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YELLOWSTONE RIVER STUDY
ANNUAL PROGRESS REPORT

RESEARCH CONDUCTED BY:
MONTANA DEPARTMENT OF
FISH AND GAME
AND
TENNECO INC.

PREPARED BY:

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Yellowstone River study annual progress

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OBJECTIVES - PHASE I

This study was initiated in August, 1974 and actual sampling of aquatic macroinvertebrates began in November. Initial research objectives were to inventory the invertebrates, determine longitudinal distribution patterns and examine the quality of the fauna utilizing species diversity indices. Once this information has been obtained, research on flow requirements and ecology of the dominant organisms can proceed.

It was decided early in the study that it would be desirable to study the entire river as a continuous ecosystem. Data gathered from all parts of the river could aid in the understanding of the faunal distribution at any one station.

METHODS - PHASE I

Twenty sampling stations were established along the Yellowstone River in Montana (Table 1) and each was sampled monthly except during severe ice conditions (January - March) and peak runoff months (May - June). Stations 1 - 4 were sampled by Rod Berg (Fish and Game funding), stations 5 - 11 by Dennis Schwehr (University of Montana, Old West Reg. Comm. funding) and stations 12 - 20 by Robert Newell (Tenneco, Inc. funding).

Initial inventory sampling was accomplished by means of Hester - Dendy multiple plate artificial substrates (E.P.A. 1973). These samplers were modified by placing larger spacers between the plates and by inserting a longer center rod. This center rod with attached plates was thrust into the substratum with the lowermost plate 2" from the bottom. Fluctuating water levels and thick, unstable ice conditions destroyed some samplers and forced their temporary removal during the winter and high water period.

Additional monthly inventory sampling was accomplished with 2 min. kick samples. This type of sampling ensures collection of most of the fauna. Data gathered from kick samples can be used in diversity calculations, percent composition and comparisons between stations.

All organisms collected from the Yellowstone River were identified to genus, counted and the data were sent to the State Data Processing Bureau where several species diversity indices were calculated. Invertebrates collected from the Tongue River were identified to genus but were not counted.

Species diversity indices were calculated using the following formulas:

$$\text{Shannon-Weaver function } (\bar{d}) = - \sum_{i=1}^S (N_i/N) \log_2 (N_i/N)$$

(Shannon and Weaver 1964)

$$\text{Equitability } (E_m) = \bar{d}/d_{\max}$$

(Margalef 1957, Krebs 1972)

Hester-Dendy multiple plate artificial substrates

Yellowstone River at Livingston

Table 1. Yellowstone River Sampling Stations

No.	Location	County	Elevation	River Mile**
1	Corwin Springs	Park	5110 ft.	549
2	Mallard Rest Access	Park	4620	515
3	Above Livingston	Park	4490	502
4	Above Shields River	Park	4380	497
5	Grey Bear Access	Sweetgrass	4100	468
6	Below Greycliff	Sweetgrass	3880	444
7	Columbus	Stillwater	3566	411
8	Laurel	Yellowstone	3294	391
9	Duck Creek Bridge	Yellowstone	3140	360
10	Huntley	Yellowstone	3110	349
11	Custer	Yellowstone	2720	300
12	Bighorn River	Treasure	2700	296
13	Myers	Treasure	2640	279
14	Forsyth	Rosebud	2490	234
15	Miles City	Custer	2335	184
16	Terry	Prairie	2190	138
17	Glendive	Dawson	2045	93
18	Intake	Dawson	1998	71
19	Sidney	Richland	1892	30
20	Cartwright, N.D.	McKenzie	1850	9

** Mouth of the Yellowstone River is river mile 0.0.

$$\text{Redundancy (R)} = \frac{d_{\max} - \bar{d}}{d_{\max} - d_{\min}}$$

(Wilhm and Dorris 1966, 1968)

$$\text{Theor. Max. diversity (d}_{\max}) = (1/N) \left[\log_2 N! - S \log_2 (N/S)! \right]$$

$$\text{Theor. Min. diversity (d}_{\min}) = (1/N) \left\{ \log_2 N! - \log_2 \left[N - (S-1)! \right] \right\}$$

$$\text{Evenness (J')} = \bar{d} / \log_2 S$$

(Pielow 1969, Egloff and Brakel 1973)

$$\text{Species Richness (SR)} = \bar{d} - \bar{d} / \log_2 N$$

(Orr et al. 1973)

where: S = number of species

N_i = number of individuals in the ith SPECIES

N = total number of individuals

A high (>3.0) Shannon-Weaver index generally means a healthy community while a low index (<1.0) generally means the community is under some type of stress (Wilhm 1970 abc), (Table 2).

Equitability has been found to be very sensitive to even slight levels of degradation. Healthy communities have values of 0.0 to 0.3 (E.P.A. 1973).

Redundancy is a measure of the repetition of information within a community and thereby expresses the dominance of one or more species and is inversely proportional to the wealth of species. Redundancy is maximal when no choice of species exists and minimal when there is a large choice of species.

Community distribution has maximum evenness if all the species abundances are equal and the greater the disparities among the different species abundances, the smaller the evenness.

Species richness is a little used index that shows maximal values with large numbers of species.

Much of the benthic fauna can presently be identified only to the genus level. Once the fauna has been identified to species a search of published literature will provide some insight into ecological requirements and tolerances. Adult insects permit positive identification to the species level and therefore adult collection has and will continue to receive strong emphasis during this study.

PRELIMINARY RESULTS - PHASE I

Several interesting patterns of longitudinal distribution occur in the 550 miles of Yellowstone River examined in this study. The Ephemeroptera (mayflies) exhibit some distinct patterns of distribution (Table 3). The mayfly community is composed of several species confined to the upper river, several species found only in the lower river and 4 species found throughout the river. Individuals of the genera Baetis, Ephemerella and Rhythrogena were the most numerous. The Ephemeroptera comprised a mean of 44 percent of the fauna and percent composition ranged from 11-88 percent (Table 9). About 75% of the mayflies have been identified to species.

The Trichoptera (caddisflies) decrease in diversity as one proceeds downstream (Table 4). The majority of the fauna is confined to the upper 9 stations. The genera Cheumatopsyche and Hydropsyche were the most abundant caddisflies collected and were also the most widespread. Trichoptera comprised an average of 16 percent of the fauna and percent composition ranged from 0-58 percent of the fauna (Table 9). Approximately 20 percent of the species have been identified .

The Plecoptera (stoneflies) decrease in diversity in a downstream direction (Table 5). A total of 29 species representing 14 genera were collected. Most of the species (25) were found in the upper river and only 4 species were confined to the lower 10 sampling stations, including several species not previously known from east of the continental divide: Brachyptera pacifica, B. fosketti, Isogenus frontalis colubrinus and Acroneuria abnormis. Stoneflies comprised a mean of 6 percent (range 0-15 percent) of the fauna, (Table 9). About 95 percent of the species have been identified.

The Diptera of the Yellowstone are dominated by the family Chironomidae (midges), where 19 genera have been tentatively identified, and were very abundant throughout the river (Table 6). The Diptera comprised a mean of 33 percent of the total fauna (range 4-78 percent) (Table 9).

The miscellaneous orders found in the river (Table 7) comprised a minor portion of the invertebrate fauna (mean of 1 percent, range 0-11 percent) (Table 9). Very few species have been identified.

A checklist of the fauna of the Yellowstone and Tongue River is presented in Table 8. An attempt was made to identify as many species as possible. In some cases, adults were collected and positive identification was possible. In other cases, the most probable species for a particular genus was tentatively placed on the list, and a question mark appears after the species which has been placed in parentheses.

Species diversity values are presented in Table 2. Only 5 months of data have been analyzed to date, but it appears that none of the sampling stations are under any excessive environmental stress. Shannon-Weaver index values (d) range from 1.53 to 3.84. No distinct patterns of indices are evident throughout the river system. Further interpretation with the limited number of samples is not warranted at this time.

OBJECTIVES - PHASE II

The second phase of this study will begin in July, 1975. The major emphasis will involve determination of flow requirements of the dominant macroinvertebrates approximately 50 miles above and below the Intake diversion. Emphasis will be to determine distribution and abundance of invertebrates in relation to current, depth and substratum.

METHODS - PHASE II

Since emergence of species occurs throughout the summer and fall, a large number of samples will be taken during each sampling period. Analysis of results will be made with data gathered at each sampling period and little comparison

will be possible between samples taken at different intervals of time (e.g. all July samples will be analyzed together with little analysis between July and August samples). Samples will be taken monthly from July through December, 1975.

Sampling stations will be established near Terry, immediately above and below Intake and at Sidney. Less frequent sampling will occur at Glendive and near the mouth of the Yellowstone River. Each sampling period will involve a minimum of 20 approximately one foot samples taken along transects perpendicular to current flow. Current velocity and water depth will be determined at each sample location. Abundance and presence or absence will each be plotted against depth and against current speed. If sufficient data are available an analysis of variance will be calculated to determine the influence of each variable.

The influence of different substratum types and flow rates will be investigated during this winter of 1975 - 1976 using facilities at the Miles City fish hatchery. Examination of results obtained from these two investigations should provide insight into flow requirements of the major benthic organisms in the lower Yellowstone.

Research will also continue to determine a quantitative sampling method that will be acceptable on the Yellowstone River. Adult collections will also be continued and experts will be consulted for identification of the more difficult taxa.

FORAGE FISH INVESTIGATIONS - PHASE I

The maintenance of the piscivorous sport and nonsport species fish populations of the lower Yellowstone depends on an adequate forage fish base. A forage fish is any fish that is utilized as a source of food by other fish.

Most members of the Cyprinidae (minnow) family found in the lower Yellowstone are probably used as forage to some extent. Other species, such as the stonecat, are commonly found in fish stomachs. In addition, age 0 fish of both sport and nonsport fish species may also be used as forage by adult fish. The objectives of the forage fish investigations are to: 1) collect and identify those fish species which may be utilized as a food source by other fish, and 2) identify the habitat requirements of the important forage fish species. A food habits study, currently being initiated under the Bureau of Reclamation Yellowstone Study, will identify those forage fish species important to the major sport and nonsport fish populations.

Forage fish samples were taken in the vicinities of Forsyth, Miles City, and Glendive during the fall of 1974. The initial objectives of this sampling were to obtain a reference collection of forage fish species and their distribution and to develop effective sampling techniques for forage species. Any attempt to determine relative abundance of forage fish species between areas depends on development of a standard unit of capture effort. If a standard unit of capture effort can be developed, then forage fish sampling sites will be established and sampled on a regular basis.

Several sampling techniques were tested during this report period for the capture of forage fish species and age 0 sport fish species. A 100-foot, 1/4-inch mesh, 8-foot deep seine is most effective in backwater areas for most forage and age 0 sport species. Certain species, such as the stonecat, are found in areas unsuitable for seining. In these cases, electrofishing with a mobile electrode and half-pulsed DC current will be used.

The 100-foot, 1/4-inch mesh seine will be used in those areas of the main channel which are suitable for seining. In areas of the main channel too deep or swift for seining, electrofishing with the boom electrode and DC current will be used.

Forage fish samples have not been sorted and identified. Analyses of samples will be done during high water and included in the next report.

Yellowstone at Glendive

Yellowstone at mouth

Table 2. Species Diversity Indices

Sta.	d (Max.)	Max.Theoretical Diversity		Min.Theoretical Diversity		Redundancy		Evenness		Equitability		Richness	
		Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
1	2.39	3.82	4.82	0.19	0.42	0.15	0.55	0.48	0.85	0.21	0.36	1.65	2.84
2	3.11	3.22	4.33	0.11	0.54	0.25	0.35	0.66	0.81	0.26	0.39	2.17	2.74
3	2.70	3.24	3.89	0.08	0.42	0.19	0.45	0.56	0.81	0.20	0.37	1.96	2.33
4	2.72	3.52	3.67	0.16	0.61	0.24	0.47	0.57	0.76	0.26	0.33	1.82	2.43
5	3.19	3.37	4.56	0.25	0.49	0.19	0.32	0.69	0.85	0.32	0.40	2.42	2.84
6	2.97	3.61	4.48	0.22	0.50	0.36	0.44	0.57	0.69	0.27	0.34	2.09	2.66
7	3.60	3.29	4.72	0.39	0.73	0.23	0.29	0.75	0.76	0.36	0.43	2.28	3.19
8	3.84	2.85	4.28	0.78	0.98	0.12	0.24	0.79	0.87	0.43	0.53	1.94	3.34
9	3.12	3.58	4.55	0.42	0.84	0.35	0.40	0.66	0.70	0.33	0.39	2.10	2.76
10	3.20	2.83	4.25	0.17	1.13	0.13	0.82	0.22	0.82	0.09	0.51	0.77	2.69
11	2.21	3.74	4.47	0.18	0.53	0.45	0.62	0.41	0.60	0.18	0.28	1.64	1.95
12	2.74	3.13	4.12	0.30	1.00	0.33	0.36	0.66	0.70	0.30	0.42	2.01	2.43
13	1.53		4.44		0.13		0.67		0.34		0.14		1.39
14	2.94		4.17		0.63		0.35		0.67		0.37		2.57
15	1.75		4.01		0.28		0.60		0.44		0.20		1.56
16	-		-		-		-		-		-		-
17	1.90		2.82		0.39		0.38		0.68		0.28		1.62
18	2.84		3.91		0.73		0.34		0.69		0.39		2.45
19	2.41		2.97		0.66		0.24		0.76		0.39		2.02
20	3.36		3.96		1.04		0.21		0.84		0.51		2.84

Table 3. Longitudinal Distribution of the Ephemeroptera of the Yellowstone River.

TAXA	STATIONS																			
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
<u>Baetis (propinquus)?</u>	x																			
<u>Ephemerella hecuba</u>		x																		
<u>E. heterocaudata</u>		x																		
<u>E. hystrix</u>		x	x																	
<u>Epeorus albertae</u>		x																		
<u>Epeorus longimanus</u>		x	x																	
<u>Ephemerella doddsi</u>		x	x	x	x	x	x													
<u>Ephemerella tibialis</u>		x	x	x	x															
<u>Ephemerella grandis</u>		x	x	x	x	x														
<u>Paraleptophlebia</u> ...																				
<u>heteronea</u>		x	x	x	x	x	x													
<u>Ameletus (oregonensis)?</u> ...		x	x	x	x	x	x	x	x	x	x	x	x	x						
<u>Ephemerella margarita</u>		x	x	x	x	x	x													
<u>Ephemerella inermis</u>		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x		
<u>Baetis (alexanderi)?</u>		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	
<u>Baetis parvus</u>		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	
<u>Heptagenia elegantula</u>		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	
<u>Rhithrogena hageni</u>		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	
<u>Tricorythodes minutus</u>					x	x	x	x	x	x	x	x	x							
<u>Leptophlebia</u>																				
<u>(gravastella)?</u>				x	x	x	x	x	x	x	x	x	x	x	x	x	x	x		
<u>Traverella albertana</u>							x	x	x	x	x	x	x	x	x	x	x	x	x	
<u>Stenonema</u> sp.									x	x	x	x	x	x	x	x	x	x		
<u>Choroterpes</u>																				
<u>(albiannulata)?</u>									x	x	x	x	x	x	x	x	x	x		
<u>Baetisca</u> sp.																x				
<u>Dactylobaetis (cephus)?</u> ..																	x	x	x	x
<u>Ephoron album</u>																	x	x	x	x
<u>Lachlania powelli</u>																		x		
<u>Ametropus (neavei)?</u>																				x
<u>Brachycercus (prudens)?</u> ...																				x
<u>Isonychia</u>																				
<u>(sicca campestris)?</u>																				x

Table 4. Longitudinal Distribution of Trichoptera of the Yellowstone River.

TAXA	STATIONS																			
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
<u>Amiocentrus aspilus</u> ..					x															
<u>Rhyacophila</u> sp.....		x	x	x	x															
<u>Glossosoma</u> sp.		x	x	x	x	x	x	x												
<u>Glossosoma velona</u>									x											
<u>Psychomyia</u> sp.....		x	x	x	x	x	x													
<u>Athripsodes</u> sp.....		x	x	x	x	x	x	x												
<u>Lepidostoma</u> sp.....		x	x	x	x	x	x	x	x											
<u>Arctopsyche grandis</u> ..		x	x	x	x	x	x	x	x											
<u>Brachycentrus</u> sp.....		x	x	x	x	x	x	x	x											
<u>Oecetis</u> sp.....							x		x											
<u>Oecetis disjuncta</u>														x						
<u>Hydroptila</u> sp.....		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x				
<u>Cheumatopsyche</u> sp.....		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	
<u>Cheumatopsyche enonis</u> .										x	x	x	x	x	x					
<u>Hydropsyche</u> sp.....		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
<u>H. occidentalis</u> x														x						
<u>H. separata</u>																		x		
<u>Polycentropus</u> sp.....													x							
<u>Ochrotrichia potomas</u> ..													x							
<u>Leptocella</u> sp.....													x				x	x		
<u>Neotrichia</u> sp.....																	x

Diversion at Intake

Table 5. Longitudinal Distribution of Plecoptera of the Yellowstone River.

TAXA	STATIONS																			
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
<u>Paraleuctra sara</u>	x																			
<u>Pteronarcys</u>																				
<u>californica</u>	x	x	x	x	x															
<u>Arcynopteryx parallela</u> ...	x	x	x	x	x	x	x	x	x											
<u>Hesperoperla pacifica</u> ...	x	x	x	x	x	x	x	x	x											
<u>Isocapnia missouri</u>	x	x	x	x	x	x	x													
<u>Isocapnia vedderensis</u>	x	x	x	x	x	x														
<u>Nemoura besametsa</u>	x	x																		
<u>Nemoura cinctipes</u>	x	x	x	x	x	x	x	x												
<u>Claassenia sabulosa</u>	x	x	x	x	x	x	x	x												
<u>Pteronarcella badia</u>	x	x	x	x	x	x	x	x	x	x										
<u>Alloperla</u> spp.....	x	x	x	x	x	x	x	x	x	x	x	x								
<u>Alloperla signata</u>	x	x	x	x	x															
<u>Alloperla pallidula</u>	x	x	x	x	x	x	x	x												
<u>Alloperla coloradensis</u> ..						x														
<u>Capnia</u> spp.....	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x					
<u>Capnia distincta</u>	x																			
<u>Capnia confusa</u>	x	x	x	x	x															
<u>Capnia gracilaria</u>	x	x																		
<u>Capnia poda</u>	x	x	x	x	x															
<u>Capnia limata</u>								x	x	x	x	x	x	x	x					
<u>Brachyptera</u> spp.....	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	
<u>B. nigripennis</u>	x	x	x	x	x	x	x													
<u>B. pacifica</u>													x	x						
<u>B. fosketti</u>															x	x	x	x		
<u>Isoperla</u> spp.....	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	
<u>Isoperla patricia</u>	x	x	x	x	x	x	x													
<u>Isoperla mormona</u>	x	x	x	x	x	x														
<u>Isoperla longiseta</u>						x														
<u>Isogenus</u> spp.....	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	
<u>Isogenus aestivalis</u>	x																			
<u>Isogenus tostonus</u>	x	x	x	x	x	x	x													
<u>Isogenus elongatus</u>	x	x	x	x	x	x	x													
<u>Isogenus frontalis</u>															x	x	x	x		
<u>Acroneuria abnormis</u>															x					

Table 6. Distribution of the Diptera of the Yellowstone River.

TAXA	STATIONS																			
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
BLEPHAROCERIDAE																				
<u>Agathon</u> sp.....	x																			
CERATOPOGONIDAE																				
													x	x			x			
CHIRONOMIDAE																				
<u>Orthocladus</u> sp.....	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
<u>Cardiocladius</u> sp.....	x	x	x	x	x	x	x	x	x	x	x	x	x	x						
<u>Diamesa</u> sp.....	x	x	x	x	x	x	x													
<u>Metriocnemus</u> sp.....	x																			
<u>Procladius</u> sp.....		x																		
<u>Pseudodiamesa</u> sp.....							x	x												
<u>Chironomus</u> sp.....								x												
<u>Cricotopus</u> sp.....								x												
<u>Ablabesmyia</u> sp.....		x	x							x	x							x	x	
<u>Microtendipes</u> sp.....		x	x				x	x	x		x	x								
<u>Rheotanytarsus</u> sp.....		x								x					x					
<u>Eukiefferiella</u> sp....	x					x	x	x	x	x	x	x	x	x	x	x	x	x	x	
<u>Brillia</u> sp.....							x			x	x	x							x	
<u>Tribelos</u> sp.....			x					x	x					x						
<u>Clinotanypus</u> sp.....													x						x	
<u>Cryptochironomus</u> sp.															x					
<u>Cryptocladius</u> sp.....														x					x	
<u>Paralauterborniella</u> ..							x													
<u>Trichocladius</u> sp.....																	x	x		
																			x	
EMPIDIDAE																				
<u>Hemerodromia</u> sp.....	x	x	x	x			x			x										
RHAGIONIDAE																				
<u>Atherix variegata</u>	x	x	x	x	x	x	x	x	x	x										
SIMULIIDAE																				
<u>Simulium</u> sp.....	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
TANYDERIDAE																				
<u>Protoplasia fitchii</u> ...						x														
TIPULIDAE																				
<u>Dicranota</u> sp.														x		x				
<u>Hexatoma</u> sp.....	x	x	x	x	x	x	x	x	x	x	x	x	x	x						
<u>Holorusia</u> sp.....						x														
<u>Tipula</u> sp.....										x										

Table 7. Distribution of the Miscellaneous Orders of the Yellowstone River.

TAXA	STATIONS																			
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
ISOPODA																				
<u>Asellus racovitzai</u> .										x										
LEPIDOPTERA																				
<u>Cataglyphis</u> sp.....						x								x						
HEMIPTERA																				
<u>Ambrysia mormon</u>												x								
<u>Hesperocorixa</u> sp....								x	x	x	x	x	x	x					x	
OLIGOCHAETA																				
												x	x	x			x	x		
MOLLUSCA																				
<u>Ferrissia</u> sp.....																	x	x		
<u>Gyraulus</u> sp.....																				x
<u>Physa</u> sp.....								x			x									
ODONATA																				
<u>Gomphus</u> sp.....																				x
<u>Amphiagrion</u> sp.....										x										
COLEOPTERA																				
<u>Hydroporus</u> sp.....	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x				
<u>Gyrinus</u> sp.....										x										
<u>Microcylloepus</u> sp...							x	x	x	x										
<u>Dubiraphia</u> sp.....																	x			
<u>Stenelmis</u> sp.....																	x		x	
<u>Optioservus</u> sp.....	x						x	x	x	x			x							
<u>Zaitzevia</u> sp.....										x										
ACARI																				
							x	x	x	x										

Table 8. Checklist of the Aquatic Macroinvertebrates of the Tongue River and Yellowstone River.

Phylum Arthropoda

Order Ephemeroptera

Family Siphonuridae

Ameletus (oregonensis McD.) ?

Isonychia (sicca campestris McD.) ?

Family Baetidae

Baetis (alexanderi M.S. Edmunds and Jensen, sp.nov.) ?

" (parvus Dodds

" (propinquus Walsh) ?

Dactylobaetis (cephesus Traver & Edmunds) ?

Family Oligoneuridae

Lachlania (powelli Edmunds) ?

Family Heptageniidae

Epeorus (Iron) albertae (McD.)

" (") longimanus (Eaton)

Heptagenia elegantula (Eaton)

Rhithrogena hageni Eaton

Stenonema sp.A

Family Ametropodidae

Ametropus (neavei McD.) ?

Family Leptophlebiidae

Choroterpes (albiannulata McD.) ?

Leptophlebia (gravastella Eaton) ?

Paraleptophlebia heteronea (McD.)

Traverella albertana (McD.)

Family Ephemerellidae

Ephemerella (Attenuatella) margarita Needham

" (Caudatella) heterocaudata heterocaudata McD.

" (") hystrix Traver

" (Drunella) doddsi Needham

" (") grandis grandis Eaton

" (Ephemerella) inermis Eaton

" (Serratella) tibialis McD.

" (Timpanoga) hecuba hecuba (Eaton)

Family Tricorythidae

Tricorythodes minutus Traver

Family Polymitarcidae

Ephoron album (Say)

Family Caenidae

Brachycercus (prudens McD.) ?

Family Baetiscidae

Baetisca sp.A

Order Trichoptera

Family Rhyacophilidae

Rhyacophila sp.A

Table 8 Continued

Family Glossosomatidae

Glossosoma sp.A
" velona Ross

Family Psychomyiidae

Polycentropus sp.A
Psychomyia sp.A

Family Hydropsychidae

Arctopsyche grandis (Banks)
Cheumatopsyche sp.A
" enonis Ross
Hydropsyche sp.A
" occidentalis Banks
" separata Banks

Family Hydroptilidae

Hydroptila sp.A
Ochrotrichia potomas Denning
Neotrichia sp.A

Family Leptoceridae

Athripsodes sp.A
Leptocella sp.A
Oecetis sp.A
Oecetis disjuncta (Banks)

Family Lepidostomatidae

Lepidostoma sp.A

Family Brachycentridae

Amiocentrus aspilus (Ross)
Brachycentrus sp.A

Order Plecoptera

Family Nemouridae

Nemoura (Prostoia) besametsa Ricker
" (Zapada) cinctipes Banks
Paraleuctra sara Claassen
Capnia (Capnia) confusa Claassen
" " gracilaria "
" " limata Frison
" (Utacapnia) distincta Frison
" " poda Nebeker & Gaufin
Isocapnia missouri Ricker
" vederensis (Ricker)
Brachyptera (Taenionema) fosketti Ricker
" " nigripennis (Banks)
" " pacifica (Banks)

Family Pteronarcidae

Pteronarcella badia (Hagen)
Pteronarcys californica Newport

Family Perlodidae

Arcynopteryx (Skwala) parallela (Frison)
Isogenus (Cultus) aestivalis (Needham & Claassen)
" " tostonus Ricker
" (Isogenoides) frontalis colubrinus Hagen

Table 8 Continued

- Isoperla mormona Banks
- " longiseta Banks
- " patricia Frison
- Family Chloroperlidae
- Alloperla (Suwallia) pallidula (Banks)
- " (Sweltsa) coloradensis (Banks)
- " (Triznaka) signata (Banks)
- Family Perlidae
- Acroneturia abnormis Newm.
- " (Hesperoperla) pacifica Banks
- Claassenia sabulosa (Banks)

Order Isopoda

- Family Asellidae
- Asellus racovitzai racovitzai Williams

Order Lepidoptera

- Family Pyralidae
- Cataclysta sp.A

Order Hemiptera

- Family Corixidae
- Hesperocorixa sp.A
- Family Naucoridae
- Ambrysis mormon Mont.
- Family Veliidae
- Rhagovelia sp.A

Order Odonata

- Family Gomphidae
- Gomphus sp.A
- Ophiogomphus sp.A
- Family Agrionidae
- Calopteryx sp.A
- Family Coenagrionidae
- Argia sp.A
- Amphiagrion sp.A
- Enallagma sp.A
- Ischnura sp.A

Order Coleoptera

- Family Dytiscidae
- Hydroporus sp.A
- Family Elmidae
- Dubiraphia sp.A
- Microcylloepus pusillus (LeConte)
- Optioservus quadrimaculatus (Horn)
- Stenelmis sp.A
- Zaitzevia parvula (Horn)
- Family Gyrinidae
- Gyrinus sp.A

Table 8 Continued

Order Diptera

Family Elepherozeridae

Agathon sp.A

Family Ceratopogonidae

Family Chironomidae

Subfamily Tanypodinae

Ablabesmyia sp.A

Clinotanytus sp.A

Cryptocladus sp.A

Procladius sp.A

Subfamily Chironominae

Chironomus sp.A

Cryptochironomus sp.A

Microtendipes sp.A

Paralauterborniella sp.A

Rheotanytarsus sp.A

Subfamily Diamesinae

Diamesa sp.A

Pseudodiamesa sp.A

Subfamily Orthoclaadiinae

Brillia sp.A

Cardiocladus sp.A

Cricotopus sp.A

Eukiefferiella sp.A

Metriocnemus sp.A

Orthocladus sp.A

Trichocladus sp.A

Family Empididae

Hemerodromia sp.A

Family Rhagionidae

Atherix variegata Walker

Family Simuliidae

Simulium sp.A

Family Tanyderidae

Protoplasia fitchii O.S.

Family Tipulidae

Dicranota sp.A

Hexatoma sp.A

Holorusia sp.A

Tipula sp.A

Order Acari

Suborder Prostigmata

Phylum Platyhelminthes

Class Turbellaria

Family Planariidae

Dugesia sp.A

Table 8 Continued

Phylum Annelida
Class Oligochaeta

Phylum Mollusca

Order Basommatophora

Family Lymnaeidae

Lymnaea sp.A

Family Physidae

Physa sp.A

Family Planorbidae

Gyraulus sp.A

Family Ancyliidae

Ferrissia sp.A

Order Eulamellibranchia

Family Unionidae

Lampsilis siligoidea (Barnes)

Order Heterodonta

Family Sphaeriidae

Pisidium sp.A

Sphaerium sp.A

Yellowstone River at Livingston

Table 9. Preliminary results of macroinvertebrate sampling on Yellowstone River (percent composition, all samples).

STATION	TAXONOMIC ORDERS					NUMBER SAMPLES ANALYZED TO DATE
	EPHEMEROPTERA	TRICHOPTERA	PLECOPTERA	DIPTERA	OTHERS	
1	27	30	3	40	< 1	3
2	52	14	15	19	0	2
3	28	7	1	64	< 1	3
4	38	5	11	46	< 1	3
5	25	58	12	5	0	3
6	67	10	5	18	< 1	3
7	49	10	6	32	< 1	2
8	48	27	9	16	< 1	2
9	67	15	7	11	< 1	10
10	20	1	1	78	< 2	4
11	20	20	2	58	0	4
12	11	11	1	77	< 1	2
13	86	0	7	7	0	1
14	88	2	6	4	0	1
15	51	7	8	33	< 1	1
16						0
17	36	28	5	31	< 1	7
18	24	3	8	54	11	1
19	26	39	7	38	0	2
20	75	10	0	8	7	1
MEAN =	44%	16%	6%	33%	1%	

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