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LIFE HISTORY OF THE MOUNTAIN SUCKER (*CATOSTOMUS PLATYRHYNCHUS*) IN MONTANA

by

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of

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VITA

The author, William Joseph Hauser, was born on August 4, 1942 in Davenport, Iowa to Mr. and Mrs. William N. Hauser. He moved to Madison, Wisconsin in 1946 and graduated from Madison East High School in June, 1960. In the fall of 1960, he entered the University of Wisconsin, and received a Bachelor of Science degree in Zoology in January, 1965. He began graduate studies at Montana State University in March, 1965. He was employed by the Montana Fish and Game Department during the summer months of 1965-1967, and he held a graduate teaching assistantship in the Department of Zoology and Entomology during the academic year of 1966-1967.

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ABSTRACT

The life history of the mountain sucker, Catostomus platyrhynchus, was studied in southwestern Montana during 1966 and 1967. Most specimens used in the study were collected from two streams by seining or electrofishing. Annuli were determined on scales from a total of 491 fish. Annuli were formed during early June. The growth history of the mountain suckers was based on the calculated length at the last annulus for fish of a given age. Female mountain suckers were slightly longer than males after age five, and had greater longevity. Average lengths (mm) at the last annulus for mountain suckers of each age from the East Gallatin River were: I - 60.5; II - 98.7; III - 115.3; IV - 133.2; V - 149.3; VI - 164.6; VII - 187.5; VIII - 202.9; IX - 220.8. Most spawning occurred during late June and early July. Males were mature at age 4 and females at age 5. Sexes were distinguished during the spawning period using secondary sexual characteristics. The number of mature eggs per female ranged from 990 for a specimen 131 mm in length to 3710 for one 184 mm in length. Food was mostly unidentified materials, but diatoms and other algae were important.

INTRODUCTION

The mountain sucker, Catostomus plathyrhynchus (Cope), was formerly a member of the genus Pantosteus. This latter was recently relegated to subgenus by Smith (1966). The mountain sucker is the most widely distributed member of the subgenus. It is found in the following river systems: Columbia, Fraser, Saskatchewan, Missouri, and Green, and is also present in the Great Basin.

Information on the life history of this species is limited to brief reports by Sigler and Miller (1963), Simon (1951), and Smith (1966). Hubbs, Hubbs and Johnson (1943), Smith (1966), and Tanner (1942) contributed to its taxonomy, and Bond (1953) presented information on distribution. My study concerns age and growth, reproduction, fecundity, and food habits of this species.

Study Areas

This study is limited to southwestern Montana. Most collections were made from Flathead Creek in the Yellowstone River drainage during the summer of 1966 and from the East Gallatin River of the Missouri River drainage during the spring and summer of 1967. A few collections were also made from the Madison River in the Missouri River drainage during the spring of 1967.

The collecting areas of Flathead Creek and the East Gallatin River were 6 to 10 meters wide. Pools as deep as 1 1/2 meters were interspersed with riffles. Bottoms were composed largely of silt and coarse gravel. Gradients were about 5.5 meters per kilometer. Filamentous algae were abundant, but higher aquatic plants were sparce.

Fish associated with the mountain sucker were: mountain whitefish (Prosopium williamsoni), cutthroat trout (Salmo clarki), rainbow trout (Salmo gairdneri), brown trout (Salmo trutta), brook trout (Salvelinus fontinalis), lake chub (Hybopsis plumbea), longnose dace (Rhinichthys cataractae), longnose sucker (Catostomus catostomus), white sucker (Catostomus commersoni), mottled sculpin (Cottus bairdi).

METHODS

Mountain suckers were collected about once a month except during the spawning season when they were taken about once a week. Fish were captured by electrofishing, seining, and dip netting. All fish were measured to the nearest milimeter in total length. Those less than 90 mm in length were measured and weighed after preservation (10% formalin), and those larger than 90 mm were measured and weighed while fresh.

Age and growth were determined by the scale method. Scale samples were obtained from the left side of the fish above the lateral line and slightly posterior to the dorsal fin. Annuli were determined after the scales were projected. A straight line relationship between body length and anterior scale radius was assumed. Results of age determinations by scales and otoliths taken from 22 mountain suckers were compared to check the accuracy of aging by the scale method. These specimens ranged from 105 to 241 mm in length and were two to nine years old. Results by both methods generally agreed.

The approximate time of spawning was determined by measuring changes in egg sizes, and by calculating changes in the "average ripeness factor" as given by Bailey (1952): (ovary volume/fish length^3) 10^8. Eggs were preserved and sizes were measured with an ocular micrometer on a von Bayer egg trough.

The number of eggs per female was determined by the method of Wagner and Cooper (1963) with certain modifications. Ten percent of the total ovary volume was obtained by breaking the ovary into six nearly equal portions and combining smaller divisions of these for a sample. The

number of "mature" eggs in a sample was then counted and multiplied by ten.

Contents from digestive tracts were analyzed. Tracts from fish less than 65 mm in length were preserved in situ, but those of larger fish were removed and preserved separately.

The entire contents of the ailimentary tracts of fish less than 31 mm were examined, but only approximately one mililiter of the contents from the anterior one-third of the tract of larger fish was used. Identification of food items was made with magnifications up to 100 x. The quantity of each item in each tract was estimated as sparce, common or abundant. Frequency of items was calculated by combining the tracts for each size group.

Water temperatures were taken at irregular intervals during the study, usually around mid-day with a pocket thermometer. Water velocities were measured with a current meter.

RESULTS

Habitat

Mountain suckers 20-35 mm in length were generally found in areas with moderate currents, at depths of 15 to 40 cm, and usually behind an obstruction. The larger of these were found at the margins of runs but retreated into deeper water when disturbed. Stewart (1926) described similar habitat for white suckers of similar size.

Nearly all mountain sucker fingerlings between 35 and 130 mm in length were captured in a small intermittent side channel of the Madison River. There was very little discharge through this channel and depths ranged from 15 to 50 cm. Aquatic vegetation was abundant. Fingerlings collected in other areas were usually associated with deep pools.

During late winter and early spring, mountain suckers longer than 130 mm in length usually were found adjacent to pools in areas where velocities were about 0.5 m/sec and depths about 1-1.5 m. During the spawning season, fish of this size were most abundant in riffle areas below pools but after the spawning season, they were usually found in deep pools. They generally utilized areas associated with bank cover and often formed small schools separate from other catostomids.

No effort was made to relate the distribution of the mountain sucker to water temperature, however Pierce (1966) reported that this species was more abundant below than above a warm springs.

Age and Growth

Sucker fry, probably including the mountain sucker, were collected in both years of the study, but we were unable to separate mountain sucker fry from the other species. The earliest dates that fry were observed during 1966 and 1967 were 21 June in Flathead Creek and 18 July in the East Gallatin River respectively. Six mountain suckers from Flathead Creek averaged 33.9 mm (range 29.5 to 36.0) on 11 September 1966, and four from the East Gallatin River averaged 23.1 mm (range 20.0 to 25.5) on 2 September 1967.

The time of first annulus formation was determined by examining the scales of 60 mountain suckers taken from the Madison River (Table 1). No annulus was found on scales of fish collected on 13 April and 18 May. An annulus was present on 5 percent of those taken on 24 May and on 95 percent of those from 16 June.

The average size of fish without an annulus was 48.3 mm (range: 38-61) and the average calculated length at the first annulus was 48.6 mm (range: 38-60). One specimen from the East Gallatin River without an annulus was 69 mm. One yearling mountain sucker from the East Gallatin River was 52 mm at the first annulus and four from Flathead Creek averaged 61.5 mm (range: 55-65) at this annulus. Growth during the first year appears to be better in the latter two streams.

Annuli were determined on scales from 185 mountain suckers from Flathead Creek and 273 from the East Gallatin River. Data were kept separate by streams and by sex. Annuli on mountain sucker scales are difficult to distinguish and scales were read several times to evaluate

Table 1. - Total lengths (mm) of mountain suckers taken during the period of first annulus formation from the Madison River, 1967. (Ranges shown in parentheses).

Date	Number examined	Mean length	Percent with annulus	Mean calculated length at annulus
13 April	10	46.6 (38-59)	0	-
18 May	10	45.2 (40-50)	0	-
24 May	20	49.8 (40-61)	5	38.0 (-)
16 June	20	60.1 (49-73)	95	48.6 (40-60)

the consistency of determinations. Annuli were characterized by compactness and by incomplete circuli in the postero-lateral regions of the scale.

In general, Lee's phenomenon is quite evident in the average calculated lengths at each annulus for the mountain sucker (Table 2). This phenomenon is also evident in the age and growth data for the white sucker and longnose sucker (Brown and Graham, 1953; Kathrein, 1951; and Spoor, 1938). The effect is more pronounced on the scales of older fish. The growth history of the mountain sucker is best represented by using the calculated lengths at the last annulus for each age group, rather than the grand averages. The average lengths (mm) at the last annulus for mountain suckers of each age class from Flathead Creek are: I - 61.5; II - 96.5; III - 118.5; IV - 137.7; V - 158.6; VI - 176.1; VII - 196.6; VIII - 208.4; IX - 222.5. For the East Gallatin River, these are: I - 60.5; II - 98.7; III - 115.3; IV - 133.2; V - 149.3; VI - 164.6; VII - 187.5; VIII - 202.9; IX - 220.8. Growth appears to be slightly better in Flathead Creek; however, there is no consistent difference. Smith (1966) reported that a female mountain sucker "175 mm in standard length, appeared to be in the fourth or fifth year, and a male 127 mm in standard length ... had three annuli on the scales."

The average calculated annual growth increment is greatest during the first year of life and decreases steadily until the third year. After the third year, it is nearly constant. Females were slightly longer than males at all ages except one, and observed differences between sexes were tested statistically with Student's t-test. Only

Table 2. - Average calculated total lengths (mm) and average calculated annual growth increments of mountain suckers at succeeding ages from Flathead Creek, 1966 and the East Gallatin River, 1967.

Location	Age	Number	Mean capture length	Calculated length at each annulus									Annual increment
				1	2	3	4	5	6	7	8	9	
Flathead Creek	I	4	93.0	61.5									61.5
	II	10	116.8	52.2	96.5								35.0
	III	21	131.0	38.1	79.5	118.5							22.0
	IV	19	151.0	30.0	63.3	103.4	137.7						19.2
	V	33	168.2	25.9	58.0	95.6	134.1	158.6					20.9
	VI	35	183.0	24.3	51.6	90.5	132.7	159.3	176.1				17.5
	VII	36	204.4	21.8	46.6	81.2	124.2	157.4	179.9	196.6			20.5
	VIII	23	215.2	20.3	42.9	74.2	111.7	145.9	174.5	194.7	208.4		11.8
	IX	4	226.5	21.0	50.3	86.0	125.3	154.8	174.8	199.0	214.3	222.5	14.1
	Total	185	Grand Average	28.0	57.6	92.1	128.2	156.2	177.1	196.0	209.3	222.5	
East Gallatin River	I	2	82.5	60.5									60.5
	II	24	125.3	51.3	98.7								38.2
	III	24	136.6	39.9	80.7	115.3							16.6
	IV	52	149.1	30.8	65.1	105.0	133.2						17.9
	V	63	160.4	27.1	57.4	94.6	127.4	149.3					16.1
	VI	59	173.4	26.7	55.1	89.3	123.2	149.7	164.6				15.3
	VII	35	194.3	26.7	54.7	90.2	124.5	153.2	174.1	187.5			22.9
	VIII	10	209.2	27.3	52.9	90.7	122.0	152.6	175.8	192.1	202.9		15.4
	IX	4	225.8	26.8	48.3	74.0	105.8	139.8	168.3	191.0	210.3	220.8	17.9
	Total	273	Grand Average	31.2	63.4	96.5	126.6	150.2	168.8	188.8	205.0	220.8	

fish of ages VI and VII from Flathead Creek were significantly different at the 95% level, but the samples were too small to be meaningful and the data were combined. Females apparently have greater longevity than males. The oldest males were 7 years of age (11 specimens). Of the old females, 60 were 7 years, 33 were 8 years, and 8 were 9 years of age.

In general, females of all species of the genus Catostomus are longer than males of the same age and usually have greater longevity (Brown and Graham, 1953; Dence, 1948; Geen, 1958; Geen, et al, 1966; Harris, 1962; Raney and Webster, 1942; and Spoor, 1938).

A length-frequency diagram was constructed from measurements of 352 mountain suckers (range:24-109 mm) from the Madison River. This indicated a major peak of abundance at 40 to 54 mm in length (227 fish), and a second "peak" at 94 to 109 mm (seven fish). These ranges in length were presumed to represent age groups I and II, respectively. These fish were collected during the period of annulus formation. Those which formed the first peak were either 0 or I years of age. Those with an annulus averaged 48.6 mm (range: 40-60) at that annulus. The second peak included six at age II, and one at age III. These averaged 89.8 mm (range: 79-97) and 101 mm at annuli II, and III respectively. The size of fish at ages I and II as shown by the Madison River length-frequency distribution are similar to the calculated lengths for fish of these ages from Flathead Creek and the East Gallatin River.

The major peaks of a length-frequency distribution for 346 mountain suckers from the East Gallatin River (Figure 1) generally agree with the

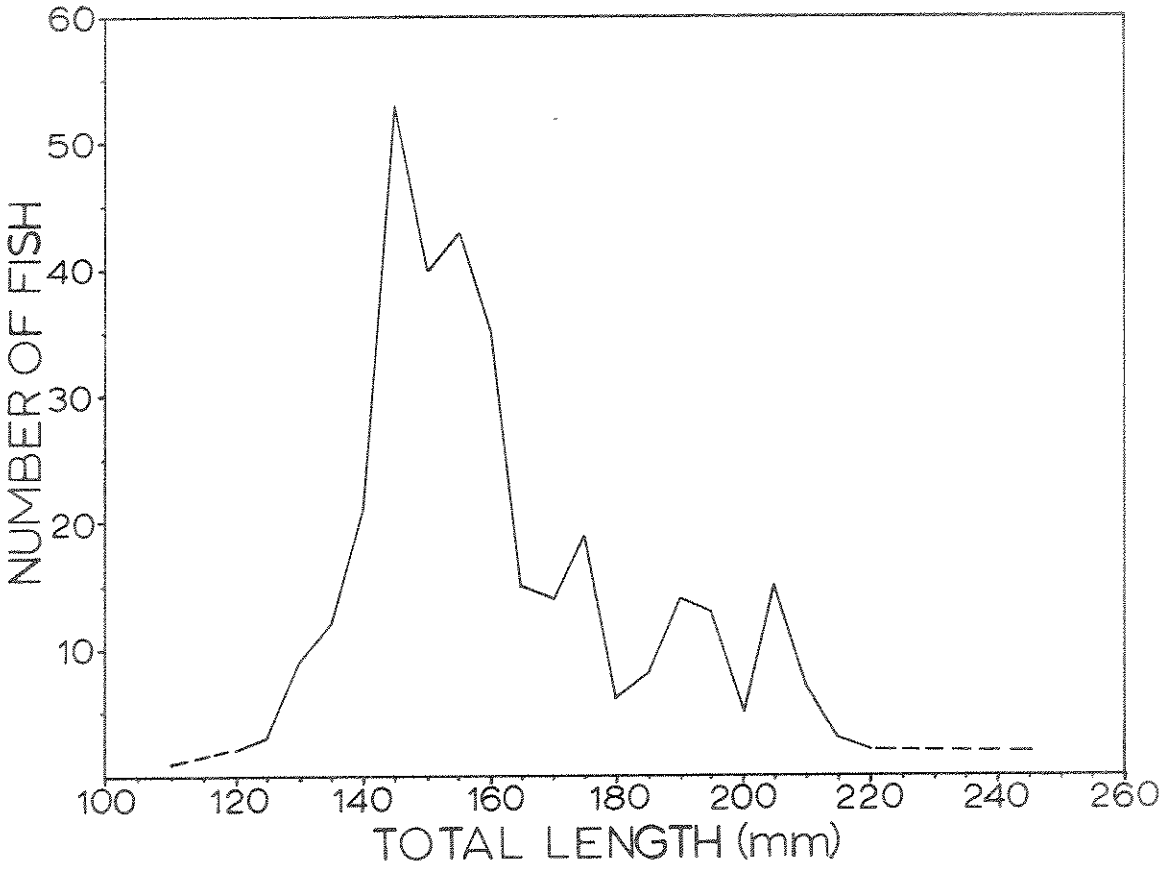

Figure 1. - Length-frequency distribution of mountain suckers from the East Gallatin River collected 9 September 1966.

calculated lengths of older fish from this stream.

A length-weight relationship was calculated for 155 female mountain suckers from the East Gallatin River. These ranged from 96 to 231 mm TL. Length groups were established at 10 mm intervals. The length-weight equation for the 155 fish was: Log W = -5.71963 + 3.31250 Log L. Differences between empirical and calculated weights were generally small.

Reproduction

The spawning season of the mountain sucker was not definitely determined, however, it was presumed to be June and July, during which time spent and partially spent females were found. This period agrees with observations of Simon (1951) and Smith (1966).

Size and age at sexual maturity were determined after examination of gonads. Eggs from gravid ovaries in mature females were classified as mature, atretic, and recruitment according to the terminology used by Vladykov (1956). Mature eggs were yellowish in color and appeared somewhat translucent. Their average size (preserved) increased directly with fish length and varied from 1.47 to 2.22 mm in diameter. A similar relation between egg size and fish length was reported by Brown (1957), Grainger (1953), and Ricker (1932). Atretic, or regressing mature eggs were large, opaque and irregularly shaped. Recruitment, or immature eggs were white, opaque, and averaged 0.84 to 1.05 mm. Hickling and Rutenberg (1936), reported that a marked difference in egg size between mature and recruitment eggs indicates a short spawning season. The

contrast in egg sizes for individual mountain suckers indicates a short spawning period for these fish.

Ovaries of all female mountain suckers longer than 145 mm in length contained mature eggs or showed evidence of spawning. Most of those between 130 and 145 mm in length had mature eggs, and the smallest individual with mature eggs was 127 mm in length. Some females are mature as early as age 3, and all are mature by age 5.

Well developed testes were thick, white, and highly convoluted and similar to those described by Spoor (1938) for the white sucker. All male mountain suckers longer than 130 mm and most of those between 115 and 130 mm had well developed testes. The smallest individual with well developed testes was 107 mm in length and the smallest one which produced milt when pressure was applied to the abdomen was 122 mm in length. Some males mature as early as age 2 and all are mature by age 4. The early-maturing fish are probably the faster growing individuals of their age groups, as shown by Alm (1959). Smith (1966) found mature mountain sucker females 90 to 175 mm in standard length and males, 64 to 140 mm.

Male mountain suckers are readily distinguished from females during the breeding season by secondary sexual characteristics. Males are characterized by having all rays of the enlarged anal fins with large, pointed, cone-shaped tubercles and those of the lower caudal fin with medium-sized tubercles, while the anal fin of the female is small and

has medium-sized tubercles on the last rays only and minute tubercles on the lower caudal fin. Males have minute tubercles on the entire body and all fins except the dorsal, while females have minute tubercles on the dorsal and lateral parts of the head and body only. In addition, both sexes have medium-sized tubercles on the scales of the peduncle adjacent to the anal fin. Similar observations of breeding tubercles on the mountain sucker was made by Smith (1966).

Both sexes develop a broad, reddish-orange stripe along the lateral line during the breeding season. In males, colors are brighter and, at maximum development, the stripe is wider and extends from the eye to the base of the caudal fin. In females, it begins at the margin of the opercular opening and usually ends near the anal fin. Similar breeding coloration of mountain suckers was found by Sigler and Miller (1963), Simon (1951), and Smith (1966). The smallest female with well developed secondary sexual characteristics was 150 mm in length, but one, 127 mm in length, had moderately developed tubercles. The smallest male with well developed tubercles was 122 mm in length, but one, 118 mm in length, had an enlarged anal fin without tubercles. Secondary sexual characteristics achieved maximum development during the last week of June. Breeding tubercles developed sooner and lasted longer than the breeding color, and secondary sexual characteristics generally developed sooner and lasted longer in males than in females.

Average ripeness factors were calculated for females collected from Flathead Creek and the East Gallatin River (Figure 2). Only mature specimens were used, and collections were combined by two-week intervals. Maximum development occurred during the last week of June and then rapidly decreased until mi-August. This indicates that most spawning occurred during the last week of June and the first two weeks of July. During this period, water temperatures ranged from 17 to 19°C in Flathead Creek and 11 to 19°C in the East Gallatin River.

Mountain suckers mature at a younger age, and spawn later in the year than the white sucker, the longnose sucker and the largescale sucker (Catostomus macrocheilus) (Brown and Graham, 1953; Geen, 1958; Geen, et al, 1966; Harris, 1962; and Spoor, 1938). Secondary sexual characteristics apparently are more extensive in the mountain sucker than in the white sucker (Reighard, 1920) and the largescale sucker, (Catostomus macrocheilus), (Branson, 1961).

Fecundity

Fecundity was determined by actual counts of mature eggs in the ovaries of three females and by sampling from the ovaries of 18 additional females. The accuracy of the sampling method was tested by making 16 separate estimates of the three actual counts. The actual counts were 2100, 2670, and 3474 eggs and the average errors for the estimates were 9.7, 5.5, and 8.5% respectively.

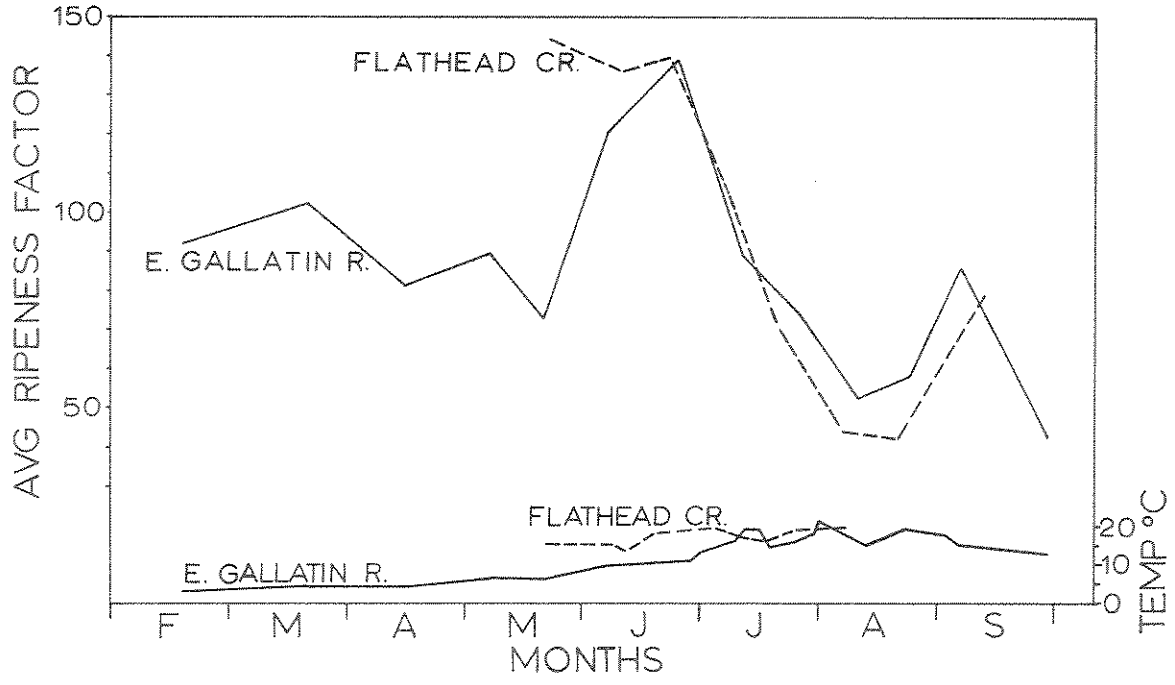

Figure 2. - Average ripeness factors of mature mountain suckers and associated water temperatures from Flathead Creek, 1966 and the East Gallatin River, 1967.

Fecundity (Figure 3) was generally related to fish length. The estimated number of eggs ranged from 990 for a female 131 mm in length from Flathead Creek to 3710 for a female 184 mm in length from the East Gallatin River. One specimen 231 mm in length from Flathead Creek had 2980 eggs.

Food Habits

Digestive tracts of 79 mountain suckers from 12 collections made between February and September 1967 were examined. Most were from the East Gallatin River, but some came from the Madison River. Digestive tract analyses are summarized in Table 3.

Food items were identified to the following groups: diatoms, other algae, higher plants, Diptera, and other animals. A large portion of the contents was unidentified material which consisted of sand particles and amorphous masses of debris. Of those items identified, diatoms were the most abundant. They were relatively more numerous in the larger fish. Other algae were next in abundance and were found in nearly all tracts. These occurred less frequently in tracts of fish smaller than 31 mm in length. Of the other algae, Closterium was most important in smaller fish and filamentous algae were most important in larger fish. Fragments of higher plants were sparse. Diptera was the most numerous animal food, with larvae being most common. Pupae were abundant in one collection. Animals taken rarely were Turbellaria (4 tracts), Ephemeroptera (4 tracts), Rotifera (1 tract),

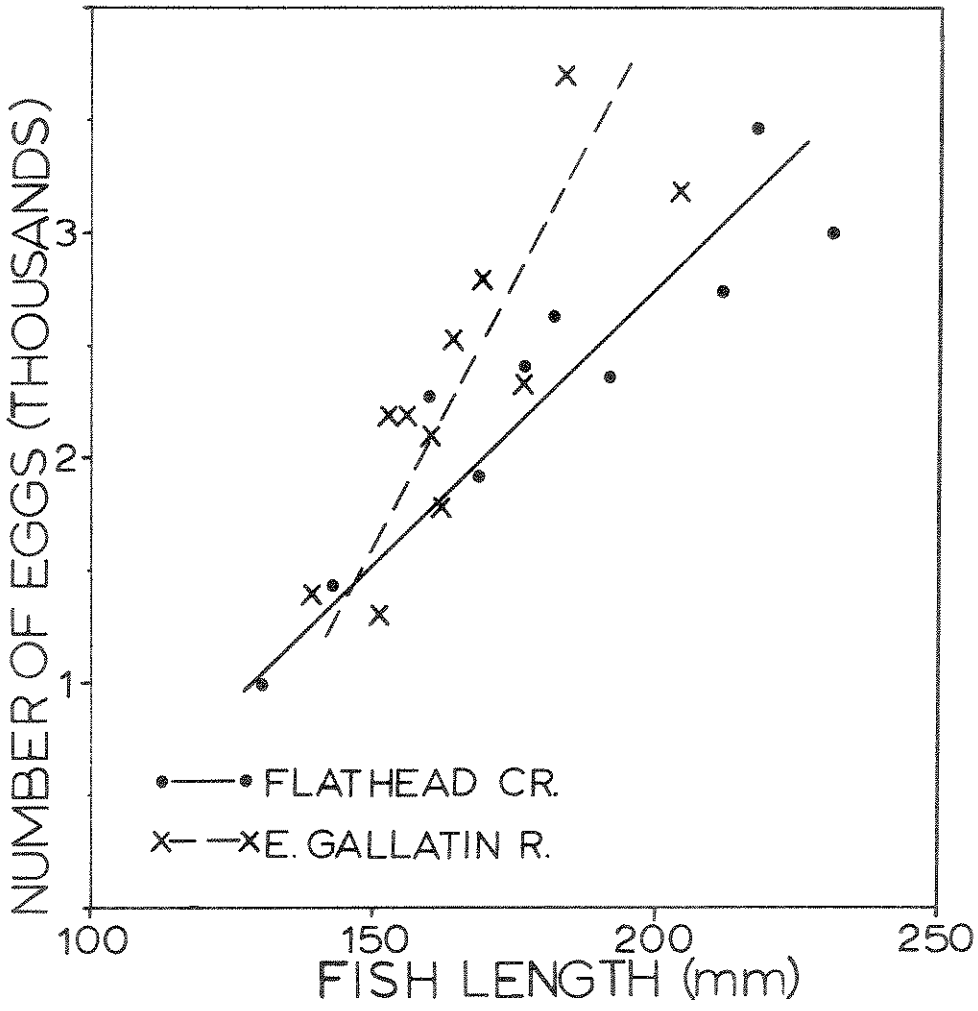

Figure 3. - Estimated and actual number of mature eggs per female from Flathead Creek, 1966 and the East Gallatin River, 1967.

Table 3. - Percentage frequency of occurrence and relative abundance of digestive tract contents for mountain suckers of different sizes taken during 1967. (Number of tracts in parentheses).

Item	20 to 30 mm (6)		31 to 69 mm (20)		70 to 212 mm (53)	
	Frequency percent	Abund-ance	Frequency percent	Abund-ance	Frequency percent	Abund-ance
Diatoms	100	Common	100	Abundant	100	Abundant
Other algae	50	Sparce	95	Abundant	100	Common
Higher plants	17	Sparce	40	Sparce	40	Sparce
Diptera	100	Common	50	Common	68	Common
Other animals	50	Sparce	15	Sparce	11	Sparce
Unidentified	100	Common	100	Abundant	100	Abundant

Plecoptera (1 tract), and Coleoptera (1 tract). Examination of tracts showed less food ingested during early spring than in late spring and summer.

Sigler and Miller (1963) and Smith (1966) reported briefly on the food habits of the mountain sucker. My study generally agrees with their results. Food items found in the white sucker by Stewart (1926), and the longnose sucker by Brown and Graham (1953), are similar to those found for the mountain sucker except their reports show more animal matter in adults.

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