MONTANA FISH AND GAME DEPARTMENT

Helena, Montana

A PRE-IMPOUNDMENT BOTTOM-FAUNA STUDY OF THE BEAVERHEAD RIVER, MONTANA

A pre-impoundment bottom-fauna study was conducted on the Beaverhead River during August 22 and 23, 1960. This study was designed to give some insight into the bottom-fauna population prior to the construction of Clark Canyon Dam by the U.S. Bureau of Reclamation. The possible effects of Clark Canyon Dam upon the fishery of the Beaverhead River are presented in a 1958 report by the U.S. Fish and Wildlife Service entitled Three Forks Division Montana. This report was based primarily upon post-impoundment river flows and failed to consider possible changes in water quality and bottom fauna-populations. As a result, the Montana Fish and Game Department, in cooperation with the Montana State Board of Health, initiated other studies. The first was a water quality study concerned with the chemical nature of all major southwest Montana streams, including the Beaverhead River. This first study was initiated during October 1959 and a progress report, presenting the first year's sampling results, has been written (Averett, 1960). The second study is reported here and concerns the types of bottom-fauna found in two stream areas of the Beaverhead River during late August, 1960.

LOCATION OF SAMPLING STATIONS

Two sampling areas were established on the Beaverhead River. (See Location Map Page 6). One was located below the proposed Clark Canyon Dam site, and the other above. The establishment of permanent sampling areas on a stream likely to undergo structural changes is at best a difficult job. Preliminary engineering reports are ambiguous concerning actual construction activities that may take place, and the chance of a sampling station being "moved" remains, at all times, possible. Nevertheless two sampling areas were established and the hope remains that they will remain intact after the construction of Clark Canyon Dam. The specific location of the two sampling areas is as follows:

Lower Area: The lower area is located in Township 9 S., Range 10 W., Section 1. The Highway location is 1.4 miles southwest of where U.S. Highway 91 crosses Grasshopper Creek; thence southeast on an unimproved road for a distance of about 150 yards. At this point there is a steel-and-plank bridge which crosses the Beaverhead River. This bridge is the sampling station marker.

The Series "A" samples (See Figure 1) were collected 15 feet upstream (south) of this bridge in a line across the river beginning at the east shore of the river. The Series "B" samples were collected 25 feet upstream from the bridge (south) in a line across the river beginning at the east shore of the river. All measurements from the bridge were taken from the upstream (south) side.

Upper Area: This area is located in Township 12 S., Range 9 W., Section 33. The Highway location is 17.4 miles south of Armstead, Montana or 1.6 miles North of Dell, Montana. At this point there is an eastbound, unimproved road leading to the Cliff Washburn Ranch. The sampling area is located in the first riffle north of the dwelling house on the Cliff Washburn Ranch. (Note: The U.S. Forest Service map lists this stream as Red Rock Creek. For this report it is considered the Beaverhead River).

The Series "C" samples (See Figure 2) were collected, in a line across the river, 60 feet north of a log shed which lies immediately north of the dwelling house on the Cliff Washburn Ranch. The Series "D" samples were collected, in a line across the river, 50 feet north of the above log shed. In both series sampling was begun on the west shore of the stream.

DESCRIPTION OF SAMPLING AREAS

Both sampling areas were located in a riffle section of the stream.

The lower sampling area (Figure 1) is a fast-water riffle 57 feet wide with an average depth of 0.98 feet. A dense growth of overhanging willows are found on both stream shores. The stream bottom material was coated with a hard, rough, layer of calcium carbonate interspersed with clean walnut-size gravel. Aquatic plants were absent in the area during the period of sampling.

The upper sampling area (Figure 2) is a low-velocity riffle 47 feet wide with an average depth of 0.43 feet. The greatest velocity of this riffle is found near the west shore and in the stream center. Except for several poplar trees on the east shore, vegetation along the stream in this area is absent. The stream bottom was coated with a layer of calcium carbonate interspersed with clean rubble up to 6 inches in diameter. Patches of filamentous green algae up to 15 inches in diameter were present in the slower-flowing areas of the riffle.

SAMPLING PROCEDURE

All samples were collected with a Surber square foot sampler. After collection samples were placed in pint jars, preserved in 70% alcohol, and transported to the laboratory for identification. The identification of all organisms was made with the aid of biological keys contained in Pennak (1953).

As mentioned under Description of Sampling Areas, both the lower and upper areas were located in riffle sections of the stream. Studies by other workers Curry (1954), Brigs (1948), Lyman (1942), Lyman and Dendy (1943), and Needham (1934), have indicated that the greatest number and variety of bottom-fauna are found in the riffle sections of streams. Gaufen et. al. (1956) found that in Lytle Creek (Ohio), "...sampling efficiency was greatest in the riffles, second in the marginal areas, and poorest in the pools". By "efficiency" Gaufen was referring to the collection of the greatest variety (types) of bottom-fauna.

The decision to collect 8 duplicate square foot samples (16 total) per sampling area was based upon the findings of Gaufen (1956). Although Gaufen sampled in riffles, marginal areas, and pools, we sampled only in the riffle area, since this was all that could be accomplished in the allowable time. Ideally several more areas should have been sampled, and samples should have been collected several times during the year.

A steel measuring tape was "stretched" across the stream and anchored at both ends. Sample collections were made along a line established by the steel tape. A recent paper by Cordone and Kelly (1961) supports this method, especially when only a limited amount of sampling can be done. In selecting a specific sampling location no regard was given to the foot-distance from the starting shore. Rather, visible habitat types were selected for each sample location. Only after the sample had been collected was the foot-distance from the starting shore recorded. Foot-distance from the starting shore was carried to the nearest whole foot.

Stream flows were determined at each sampling area with a velocity-head rod. Water from the Beaverhead River is heavily used for irrigation. Thus, the flows and average depths recorded on Figures 1 and 2 are applicable only for the sampling date under consideration.

FINDINGS

The results for the Series "A" and "B" samples (lower area) are presented on Table 1.

In the Series "A" samples the Trichoptera were the most numerous organisms comprising 76% of the total. The bulk of the Trichoptera collected were members of the Family Brachycentridae. Diptera, primarily members of the Family Simulidae, were second in abundance. They constituted 16% of the total organisms.

Bottom fauna collected in the Series "B" samples followed a pattern of type abundance similar to the Series "A" samples. The Trichoptera, principally members of the Family Bracycentridae, were the most numerous and made up 67% of the total. Diptera were second in abundance (19%) with Family Chironomidae the dominant type.

Except for some small (less than ¼ inch) unidentified bivalves (Plecypoda), the Series "B" samples contained no additional organism types that were not found in the Series "A" samples.

A consolidated tabulation of the results from the Series "A" and "B" samples follows:

Type	Series "A"		Series "B"	
	Number	Percent	Number	Percent
Trichoptera	499	76	284	67
Plecoptera	2	1	1	–
Diptera	107	16	81	19
Coleoptera	42	6	29	7
Ephemeroptera	1	–	23	5
Oligochaeta	3	1	3	1
Plecypoda	0	0	2	1
Totals	654	100	423	100

The total volume for the Series "A" samples was 18.9 cubic centimeters. For the Series "B" samples the total volume was 12.4 cubic centimeters.

The results of the Series "C" and "D" samples (upper area) are tabulated on Table 2. Except for the flatworm Planaria (found only in the Series "C" samples), organism types were similar in this sampling area.

In the Series "C" samples the Diptera were the most numerous (55%) followed by the Trichoptera (28%). The Series "D" samples showed an inverse relationship between the Diptera and Trichoptera. In this series Trichoptera were 51% and Diptera 32% of the total.

A consolidated tabulation of the results from the Series "C" and "D" samples follows:

Type	Series "C" Number	Series "C" Percent	Series "D" Number	Series "D" Percent
Trichoptera	248	28	351	51
Diptera	493	55	221	32
Coleoptera	13	1	10	1
Ephemeroptera	125	14	61	9
Oligochaeta	10	1	35	5
Plecypoda	5	1	4	1
Gastropoda	0	0	3	1
Planaria	1	-	0	0
Totals	895	100	685	100

The total volume for the Series "C" samples was 10.1 cubic centimeters. For the Series "D" samples the total volume was 11.8 cubic centimeters.

Robert C. Averett
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Authors Note: Mr. J. M. Stubbs, now with the Tennessee Game and Fish Commission, assisted with the collection of samples.

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LOCATION MAP

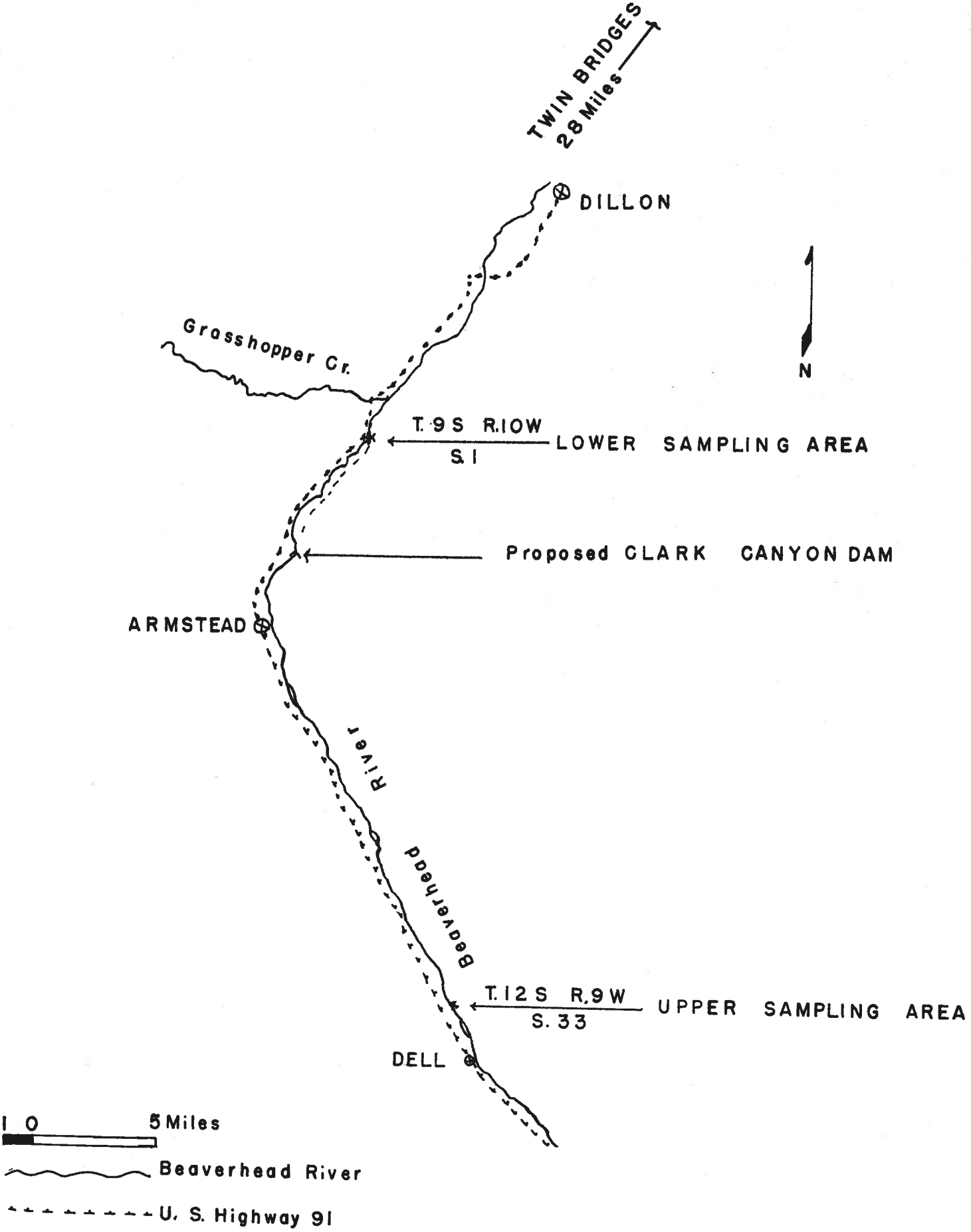


FIGURE I. LOWER SAMPLING AREA, BEAVERHEAD RIVER

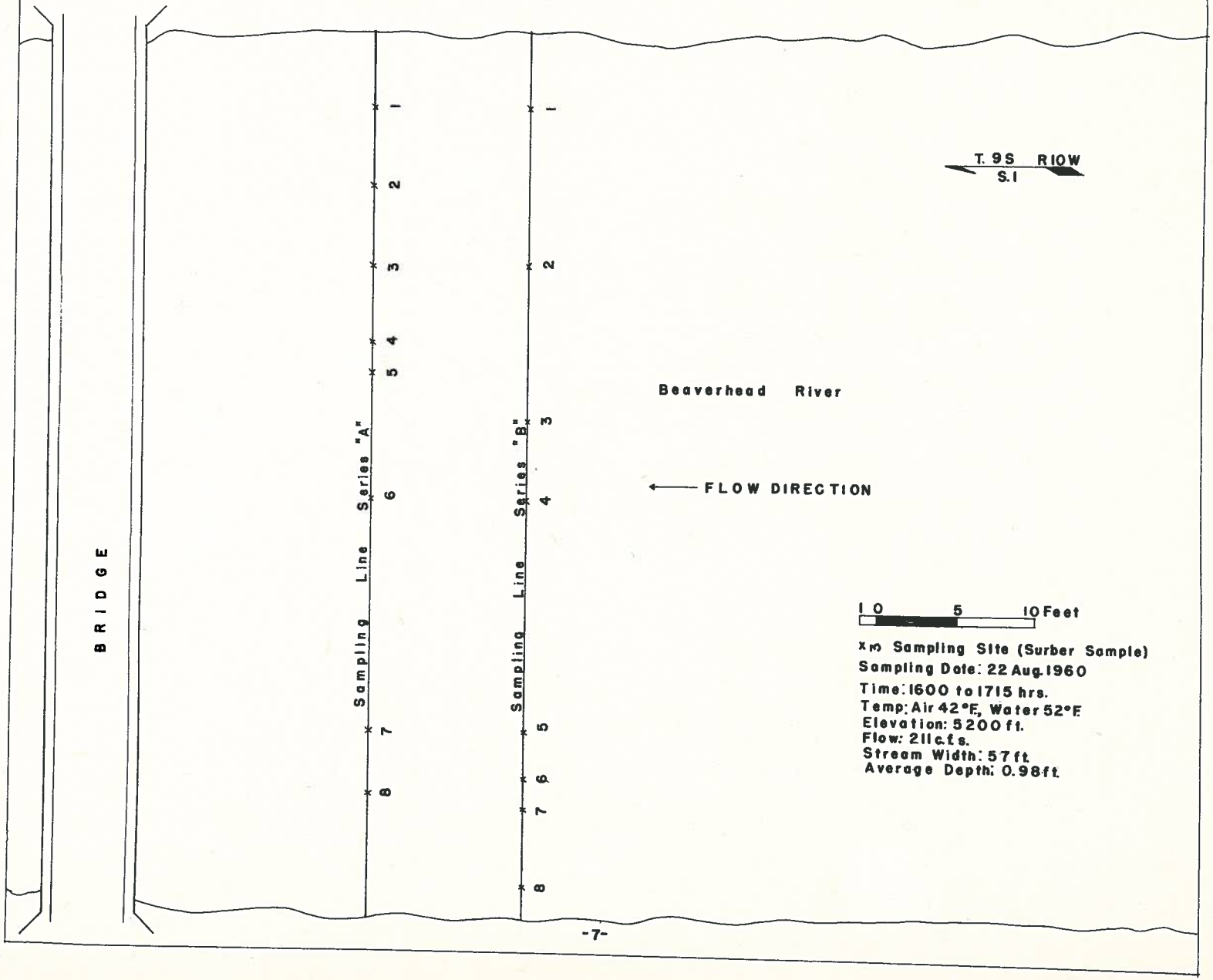
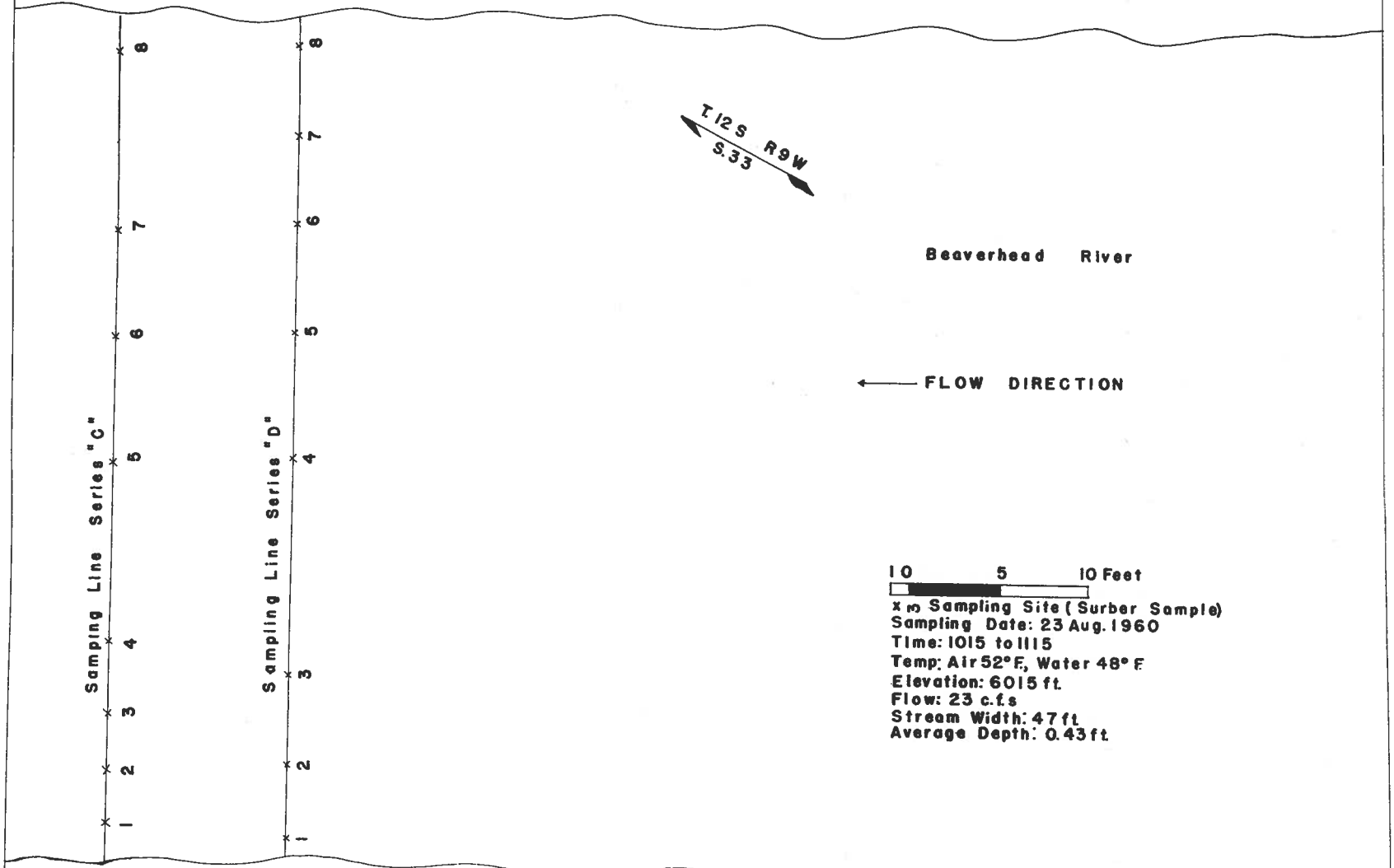


FIGURE 2. UPPER SAMPLING AREA, BEAVERHEAD RIVER



CLIFF WASHBURN RANCH

TABLE 1. Bottom-Fauna collected at lower Beaverhead River sampling station. Number in ( ) refers to percent of sample. August 22, 1960. One square foot sample per sample location.

Sample Location	Feet From Shore	Brachycentridae	Hydropsychidae	Leptoceridae (?)	Nemouridae	Rhagionidae	Tipulidae	Chironomidae	Simulidae	Elmidae	Baetidae	Oligochaeta	Plecypoda	Gastropoda	Planaria	Total Number	Total Volume (c.c.)
SERIES "A"																	
1-A	5	56 (75)	5 (7)	7 (9)	1 (1)		1 (1)			5 (7)						75	2.2
2-A	10	85 (71)	13 (11)				1 (1)	8 (7)	7 (6)	4 (3)	1 (1)					119	4.0
3-A	15	82 (63)	18 (13)				1 (1)	6 (5)	11 (8)	13 (10)						131	4.0
4-A	20	2 (10)	8 (40)		1 (5)			2 (10)	5 (25)	2 (10)						20	0.3
5-A	22	74 (41)	61 (34)				1 (1)	11 (6)	26 (14)	7 (4)						180	5.1
6-A	30	8 (32)	6 (24)	1 (4)				2 (8)	3 (12)	5 (20)						25	0.3
7-A	45	20 (37)	18 (32)	1 (2)					8 (15)	4 (8)		3 (6)				54	1.9
8-A	49	23 (46)	11 (22)				3 (6)	5 (10)	6 (12)	2 (4)						50	1.1
SERIES "B"																	
1-B	5	88 (79)	1 (1)	1 (1)			2 (2)	9 (8)		7 (6)	3 (3)					111	3.8
2-B	15	21 (40)	7 (13)				3 (6)	4 (8)	4 (8)	8 (15)	5 (10)					52	1.8
3-B	25	27 (29)	33 (35)				3 (3)	13 (14)	17 (18)				1 (1)			94	2.3
4-B	30	25 (37)	16 (24)				2 (3)	10 (15)	3 (4)	9 (12)	2 (3)		1 (2)			68	2.0
5-B	45		3 (50)									3 (50)				6	0.2
6-B	48	5 (33)	6 (40)		1 (7)		2 (13)			1 (7)						15	0.4
7-B	50	17 (36)	21 (45)				4 (9)	3 (6)		2 (4)						47	1.4
8-B	55	9 (30)	4 (13)					2 (7)		2 (7)	13 (43)					30	0.5

TABLE 2. Bottom-Fauna collected at upper Beaverhead River sampling station. Number in ( ) refers to percent of sample. August 23, 1960. One square foot sample per sample location.

Sample Location	Feet From Shore	Brachycentridae	Hydropsychidae	Leptoceridae (?)	Nemouridae	Rhagionidae	Tipulidae	Chironomidae	Simulidae	Elmidae	Baetidae	Oligochaeta	Plecypoda	Gastropoda	Planaria	Total Number	Total Volume (c.c.)
							SERIES "C"										
1-C	2	52 (62)	5 (6)				3 (3)	5 (6)			18 (22)				1 (1)	84	1.7
2-C	5	12 (8)	7 (5)					26 (18)	92 (63)		9 (6)					146	0.8
3-C	8	13 (11)	3 (2)					87 (70)	5 (4)		11 (9)		5 (4)			124	0.6
4-C	12	14 (11)	24 (20)					24 (20)	32 (26)		26 (21)	2 (2)				122	1.1
5-C	22	31 (23)	6 (5)	1 (1)				74 (56)		4 (3)	16 (12)					132	1.4
6-C	29	15 (17)	6 (7)					12 (13)	41 (45)		14 (16)	2 (2)				90	1.3
7-C	35	24 (18)	16 (12)			1 (1)		32 (24)	32 (24)	9 (7)	19 (14)					133	2.1
8-C	45	13 (20)	6 (9)			1 (2)		16 (25)	10 (16)		12 (19)	6 (9)				64	1.1
							SERIES "D"										
1-D	1	183 (65)	6 (2)					15 (5)	26 (9)	4 (2)	15 (5)	25 (9)	4 (2)	3 (1)		281	5.2
2-D	5	8 (15)	12 (22)					10 (18)	17 (31)	4 (7)	3 (5)	1 (2)				55	0.8
3-D	10	19 (26)	13 (18)			1 (1)		21 (28)	3 (4)		17 (23)					74	1.0
4-D	22	8 (18)	12 (28)				1 (2)	10 (23)	8 (19)	2 (5)	2 (5)					43	0.8
5-D	29	23 (21)	9 (8)	1 (1)				2 (2)	63 (58)		11 (10)					109	1.6
6-D	35	13 (31)	3 (7)			1 (2)		4 (10)	16 (38)		3 (7)	2 (5)				42	0.9
7-D	40	8 (22)	10 (27)			2 (6)		10 (28)	1 (3)		4 (11)	1 (3)				36	0.8
-D	45	18 (40)	5 (11)			2 (5)	1 (2)	7 (16)			6 (13)	6 (13)				45	0.7