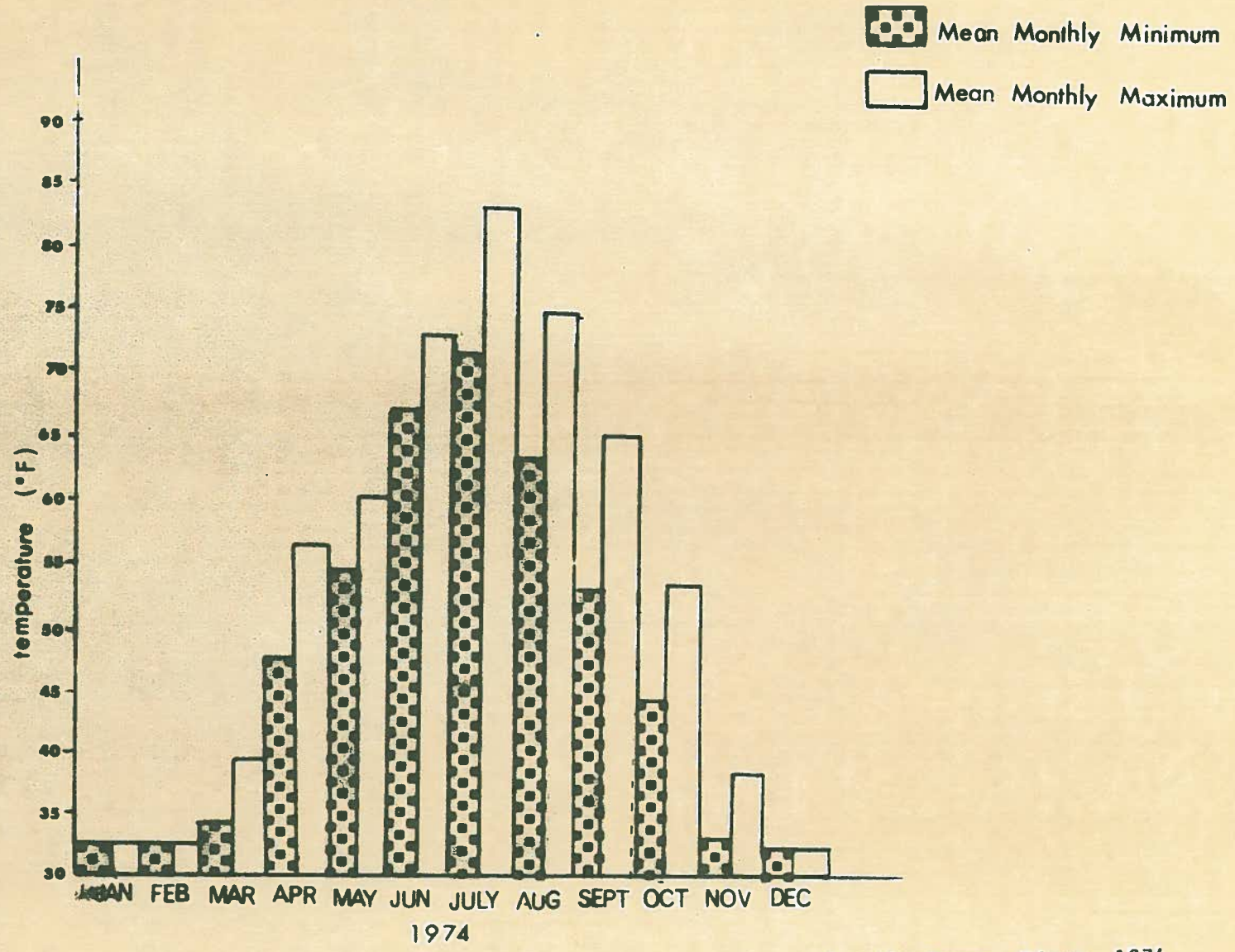

Figure 3. Mean monthly maximum and minimum temperatures for the Tongue River, 1974.

stream. Mountain whitefish and brown trout were confined to the upstream zone.

Longitudinal distribution of fish in the Tongue River is influenced by irrigation diversion structures. The T and Y diversion is the upstream limit for goldeye, walleye, burbot, shovelnose sturgeon, blue suckers and sturgeon chubs. Channel catfish did not occur above the S-H diversion. Flathead chubs are found upstream from the Mobley diversion, but in limited numbers when compared to downstream sections. Brewster's diversion is the upper limit for river carpsuckers and smallmouth bass.

Table 2. Distribution of fishes in the Tongue River by zones, in 1974.

	ZONE				
Species	V	IV	III	II	I
Carp	*	*	*	*	*
Stonecat	*	*	*	*	*
Shorthead redhorse	*	*	*	*	*
White sucker	*	*	*	*	*
Longnose sucker	*	*	*	*	*
Longnose dace	*	*	*	*	*
White crappie	*	*		*	*
Mountain sucker	*	*	*	*	
Rainbow trout	*	*	*		
Rock bass	*	*	*		
Black crappie	*	*			
Yellow perch	*	*			
Northern pike	*	*			
Whitefish	*				
Brown trout	*				
Green sunfish		*	*	*	
Smallmouth bass		*		*	*
Pumpkinseed		*			*
Black bullhead		*	*		
Flathead chub		*	*	*	*
Sauger		*	*	*	*
River carpsucker		*	*	*	*
Channel catfish				*	*
Goldeye					*
Burbot					*
Walleye					*
Shovelnose sturgeon					*
Blue sucker					*
Sturgeon chub					*
Total No. Species	15	20	14	14	19

Population Numbers and Species Composition- The fall electrofishing samples are summarized in Table 3. Estimates of total population numbers and biomass are not completed, therefore results are expressed as numbers and pounds of fish collected per mile of stream. Each sample is made up of six electrofishing trips. Numerically, flathead chubs were dominant in sections

Table 3. Summary of electrofishing samples for the Tongue River, fall, 1974; expressed as number of fish per mile of stream (Total weight shown in parenthesis).

SPECIES	SECTION					
	IB	IIB	IIA	IVB	VB	VC
Goldeye	33 (17.5)					
Mt. Whitefish					1 (0.2)	
Rainbow trout				1 (0.9)	2 (4.0)	18 (20.3)
Brown trout						3 (2.6)
Northern pike				3 (18.8)		
Carp	58 (102.1)	65 (118.3)	4 (8.4)	27 (86.4)	33 (16.5)	79 (214.9)
Flathead chub	133 (6.6)	148 (13.3)	165 (11.6)	5 (0.3)		
Sturgeon chub	1 (T)					
Silvery minnow			2 (T)			
Fathead minnow		1 (T)				
Longnose dace	3 (T)	2 (T)	15 (0.3)	1 (T)	3 (0.1)	
River carpsucker	26 (26.0)	130 (49.4)	4 (2.7)	45 (39.2)		
Shorthead redhorse	88 (69.5)	216*(116.6)	73 (47.5)	283*(274.5)	14 (15.3)	296 (731.1)
Longnose sucker	8 (4.8)	47 (27.3)	21 (16.0)	62 (65.1)	76 (14.4)	770 (1239.7)
White sucker	8 (6.0)	8 (12.1)	22 (12.8)	125 (87.5)	311*(307.9)	151 (249.2)
Mountain sucker		1 (T)	7 (0.4)		1 (0.3)	8 (1.1)
Black bullhead			1 (0.1)	1 (0.6)		
Channel catfish	7 (18.3)	24 (70.3)				
Stonecat	9 (0.6)	40 (2.0)	41 (3.3)	65 (7.2)	82 (0.8)	34 (4.1)
Rock bass		1 (0.3)	5 (1.6)	30 (4.2)	11 (1.8)	
Green sunfish		1 (T)	1 (T)	7 (0.3)		
Pumpkinseed	1 (0.1)			7 (0.1)		
Smallmouth bass	1 (0.2)	2 (0.5)		88 (9.7)		
White crappie	2 (0.3)	2 (0.3)	2 (0.3)	2 (0.5)	2 (0.2)	1 (T)
Black crappie	1 (0.1)			1 (0.1)	1 (0.1)	
Yellow perch				3 (0.2)	4 (0.4)	10 (0.6)
Sauger	58 (56.3)	11 (9.9)	11 (9.9)	5 (4.6)		
Walleye	5 (5.3)					
Total	442 (313.7)	699 (420.3)	361 (106.0)	761 (600.2)	541 (362.0)	1370 (2463.6)
No. of Species	17	16	14	19	13	11

IB (30.1% of the total number) and IIIA (45.7%), followed by shorthead redhorse (19.9 and 20.2%, respectively). Shorthead redhorse were dominant in sections IIB (30.9%), and IVB (37.2%). Carp dominated sections IB and IIB by weight, while shorthead redhorse predominated sections IIA, IVB, and VC. White suckers dominated section VB both numerically and by weight and longnose suckers were dominant in Section VC. Sucker distribution grades from predominately longnose in section VC, to white sucker dominance in section VB, with shorthead redhorse dominance in the remaining reaches (Figure 4).

Game fish concentrations were heaviest in section IVB and made up 12.7% of the total number, with smallmouth bass the dominant game fish. Smallmouths ranged in length from 2.1 to 13.5 inches and the preponderance of young-of-the-year fish indicates that they are successfully reproducing. Smallmouth bass were also found downstream from the S-H diversion, but the greatest concentration was near Birney.

Northern pike were also captured in section IVB. The inclusion of small northerns (9.3 inches in length) suggests that these fish are also reproducing in the river. The lower reaches of Hanging Woman Creek would provide excellent northern pike spawning habitat and probably acts as a nursery area for the Tongue River population of northerns.

The Tongue River supports the only rock bass population in Montana. Greatest numbers of rock bass were found in sections IVB and VB. All size classes were represented in the samples.

The greatest number of channel catfish was found in section IIB, with the largest fish weighing 7.25 pounds. Sauger were most abundant near the mouth, in section IB, and made up 13.1% of the total numbers captured. The largest sauger caught weighed 2.50 pounds.

Species Diversity- Species diversity indicies have been used by biologists to provide insight into the structure of natural communities and as possible indicators of qualitative aspects of their surrounding environments. A low diversity index (d) indicates a largely monotypic community dominated by a few abundant organisms, while a high diversity index suggest a heterogeneous community in which abundance is distributed more evenly among a number of species (Robert Newell, personal communication). Redundancy (R) was also used as an index of the repetition of information within a community, expressing the dominance of one or more species and is inversely proportional to the wealth of the species (Wilhm and Dorris, 1968).

While species diversity indicies have been used extensively with benthic macroinvertebrates to evaluate degradational environmental conditions, they have recently been applied to fish populations (Sheldon, 1968; Jackson and Harp, 1973; and Harlan and Mundy, 1974). Indicies of species diversity (d) and redundancies (R) were calculated for the 6 primary sampling sections on the Tongue River. The diversity indicies increased with progression downstream (Figure 5), indicating an increase of rarer species in the lower reaches. One exception was section IVB, which did not fit the curve. This section had the greatest number

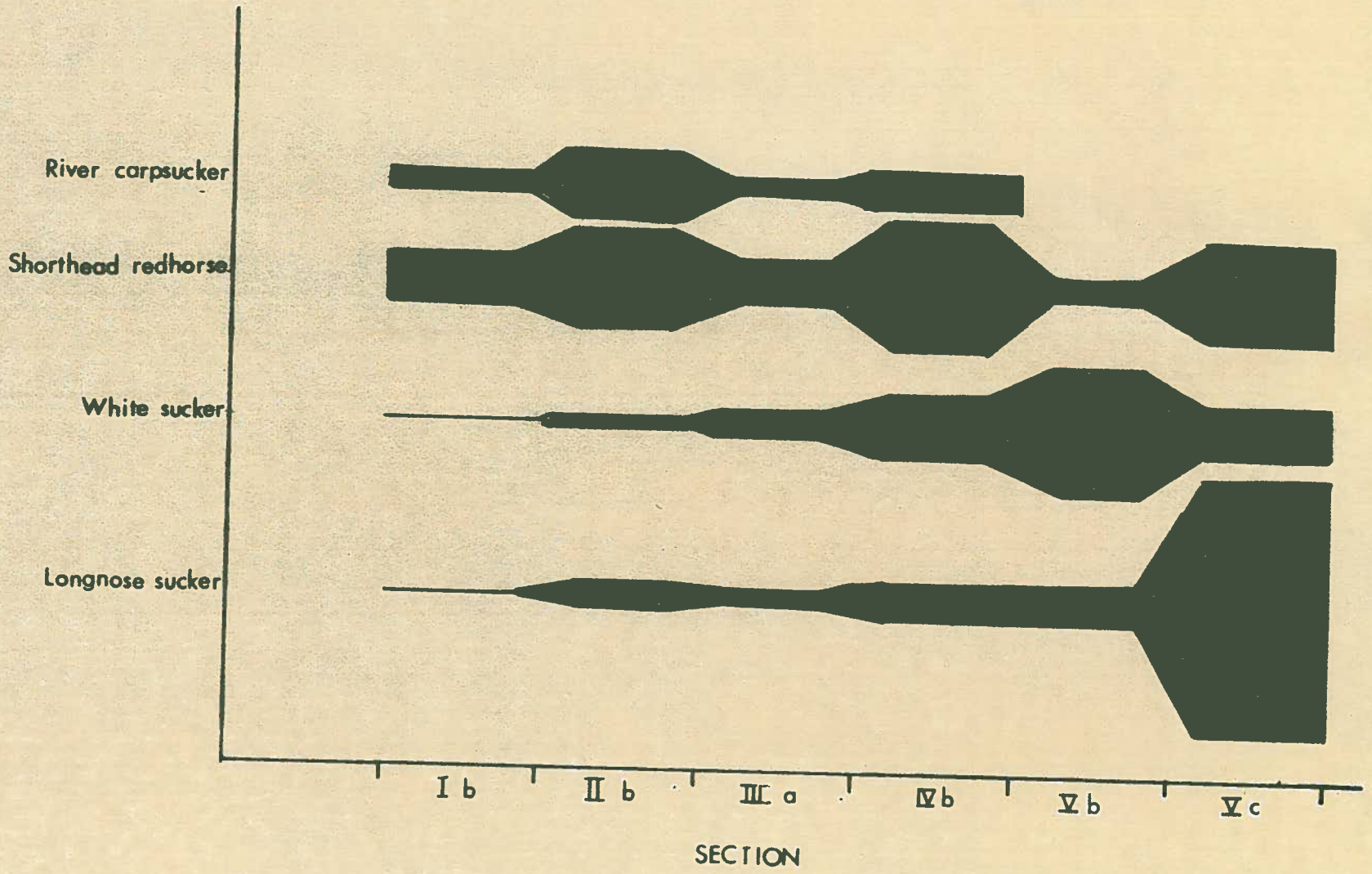

Figure 4. Longitudinal distribution of suckers in Tongue River. The width of the line indicates abundance of a species, with the widest place where the greatest numbers were present and can be used as a comparison between species abundance.

of species, many represented by few individuals. However, as Jackson and Harp (1973) showed, longitudinal distribution in a stream is not necessarily a continuous change since specific conditions and populations may reappear at intervals throughout the stream system. Redundancy substantiates the d concept since R increases with dominance by one or more species (Figure 5). Fish populations in the upstream sections were dominated by one or two species represented by a large number of individuals. And the populations in the lower reaches lack a strongly dominant species.

Measures of species diversity add another handle to the quantitative and qualitative description of a fishery. By collecting baseline data a change in the fish population can be observed by comparing diversity and redundancy. It is a generally accepted concept that a large-scale environmental stress exerted upon a diverse biological community results in a reduction of species diversity (Cairns, 1969).

Tagging - A total of 1,060 fish were tagged in the Tongue River during 1974 to evaluate movements and relative angler harvest (Table 4). Migrant shovelnose sturgeon, sauger, walleye, channel catfish and other non-sport fish were tagged in the spring in an attempt to determine home ranges of these fish in the Yellowstone River. Of 421 shovelnose sturgeon tagged, only 3 (0.71%) fish were returned, all from the Yellowstone. Sauger tag returns were also higher in the Yellowstone than in the Tongue (2.33% as compared to 0.33%, respectively). A total angler return rate of 1.51% suggests a fishery resource that is not being utilized by anglers.

Age and Growth - Scales were collected from all species taken in the primary sampling sections as a comparison of age and growth. Scales are currently being prepared for analysis and will be worked during the next quarter.

Migrant Fish Populations- Sampling during the spring of 1974 in the lower reaches of the Tongue River (downstream from the T and Y Diversion) revealed a large number of fish moving into the river from the Yellowstone. Sauger, shovelnose sturgeon and blue suckers moved into the river in sizable numbers. Gonadal development suggested spawning runs were being made by these fish. Sauger concentrations became obvious from fishermen use during mid-April and were present in the river until spring run-off precluded sampling efforts.

The run of shovelnose sturgeon was monitored during the period April 4 to July 8, with 427 fish captured (Peterman and Haddix, 1975). A total of 421 sturgeon were tagged and released. Two methods were used to tag sturgeon in 1974. Serially numbered Floy (FD-67) anchor tags were placed immediately posterior to the dorsal fin and number 3 monel wing band tags were placed over the anterior fin rays of the pectoral fin (Helms, 1974).

Shovelnose sturgeon were sampled again in the lower Tongue in 1975. Through June 13, 485 fish were captured, tagged and released. Sampling is continuing at the writing of this report. The first sturgeon was captured in 1975 on May 9 as compared to April 4 in 1974. However,

Table 4, Summary of fish tagging and angler returns, Tongue River, 1974. (Percent returns shown in parenthesis).

Species	Number Tagged	Tongue River	Yellowstone River	Total
Shovelnose sturgeon	421	-	3 (0.71)	3 (0.71)
Sauger	301	1 (0.33)	7 (2.33)	8 (2.66)
Channel catfish	194	1 (0.52)	1 (0.52)	2 (1.03)
Smallmouth bass	34	1 (2.94)	-	1 (2.94)
Rock bass	33	-	-	-
Rainbow trout	28	1 (3.57)	-	1 (3.57)
Walleye	16	1 (6.25)	-	1 (6.75)
Burbot	11	-	-	-
Blue sucker	11	-	-	-
Northern pike	5	-	-	-
White crappie	3	-	-	-
Bigmouth buffalo	2	-	-	-
Drum	1	-	-	-
Total	1060	5 (0.47)	11 (1.04)	16 (1.51)

large concentrations of fish were not found in 1974 until around May 9 (Peterman and Haddix, 1975). Cooler water temperatures in 1975 may have caused the later arrival of fish. Numbered Floy (FD-67) anchor tags were used in 1975, but were placed through the pectoral girdle as described by Helms (1975).

Average lengths and weights of fish captured in 1975 were 29.4 inches (fork length) and 5.26 pounds, respectively (Table 5), and are comparable to fish taken in 1974, 30.2 inches (fork length) and 5.35 pounds, respectively. The largest fish taken in 1974 weighed 15.5 pounds as compared to a maximum of 13.25 pounds in 1975. The weight-frequency distribution is also comparable between years. In 1974, 26.0% of the fish weighed six pounds or more; 11.0% weighed 8 pounds or more and 5.0% weighed 10 pounds or more (Peterman and Haddix, 1975), as compared to 26.9% greater than 6 pounds, 10.9% greater than 8 pounds and 2.5% greater than 10 pounds in 1975. The Tongue River run appears to be composed of larger sized fish than reported elsewhere. In the lower Missouri River, the average weight was about one pound, with four pound fish considered rare (Schmulbach, 1974), while the average size reported by Helms (1974) from the Mississippi River was between 2 and 3 pounds. Limited sampling in the Yellowstone near Intake also revealed smaller fish with a average weight of 2.19 pounds (Peterman and Haddix, 1975). The larger size of fish in the Tongue may result from sampling a spawning population. Still, the numberof fish greater than maximums reported in other areas is significant.

Tag returns of 1974 fish taken during routine sampling in 1975 totaled 7.4% (31 of 420) through June 13. Of 240 fish tagged with monel tags, 19 (7.9%) have been returned, compared to 6.6% (12 of 180) Floy anchor tag returns. Through June 13, the tag return rate of 485 sturgeon tagged in 1975 was running 5.4%. Angler returns have been slight, averaging less than 0.5%, suggesting low harvest rate.

Monel tag returns showed that the tag had become completely encased with skin tissue and appeared simply as a raised area on the fin. Calculating

growth rate on tag returned fish revealed that all fish tagged with monel tags had lost considerable weight, while Floy tagged fish showed weight gain. Eighteen fish returned with monels lost an average of 0.80 pound per fish (range of 0.31 - 3.00 pounds), while 11 fish returned with Floy tags showed a weight gain of 0.32 pound per fish (range of 0.0 - 0.85 pounds). Apparently monel tags caused a physiological change significant enough to result in a weight loss.

Other fish taken coincidentally with sturgeon sampling were tagged and released (Table 5). Tag returns were collected from sauger which had been tagged in 1974. All returns came from approximately the same place where they were tagged. Several paddlefish were observed during shocking operations on the lower Tongue. While none were collected due to their large size, their presence in the Tongue River shows the importance of the river.

Table 5. Summary of fish sampling in the lower Tongue River, April 23-June 13, 1975.

Species	Number	Average Length 1/	Average Weight	Number Tagged
Shovelnose sturgeon	485	29.6	5.26	485
Sauger	104	15.2	1.02	89
Channel catfish	37	20.7	4.53	37
Blue suckers	13	27.1	6.56	13
Bigmouth buffalo	12	21.5	6.23	12
Walleye	2	18.5	1.97	2
Northern pike	1	28.2	6.50	1
Smallmouth bass	1	14.8	1.84	1
Ling	1	13.3	0.58	1
Drum	1	19.8	4.28	1
Total	658			643

1/ Fork length

Passage and spawning flow requirements are an important consideration in determining instream flow needs for fish. Apparently a large number of Yellowstone River fish utilize the lower Tongue River as a spawning and nursery area. It will be important to monitor the use of the Tongue by spawning fish to evaluate passage flow needs and to attempt to locate spawning areas to determine spawning needs. Effort will be expended during the next quarter to locate spawning areas and evaluate passage flow requirements.

Fish Populations of Tributaries- Fish populations were sampled in the major tributaries of the Tongue River to evaluate species distribution and species composition. The major tributaries and river mile at its confluence with the Tongue are: Pumpkin Creek, 20.0; Otter Creek, 112.7; and Hanging Woman Creek, 156.7. Two sampling sites were establishedon Pumpkin and Otter Creeks and four on Hanging Woman Creek.

The distribution of fish for the tributaries is shown in Table 6 and 7. The stations nearest the mouth in each tributary showed the greatest number

Table 6, Distribution of fish in Pumkin Creek and Otter Creek, 1974.

Pumpkin Creek			Otter Creek Stations		
Species	1	2	Species	1	2
Carp	*	*	White sucker	*	*
Channel catfish	*	*	Pumkinseed	*	*
Goldeye	*		Carp	*	
Flathead chub	*		River carp sucker	*	
Longnose dace	*		Shorthead redhorse	*	
Shorthead redhorse	*		Black bullhead	*	
White sucker	*		Yellow bullhead	*	
Mountain sucker	*		Green sunfish	*	
Stonecat	*		Smallmouth bass	*	
White crappie	*		White crappie	*	
Sauger	*		Yellow perch	*	
Unknown 1	*		Unknown 4		*
Unknown 2		*			
Unknown 3		*			
Total Number species	12	4		11	3

Table 7. Distribution of fish in Hanging Woman Creek, 1974.

Species	1	2	3	4
Flathead minnow	*	*	*	*
White sucker	*	*	*	*
Green sunfish	*	*	*	
Carp	*	*		*
Lake chub	*		*	*
Hybopsis sp		*		*
Longnose dace		*		*
Black bullhead	*	*		
Yellow bullhead	*	*		
White crappie	*			
Total Number of Species	8	8	4	6

of species. Pumpkin Creek had the most species. Pumpkin Creek had the most species with 12. Most species were similar to those found in the main-stem. Exceptions were greatest in Hanging Woman with four species not found in the Tongue River.

Young northern pike captured near the mouth of Hanging Woman Creek (Section IVB) suggested that northerns may use the creek as a nursery area. Fish use of Hanging Woman Creek was monitored during the spring of 1975 with the use of a temporary fish trap. The leads of the trap were constructed from 1-inch mesh chicken wire and a frame trap net served as the body of the trap. A total of 134 upstream migrants were taken in the trap. White suckers were predominant (77.6%) followed by carp (9.7%). Other fish taken in the order of abundance were: northern pike (5.2%), river carpsuckers (4.5%), shorthead redhorse (2.2%) and green sunfish (0.8%).

Mature northerns of both sexes indicates that the tributary is important to maintaining the integrity of the Tongue River system. The northern pike averaged 23.4 inches in length (range 19.7 - 30.6) and 3.54 pounds in weight (range 2.25 - 7.37). The close proximity of the trap to Birney resulted in some piracy of trapped fish. Since northerns and other fish apparently utilize Hanging Woman Creek, it is important to establish instream flow standards on the Tongue River and its tributaries.

FISH POPULATIONS - TONGUE RIVER RESERVOIR

The Tongue River Reservoir and a portion of the drainage upstream were chemically treated in 1957 to remove undesirable fish species. Following rehabilitation, the reservoir was stocked with rainbow trout in an attempt to duplicate fishing which commonly follows the initial impounding of reservoirs. A total of 2,406,824 fingerling rainbow trout were planted during the years 1958-1960. Gill net sampling in November, 1959 produced 80 rainbow trout per net night, while sampling in January, 1960 took only 7 rainbow per net night. Stocking with trout was stopped because the undesirable fish had again built up to high population levels. However, correspondence in 1962 suggests that the reservoir was still producing some good catches of rainbow trout, with fish ranging from 1½ to 6 pounds being harvested by anglers.

Stocking recommendations for a warm water fishery in the reservoir were implemented in 1963 and are summarized in Table 8. Northern pike fry and fingerling were stocked in 1963-1966 to develop a self-sustaining population. No northerns were planted in 1967 and 1968, as a check on natural reproduction, but were again planted in 1969-1974. In 1972, 1973 and 1974, fingerlings were planted, rather than fry, to determine differential survival rates. Channel catfish were introduced in 1963 and 1964, and largemouth bass were planted in 1964 and again in 1972 and 1973. Attempts were made to establish a walleye pike fishery during the years 1965-1969. Since the first plant of walleyes would have matured in 1970, this plant was dropped as a check on spawning success.

Frame trap nets were fished during April, May and June to establish indicies of the spawning strength of sport fish populations. Seven traps were fished a total of 153 nights. The reservoir was divided into three zones (Figure 6) and the traps were located in areas that appeared to be good spawning habitat.

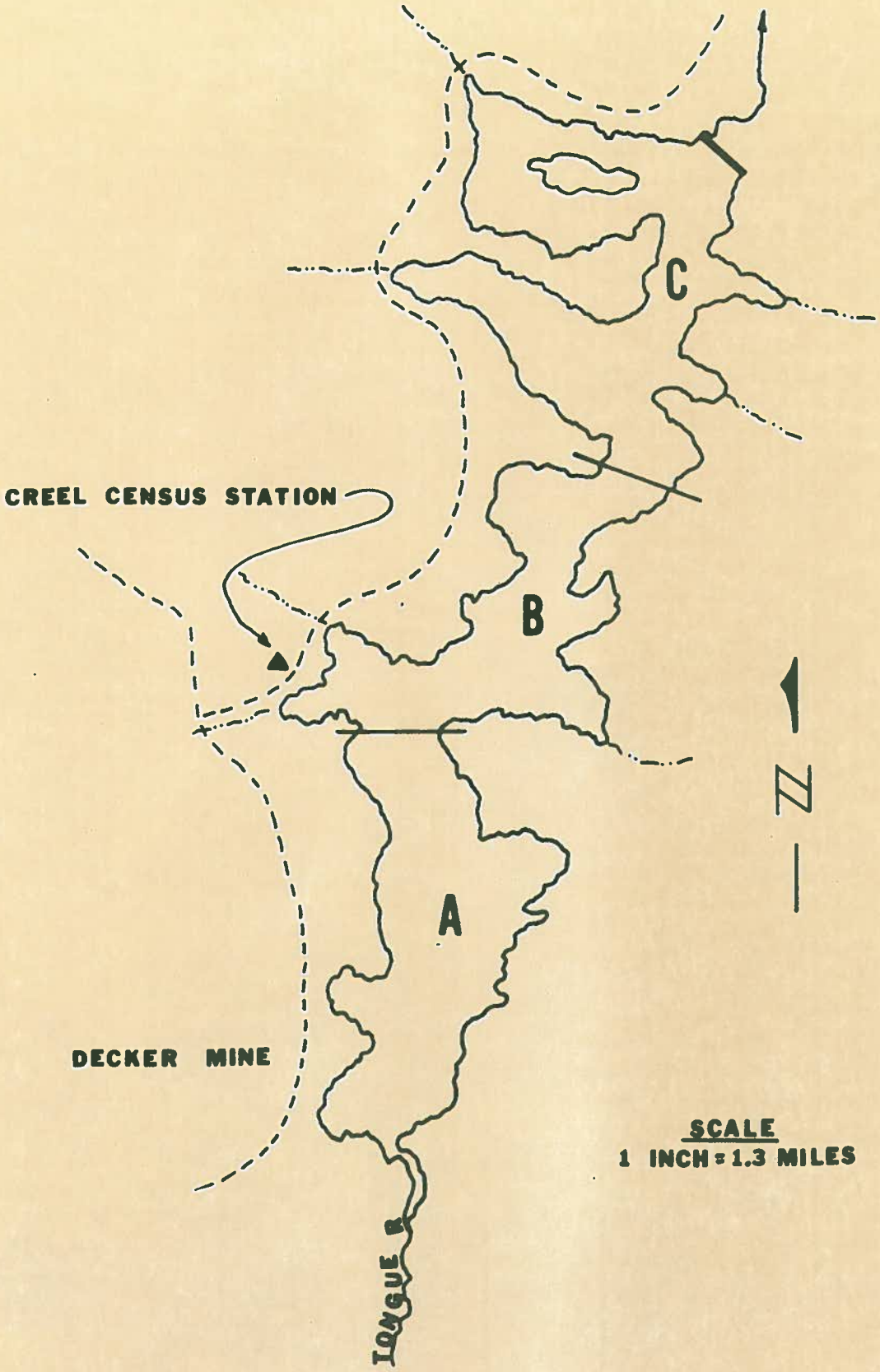

Figure 6. Map of Tongue River Reservoir delineating the three sampling zones.

Table 8. Summary of warm water fish plants in the Tongue River Reservoir, 1963-1973.

Year	Species	Size	Number
1963	Northern pike	fry	210,000
	Northern pike	fingerling	35,200
	Channel catfish	3"	20,608
1964	Northern pike	fry	100,000
	Channel catfish	2"	99,180
	Largemouth bass	1"	150,000
1965	Northern pike	fry	339,300
	Walleye pike	fry	750,000
1966	Northern pike	fry	210,500
	Walleye pike	fry	100,000
1967	Walleye pike	fry	197,750
1968	Walleye pike	fry	601,214
1969	Northern pike	fry	650,000
	Northern pike	fingerling	513,200
	Walleye pike	fry	92,480
1970	Northern pike	fry	1,125,000
1971	Northern pike	fry	360,000
1972	Northern pike	fingerling	14,058
	Largemouth bass	2"	199,290
1973	Northern pike	fingerling	13,184
	Largemouth bass	2"	27,540
1974	Northern pike	fingerling	3,330

Trap net catches for 1975 are compared with catches for 1972, 1973, and 1974 in Table 9.

A total of 6,035 fish were captured in 1975 through June 7. Traps are still being fished for black and white crappie and smallmouth bass. White crappie were the predominant fish taken, followed by yellow perch. Carp, yellow perch and white crappie dominated the catch in 1972, 1973 and 1974, respectively (Elser, 1973, 1974).

Game fish made up 4.8 percent of the total catch in 1975 as compared to 8.7 percent in 1974. Catch statistics of northern pike and walleye are shown in Table 10. Northern pike were taken almost exclusively in zone A with

these traps accounting for over 94% of the northern catch (Table 11). This area is obviously best suited for northern pike reproduction with shallow bays. The increase in northern pike numbers in 1974 and 1975 is assumed due to increased survival of fingerling plants.

The walleye catch was distributed about equally between zones A and B, contributing 42.0 and 39.8 percent, respectively. The remaining 18.2 percent were taken in zone C. Black and white crappie showed distributional patterns, with 56.2% of the blacks being caught in zone C. White crappie were most abundant in zone B (71.0%), followed by zone A (23.7%). Only 5.3% of the white crappie were caught in zone C. This distribution is probably the result of differential water quality between the upper and lower ends of the reservoir.

Table 9. Comparison of trap net catches - Tongue River Reservoir 1972-1975, expressed as numbers per net night.

	1972		1973		1974		1975 1/	
Species	No.	%	No.	%	No.	%	No.	%
Northern pike	0.34	1.78	0.25	1.79	0.95	5.79	1.12	2.83
Carp	7.05	37.10	3.39	24.40	1.46	8.90	4.00	10.14
Goldfish	0.01	0.05	0.02	0.14	0.10	0.61	0.23	0.58
Golden shiner	0.09	0.47	0.11	0.79	0.04	0.24	1.03	2.61
Shorthead redhorse	0.13	0.68	0.21	1.51	0.29	1.77	0.18	0.46
White sucker	0.19	1.00	0.49	3.52	0.30	1.83	0.33	0.84
Longnose sucker	-		0.03	0.21	0.03	0.18	-	
Black bullhead	1.51	7.94	0.43	3.09	0.55	3.35	0.34	0.86
Yellow bullhead	-		-	-	0.26	1.59	0.36	0.91
Stone cat	-		0.01	0.07	0.01	0.06	0.03	0.08
Largemouth bass	0.01	0.05	-		0.02	0.12	-	
Smallmouth bass	0.01	0.05	0.01	0.07	0.03	0.18	0.07	0.18
Rock bass	-		0.01	0.07	0.01	0.06	0.05	0.13
Green sunfish	-		0.02	0.14	0.02	0.12	0.05	0.13
Black crappie	1.24	6.52	1.30	9.35	2.99	18.24	4.44	11.26
White crappie	1.99	10.47	3.50	25.19	7.96	48.55	21.71	55.05
Sauger	-		0.02	0.14	0.09	0.55	0.12	0.30
Walleye	0.38	2.00	0.12	0.86	0.33	2.01	0.58	1.47
Yellow perch	6.05	31.84	3.96	28.56	0.96	5.85	4.80	12.17
Total	19.00		13.89		16.4		39.44	
No. Trap nights	85		121		168		153	

1/ Through June 7

Table 10. The average lengths and weights of northern pike and walleye caught in trap nets in the Tongue River Reservoir, 1972-1975.

	Northern pike				Walleye			
Year	No.	Average Length (in)	Range (in)	Average Wt. (lbs)	No.	Average Length (in)	Range (in)	Average Wt. (lbs)
1972	29	29.4	23.5-42.5	8.25	32	19.5	14.1-22.4	2.94
1973	48	28.8	25.5-46.8	8.26	24	21.3	14.3-25.4	3.62
1974	140	28.3	15.5-45.5	6.47	44	20.1	12.0-31.1	3.32
1975	131	31.8	11.1-51.2	6.79	87	18.5	10.6-32.0	2.68

Numbered Floy (FD-67) anchor tags were placed in a total of 424 sport fish to evaluate growth rates, movement and relative fishermen harvest (Table 12). A total of 158 (37.3%) tagged fish have been taken in subsequent years during the spring trapping season (Table 13). Black crappie returns were highest, with 23 returns out of 38 tagged fish (60.5%). All black crappie which were tagged were large (up to 3.0 pounds), and returned to the same trap area where they were tagged. Northern pike returns averaged 58.8 percent (130 returns out of 221 tagged fish). In 1975, 171 northern pike were captured, of which 89 (52.0%) were tag returns, suggesting a high percentage of the northern population is tagged. Black and white crappie are marked by removing the left pectoral fin. An estimate of population strength will be made using the Schnabel estimator.

Angler returns for northern pike are averaging 9.3 percent with s 17.1 percent return rate two years after tagging and 6.4 percent return rate one year following tagging. Walleyes tagged in 1974 have shown a 5.9 percent rate of return while smallmouth bass tagged the same year were returned at a 33.3 percent rate. In 1975, anglers returned three tags within the first two months following tagging. The small rate of tag return suggests harvests well within tolerable limits of the fish populations.

Growth rates were calculated for tagged northern pike, black crappie and white crappie. Eleven northerns returned two years following tagging gained an average 2.2 inches and 2.20 pounds, while 33 fish recaptured the year following tagging increased in length by 1.9 inches and in weight by 1.54 pounds. One year after tagging, seven black crappie grew an average of 1.1 inches and 0.32 pounds, while one white crappie return gained 0.6 inches and 0.42 pounds in a year.

A creel census was initiated, designed to obtain fisherman use on the reservoir and angler harvest. A creel census station located on the main access road to the reservoir is operated one week day and one weekend day each week. Anglers are interviewed to determine residence, length of fishing trip and number of fish caught. The data is recorded on a standardized form and will be analyzed with the aid of a computer program.

Table 11. Summary of trap net catches by zone in the Tongue River Reservoir, 1975

Species	April			May			June			Total			Total
	A	B	C	A	B	C	A	B	C	A	B	C	
Northern pike	67	1	1	89	6	2	5			161	7	3	171
Carp	195	23	27	264	53	34	9	7		468	83	61	612
Goldfish	21		1	11	1		1			33	1	1	35
Golden shiner	17	1	1	15	60	8	4	51	1	36	112	10	158
Shorthead redhorse	2			9	5	5	3	2	1	14	7	6	27
White sucker	5		2	1	5	8	2	2	26	8	7	36	51
Longnose sucker	0												
Black bullhead	11	1		13	20	4	1	1	1	25	22	5	52
Yellow bullhead	2			2	33	10	1	5	2	5	38	12	55
Channel catfish	0												
Stonecat	0				3			2			5		5
Largemouth bass					9	1			1		9	2	11
Smallmouth bass				1	7					1	7		8
Rock bass				1	2	2	31	46	283	3	2	2	7
Green sunfish	2			62	125	97	493	1639	88	127	171	382	680
Black crappie	34		2	211	717	89				787	2358	177	3322
White crappie	83	2											
Sauger	2	3		11		2	3	1		13	3	2	18
Walleye	26	31	9	8	3	7	3	12		37	35	16	88
Yellow perch	75	11		9	83	542				87	106	542	735
Total	542	73	43	707	1132	811	556	1768	403	1805	2973	1257	6035
Fish/night	27.1	14.6	14.3	17.2	34.3	35.3	55.6	160.7	57.6	25.8	60.7	38.1	39.44
Trap nights	20	5	3	41	33	23	10	11	7	71	49	33	153

Table 12. Summary of tagged fish in Tongue River Reservoir, 1973-1975

Species	1973	1974	1975
Northern pike	41	110	70
Walleye	10	34	76
Sauger	1	9	8
Largemouth bass		2	1
Smallmouth bass	2	3	9
Black crappie		19	19
White crappie		6	4
Total	54	183	187

Table 13. Summary of tagged fish returns in trap nets, Tongue River Reservoir, 1972-1975.

	Northern pike		Walleye		Black Crappie		White Crappie	
Year	Tagged	% Ret.	Tagged	% Ret.	Tagged	% Ret.	Tagged	% Ret
1973	41	75.6	10					
1974	110	68.2	34	8.8	19	57.9	6	16.7
1975	70	34.2	76	1.3	19	63.2	4	
Total	221	58.8	120	3.3	38	60.5	10	10.0

DISCUSSION

Streams vary greatly in size, velocity, gradient, nature of the bed temperature and other features. Generally, streams change from the steep torrent to the sluggish meandering waterways as they proceed from source to mouth (Allen, 1969). Usually there are stages between the two extremes which are characterized by specific environmental features and a particular assemblage of fish species.

Many attempts have been made to associate particular fish faunas with these defined zones. Huet (1959) devised a scheme for European streams using four categories, naming each zone from the characteristic fish species found in them. In descending order of current velocities they are:

(1) The trout zone:
(2) The grayling zone:
(3) The barbel zone:
(4) The bream zone:

Each of these zones is characterized by a particular set of combinations of stream gradient and stream width. North American streams have been classified by zones by Lagler, et. al. (1962) as follows:

(1) Grayling
(2) Stream char
(3) Flowing water minnows and pike
(4) Basses
(5) Catfishes, suckers and quiet water minnows

As the gradient diminishes, the headwater fishes disappear and are replaced successively by others better adapted to the changing environment.

Fish populations in the Tongue River exhibit a succession from torrent zones fishes (trout) to the quiet zone fishes (catfish and suckers). Fish population data suggest that the Tongue River mimics the fish distribution, fish species diversity, and fish species zonation of the Yellowstone River, which is also extremely important to the scope of energy development. The results of the Tongue River Study will be compared to fish population studies currently being conducted in the Yellowstone main stem. This will aid in determining similarities with (or defining differences between) the Tongue sub-basin and the entire Yellowstone River Basin.

The objective of the Tongue River Reservoir segment of this study is to obtain baseline information on the fish populations of the reservoir and to document angler use and harvest rates. Decker Coal Company plans to expand their mining operations in the near future to include the east side of the reservoir. Questions raised concerning high sodium levels in the soils of the area makes it important to evaluate current fish population levels in the reservoir. Fish population data will be coordinated with information collected on a detailed limnology study of the reservoir. This information will allow us to evaluate the effects of a strip mine in close proximity to a reservoir. Other aspects of energy related developments will also be investigated and their impacts evaluated.

LITERATURE CITED

Allen, K.R., 1969. Distinctive aspects of the ecology of stream fishes: a review. J. Fish. Res. Bd. Canada, 26:1429-1438.

American Fisheries Society. 1970. A list of common and scientific names of fishes. Amer. Fish. Soc. Spec. Publ. No. 6, 150 pp.

Cairns, J., Jr. 1969. Rate of species diversity restoration following stress in freshwater protozoan communities. Univ. of Kans. Sci. Bull. 48:209-224.

Dooley, J. 1975. Use of water surface profiles in Montana Department of Fish and Game studies. Bu. Rec. Workshop, Jan. 22, 1975. Mineo.

Elser, A. A. 1973. Tongue River Reservoir Study. Montana Department of Fish and Game, Job Progress Report. F-30-R-10, Job II A: 11pp.

Elser, A.A. 1974. Tongue River Reservoir Study. Montana Department of Fish and Game, Job Progress Report. F-30-R-11, Job II A: 12 pp.

Harima, H., and P.R. Mundy. 1974. Diversity indicies applied to the fish biofacies of a small stream. Trans. Amer. Fish. Soc. 105:457-461.

Helms, D.R. 1973. Progress report on second year study of shovelnose sturgeon in the Mississippi River. Iowa Cons. Comm. Compl. Rept. No. 2-156-R-2: 33pp.

Helms, D.R. 1974. Shovelnose sturgeon in the Mississippi River, Iowa. Iowa Fisheries Research Technical Series 74-3, 68 pp.

Huet, M. 1959. Profiles and biology of Western European streams as related to fish management. Trans. Amer. Fish. Soc. 88:155-163.

Jackson, W.D. and G.L. Harp. 1973. Ichthyofaunae diversification and distribution in an Ozark stream in northcentral Arkansas. Ark. Acad. of Sci. Proc. 27:42-46.

Lagler, K.F., J.E. Bardach, and R.R. Miller, 1962. Ichthyology-John Wiley and Sons, Inc., New York. 545 p.

Larimore, R. W. 1961. Fish population and electrofishing success in a warm water stream. J. Wildl. Mgmt., 25:1-12.

Peterman, L.G. and M.H. Haddix. 1974. Preliminary fishery investigations on the lower Yellowstone River. Proceedings 35th Annual Meeting of the Fort Union Coal Field Symposium, (in press): 17 pp.

Shannon, C.E. and W. Weaver. 1964. The mathamatical theory of communication Univ. of Ill. Press, Urbana: 125 pp.

Sheldon, A.L. 1968. Species diversity and longitudinal succession in stream fishes. Ecology 49(2): 193-198.

Vincent, R. 1971. River electrofishing and fish population estimates. Prog. Fish Cult. 33(3): 163-169.

Vincent, R. 1974. Addendum to river electrofishing and fish population estimates. Prog. Fish Cult. 36(3):182.

Wilhm, J. L. and T.C. Dorris. 1968. Biological parameters for water quality criteria. Bioscience 18:477-481.

MONTANA DEPARTMENT OF FISH AND GAME

OLD WEST REGIONAL COMMISSION
ANNUAL REPORT
July 1, 1974 through June 30, 1975

I. **PROJECT TITLE:** Investigation of Aquatic Communities

II. **PROJECT NUMBER:** Task I

III. **ACTIVITIES DURING THE QUARTER:**

A. Accomplishments during the quarter - see attached.

B. Estimated percentage of completion

1. Tongue River - 45%

2. Tongue River Reservoir - 25%

C. Discrepancies - none

D. Anticipated activities of significance

1. Tongue River

a. Continue to monitor migrant fish use in lower Tongue River to evaluate passage and spawning flow requirements.

b. Measure physical parameters on primary sections.

2. Tongue River Reservoir

a. Continue creel census to determine use and harvest rates and to evaluate potential effects of water withdrawals on the recreation of the reservoir.

b. Continue the study of fish population structure and dynamics to assess the impact of major water withdrawals.

V. Financial information

A. Next quarter needs (estimated)

Salaries	$ 9,000.00
Benefits	750.00
Per Diem	3,500.00
Mileage (state vehicle)	2,000.00
Repairs and maintenance	500.00
Miscellaneous	200.00
Total	$15,950.00