# MACROINVERTEBRATE DISTRIBUTION IN THE EAST GALLATIN RIVER, MONTANA

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## ABSTRACT

Aquatic macroinvertebrate distribution in relation to the Bozeman municipal sewage discharge point in the East Gallatin River (Gallatin County) Montana is reported. Benthos samples were collected on twelve dates between June 1973 and August 1974 at seven stations. A marked change in macroinvertebrate community structure was observed in the region immediately below the sewage outfall point.

# LIST OF TABLES AND FIGURES

# INTRODUCTION

The objective of this study was to determine how water quality, with particular reference to ammonia, affects the distribution and abundance of aquatic macroinvertebrates in the East Gallatin River (Gallatin County) Montana. This work is part of a more extensive study by the Montana State University Fisheries Bioassay Laboratory on the toxicity of ammonia to fishes and aquatic macroinvertebrates.

The East Gallatin River is the principal tributary to the Gallatin River (sometimes referred to as the West Gallatin), which is one of three rivers which join at Three Forks, Montana, to begin the Missouri River. The East Gallatin begins at the confluence of Bear and Rocky Creeks, east of the city of Bozeman, and flows in a northwesterly direction for approximately 70 kilometers before joining the Gallatin River north of Manhattan, Montana. The East Gallatin drainage area is approximately 642 square miles (1660 $km^2$) (Stuart, et al. 1974). The average discharge of the East Gallatin between 1939 and 1961 (measured approximately 6 km above the city of Bozeman sewage treatment plant) was 85 cfs (2.4 $m^3$/sec). The maximum recorded discharge was 1230 cfs (35 $m^3$/sec) in June 1953, and the minimum was 12 cfs (0.34 $m^3$/sec) in December 1944 and March 1955 (op. cit.).

The principal single point pollution source to the East Gallatin River is the sewage treatment plant of the city of Bozeman. Other sources of pollution include agricultural run-off, domestic sewage seepage, fish culture and industrial wastes. The report by Stuart, et al. (1974) treats this topic in some detail.

Until December 1970, Bozeman sewage was processed at a primary treatment plant and discharged into the East Gallatin approximately

1 km below the East Gallatin - Sourdough Creek confluence. A new sewage plant, capable of secondary treatment, went into partial operation at that time. The new plant, located 7 km downstream from the old discharge point, was handling the total city discharge by August 1971, with approximately 80% of this discharge receiving secondary treatment.

Avery (1970) studied the effects of effluent from the old sewage treatment plant on the macroinvertebrate community of the East Gallatin River. Glorvigen (1972) conducted a similar study during the transition from primary to secondary treatment (April 1970 - September 1971). Both reported significant reductions in clean-water forms for several kilometers downstream from the old sewage outfall point. Glorvigen also noted that there appeared to be no detrimental effects on the invertebrate fauna approximately 6 km below the new sewage outfall point. There have been no reports of benthic invertebrate work done on the East Gallatin since the new sewage plant began operating on a sustained basis in August 1971.

## MATERIALS AND METHODS

Ten benthos sampling stations were established in the East Gallatin River in June 1973 (Figure 1, Table 1). This initial selection was based upon our field observations and results of previous studies on changes in the aquatic biota and water chemistry of the East Gallatin River (Avery 1970, Bahls 1971, Glorvigen 1972, Soltero 1969, Vincent 1968, 1969, 1971). During August, Stations 1, 9 and 12B were added, but were later eliminated along with Stations 4, 5 and 8A. Preliminary examination of the benthos samples indicated that the remaining seven stations adequately covered that section of the river in which the macroinvertebrate community was affected by the sewage discharge.

Sampling stations were riffles, consisting of small to medium (6-15 cm) cobble. Water velocity in these riffles ranged from 45-90 cm/sec as determined using a Gurley (Model 625-F) current meter.

A modified Hess sampler (Waters and Knapp 1961) was used to obtain a 0.28 $m^2$ sample from each station. Samples were stored in 10% formalin or 70% ethanol solutions until laboratory analysis. Samples were collected twelve times from June 1973 to August 1974. In the laboratory, samples were hand-picked, and invertebrates were identified using keys by Gaufin, et al. (1972), Jensen (1966), Pennak (1953), Smith (1968), Usinger (1968) and Wiggins (1965). Organisms were identified to the species level where feasible; where deemed necessary, identifications were confirmed by recognized experts of the various taxa. Many Plecoptera and Ephemeroptera were reared in the laboratory to the adult stage to permit positive species determinations.

# EAST GALLATIN RIVER SAMPLING STATIONS

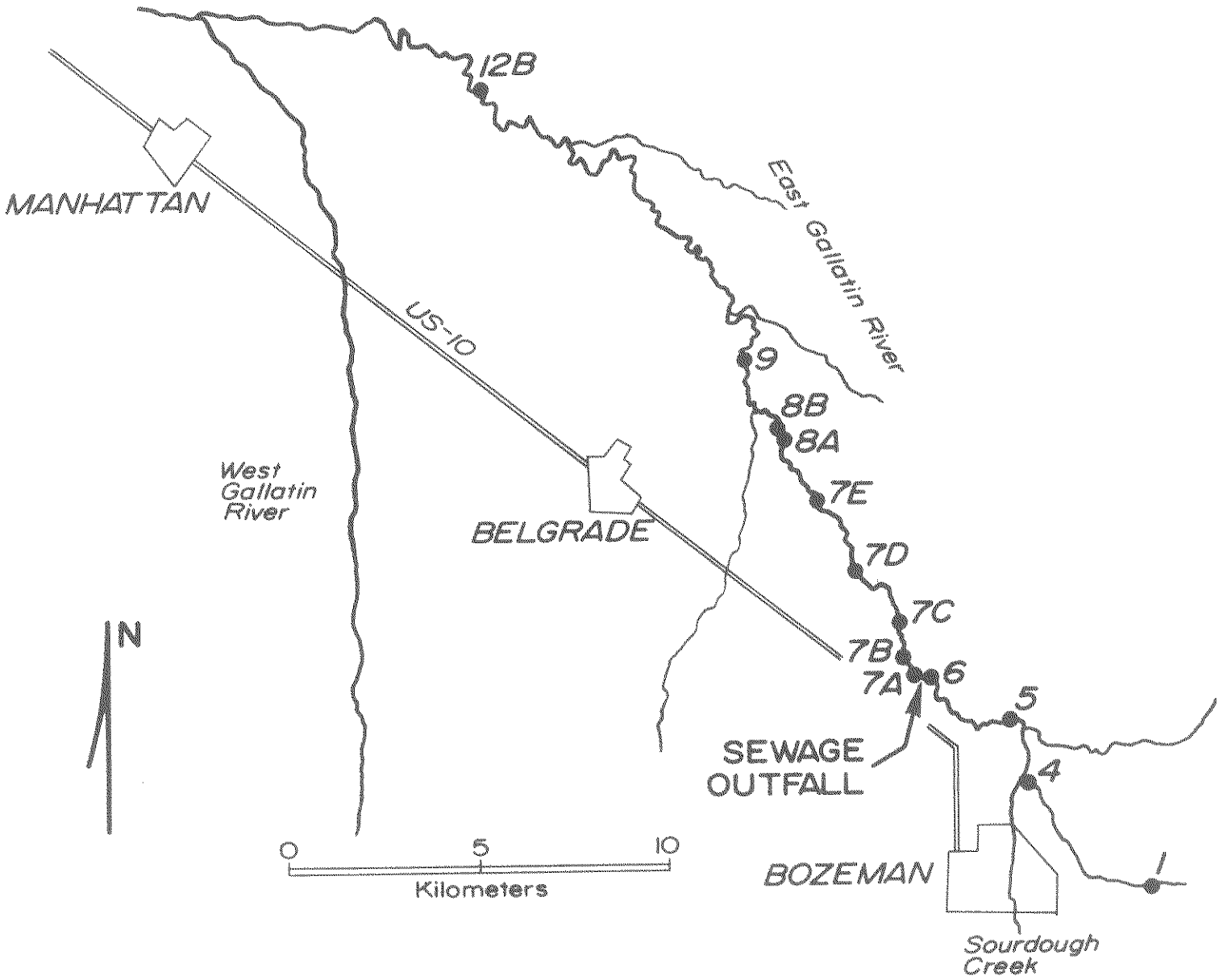

Table 1

EAST GALLATIN RIVER (GALLATIN COUNTY) MONTANA

SAMPLING STATIONS

| Station Number | Distance downstream from Bear Cr.-Rocky Cr. confluence, km* | Distance from sewage outfall point, km* | Location and Description |
|---|---|---|---|
| -- | 0.0 | 18.9 | Bear Cr.-Rocky Cr. confluence |
| EG-6 | 18.7 | 0.2 | At bridge south of Riverside Country Club |
| -- | 18.9 | 0.0 | Sewage outfall point |
| EG-7A | 19.2 | 0.3 | Below effluent from Bozeman sewage treatment plant |
| EG-7B | 20.1 | 1.2 | West of Riverside Country Club tennis courts |
| EG-7C | 21.9 | 3.0 | Above Hoffman farm bridge |
| EG-7D | 24.2 | 5.3 | East of Hollis Harrison house |
| EG-7E | 27.5 | 8.6 | West of Bob Spain ranch house |
| EG-8B | 31.3 | 12.4 | West of Hugh Spain house |
| -- | 71.1 | 52.2 | East Gallatin-Gallatin confluence |

*Measurements made from aerial photographs, 1000 ft/inch (Gallatin County ASCS 1971)

The following species diversity indexes were employed in analyzing macroinvertebrate count data.

Margalef Index (Margalef 1957)

$$d = (s-1)/\log N$$

where d = diversity
s = number of species
N = total numbers

Simpson Index (Simpson 1949)

$$d = \sum_1^s [n_i(n_i-1)/N(N-1)]$$

where d = diversity
s = number of species
$n_i$ = number of individuals in $i^{th}$ species
N = total number of individuals

Shannon Index (Patten 1962, as modified by Hamilton, in press)

$$D = -\sum_1^t [(n_i/N) \log_2(n_i/N)]$$

(diversity per individual)

$$D_{max} = -(t-r)\left(\frac{k}{N}\right) \log_2 \frac{k}{N} - r\left(\frac{k+1}{N}\right) \log_2 \left(\frac{k+1}{N}\right)$$

(maximum diversity)

$$D_{min} = -\left(\frac{t-1}{N}\right) \log_2 \frac{1}{N} - \left(\frac{N-t+1}{N}\right) \log_2 \frac{N-t+1}{N}$$

(minimum diversity)

$$R = (D_{max} - D)/(D_{max} - D_{min})$$

(redundancy)

where $t$ = number of taxa

$n_i$ = number of individuals in the $i^{th}$ taxon

$N$ = total number of individuals

$k$ = greatest integer less than $\frac{N}{t}$

$r = N-kt$

Equitability (Lloyd and Ghelardi 1964)

$$e = s'/s$$

where $e$ = equitability

$s'$ = number of species expected from a community that conforms to MacArthur's (1957) broken stick model

$s$ = number of species found in the sample

All calculations were carried out on the MSU Xerox Sigma 7 computer, programmed in Basic.

# RESULTS

Results for species diversity, percent macroinvertebrate composition, total numbers of species and total numbers of individuals are presented in Tables 2-5 and Figure 2. A species checklist, with frequency of occurrence and relative abundance, is reported in Table 6. Values reported in Tables 2-6 are mean values of all samples collected at each station (twelve samples for Stations 6, 7A, 7B, 7E and 8B, eleven samples for Station 7D, and ten samples for Station 7C).

Raw data counts are reported in Tables 8-19, which are included as an Appendix to this Report.

Table 2

Diversity[1] and Biotic Index Values[2]

East Gallatin River (Montana)

June 1973 - August 1974

| Sampling Stations | Shannon Index | Shannon's Redundancy | Equitability | Margalef Index | Simpson Index |
|---|---|---|---|---|---|
| EG-6 | 2.60 | 0.43 | 0.42 | 3.01 | 0.26 |
| | (1.95-3.02) | (0.33-0.53) | (0.26-0.65) | (2.16-3.71) | (0.19-0.46) |
| EG-7A | 2.49 | 0.43 | 0.65 | 2.58 | 0.28 |
| | (1.53-3.55) | (0.22-0.73) | (0.36-1.06) | (1.63-3.83) | (0.09-0.48) |
| EG-7B | 2.60 | 0.35 | 0.75 | 2.40 | 0.23 |
| | (1.82-3.14) | (0.14-0.50) | (0.53-1.22) | (1.62-3.29) | (0.11-0.44) |
| EG-7C | 2.98 | 0.34 | 0.77 | 3.05 | 0.17 |
| | (2.21-3.42) | (0.14-0.62) | (0.35-1.08) | (2.45-3.72) | (0.10-0.33) |
| EG-7D | 2.58 | 0.43 | 0.48 | 2.94 | 0.26 |
| | (1.69-3.31) | (0.18-0.62) | (0.25-1.00) | (2.13-4.20) | (0.16-0.46) |
| EG-7E | 2.03 | 0.54 | 0.33 | 2.47 | 0.39 |
| | (0.92-3.35) | (0.31-0.71) | (0.16-0.58) | (0.85-3.62) | (0.14-0.66) |
| EG-8B | 2.24 | 0.52 | 0.33 | 2.72 | 0.35 |
| | (0.74-3.05) | (0.39-0.85) | (0.18-0.48) | (1.21-4.01) | (0.20-0.80) |

[1]Diversity values based on insect counts excluding Chironomidae

[2]means; ranges given in parentheses

Table 3

Macroinvertebrate Composition in Percent of Total Numbers[1]

East Gallatin River (Montana)

June 1973 - August 1974

| Sampling Stations | Macroinvertebrates[2] | | | | | |
|---|---|---|---|---|---|---|
| | Ephem. | Plec. | Trich. | Cole. | Dipt. | Oligo. |
| EG-6 | 43.5 | 11.0 | 23.9 | 1.5 | 19.6 | 0.5 |
| EG-7A | 19.8 | 0.6 | 4.2 | 0.9 | 49.7 | 24.8 |
| EG-7B | 10.4 | 0.3 | 0.9 | 0.6 | 25.3 | 62.5 |
| EG-7C | 17.0 | 2.0 | 4.2 | 1.3 | 32.3 | 43.2 |
| EG-7D | 41.4 | 4.6 | 10.5 | 0.6 | 15.6 | 27.3 |
| EG-7E | 65.7 | 3.8 | 4.5 | 0.2 | 14.3 | 11.5 |
| EG-8B | 68.4 | 7.6 | 6.1 | 0.1 | 13.9 | 3.9 |

[1]Excluding Gastropoda, Hirudinea, and Isopoda

[2]Ephem. = Ephemeroptera
Plec. = Plecoptera
Trich. = Trichoptera
Cole. = Coleoptera
Dipt. = Diptera
Oligo. = Oligochaeta

DIPTERA, EPHEMEROPTERA, PLECOPTERA AND OLIGOCHAETA
COMPOSITION IN PERCENT OF TOTAL NUMBERS
OF MACROINVERTEBRATES

EAST GALLATIN RIVER (MONTANA) JUNE 1973 - AUGUST 1974

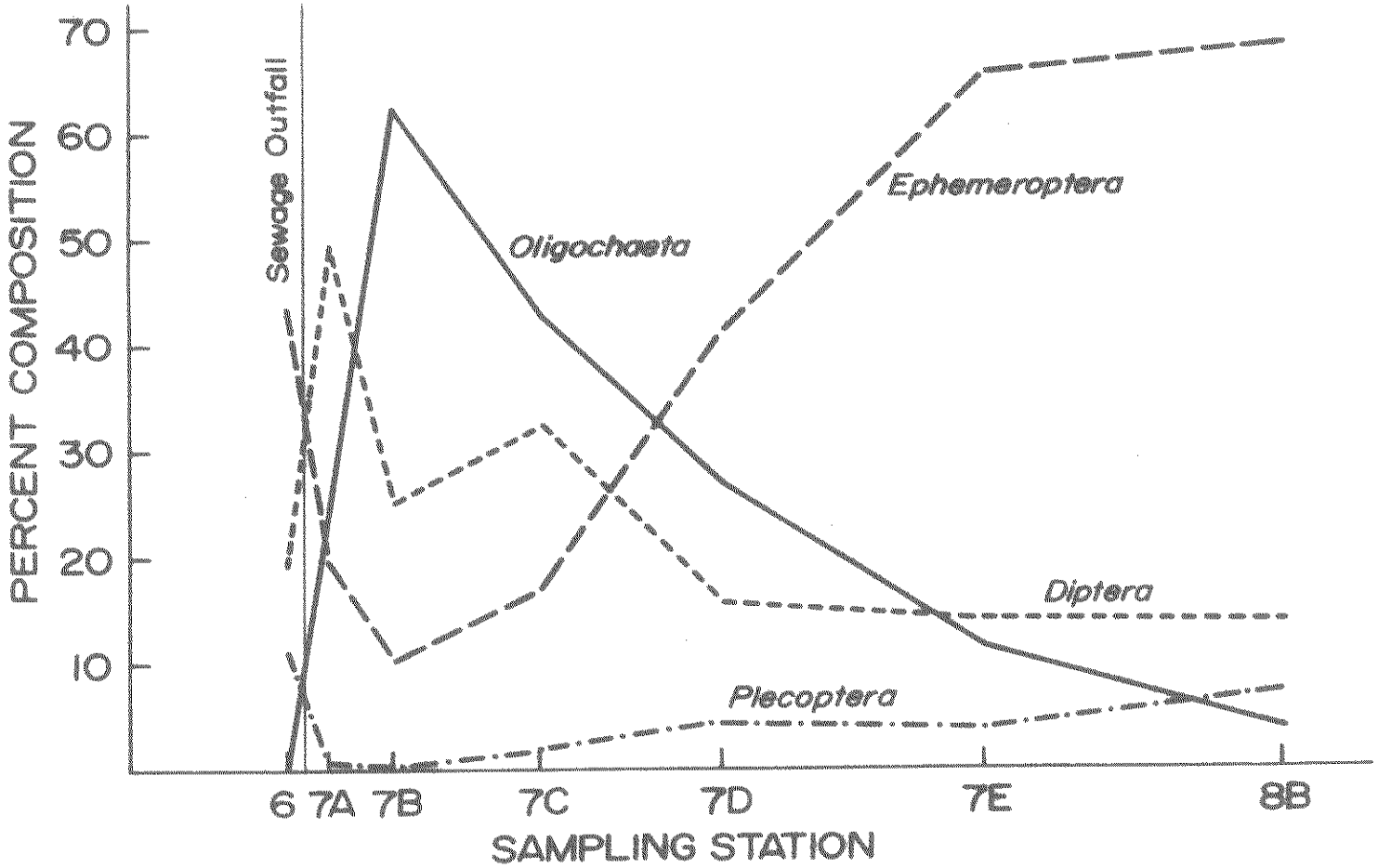

Table 4

Numbers[1] of Aquatic Insect Species

East Gallatin River (Montana)

June 1973 - August 1974

| Sampling Stations | Aquatic Insect Species[2] | | | | | Mean Totals |
|---|---|---|---|---|---|---|
| | Ephem. | Plec. | Trich. | Cole. | Dipt.[3] | |
| EG-6 | 6.8 (4-12) | 5.0 (2-9) | 4.4 (3-7) | 1.7 (1-3) | 3.2 (2-4) | 21.1 |
| EG-7A | 3.6 (2-9) | 1.5 (0-5) | 2.4 (1-4) | 0.9 (0-2) | 4.3 (1-6) | 12.7 |
| EG-7B | 4.1 (1-10) | 1.4 (0-4) | 2.0 (1-4) | 1.2 (0-2) | 3.7 (1-6) | 12.4 |
| EG-7C | 5.5 (3-9) | 2.3 (0-5) | 3.0 (2-4) | 1.3 (0-2) | 3.8 (1-6) | 15.9 |
| EG-7D | 6.3 (3-8) | 3.5 (0-7) | 3.8 (1-6) | 1.9 (0-4) | 4.2 (0-8) | 19.7 |
| EG-7E | 7.0 (3-11) | 3.7 (0-7) | 3.0 (1-5) | 1.1 (0-2) | 3.8 (0-6) | 18.6 |
| EG-8B | 7.7 (3-13) | 4.8 (0-9) | 3.8 (1-6) | 1.0 (0-2) | 4.2 (2-7) | 21.5 |

[1]Means; ranges given in parentheses

[2]Ephem. = Ephemeroptera
Plec. = Plecoptera
Trich. = Trichoptera
Cole. = Coleoptera
Dipt. = Diptera

[3]Exclusive of Chironomidae

Table 5

Total Numbers[1] of Aquatic Macroinvertebrates
East Gallatin River (Montana)
June 1973 - August 1974

| Sampling Stations | Macroinvertebrates[2] | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Ephem. | Plec. | Trich. | Cole. | Dipt. | Oligo. | Gastr. | Hirud. | Isop. |
| EG-6 | 461 (113-895) | 123 (16-268) | 314 (6-837) | 17 (0-40) | 209 (8-355) | 3 (0-7) | 1 (0-2) | <1 (0-1) | <1 (0-1) |
| EG-7A | 88 (3-437) | 3 (0-20) | 19 (2-60) | 4 (0-11) | 294 (4-957) | 121 (14-272) | -- | -- | <1 (0-2) |
| EG-7B | 92 (6-227) | 4 (0-23) | 11 (1-29) | 9 (0-53) | 285 (3-894) | 973 (17-2160) | -- | -- | -- |
| EG-7C | 164 (14-746) | 18 (0-152) | 45 (3-316) | 11 (0-34) | 282 (3-1315) | 273 (28-481) | -- | -- | -- |
| EG-7D | 554 (39-1138) | 63 (0-176) | 150 (1-442) | 7 (0-18) | 211 (3-525) | 293 (17-1299) | 1 (0-9) | <1 (0-2) | -- |
| EG-7E | 1103 (111-2369) | 89 (0-240) | 113 (1-264) | 4 (0-11) | 327 (5-1014) | 169 (19-393) | 3 (0-10) | <1 (0-2) | -- |
| EG-8B | 1640 (136-4556) | 203 (0-625) | 160 (2-565) | 2 (0-4) | 346 (7-704) | 38 (2-162) | 5 (0-21) | 1 (0-2) | 1 (0-2) |

[1]Means; ranges given in parentheses

[2]Ephem. = Ephemeroptera; Plec. = Plecoptera; Trich. = Trichoptera; Cole. = Coleoptera; Dipt. = Diptera; Oligo. = Oligochaeta; Gastr. = Gastropoda; Hirud. = Hirudinea; Isop. = Isopoda

TABLE 6

CHECKLIST, FREQUENCY OF OCCURRENCE[1], AND RELATIVE ABUNDANCE[2] OF AQUATIC MACROINVERTEBRATES

EAST GALLATIN RIVER JUNE 1973 - AUGUST 1974

| | Benthos Sampling Stations | | | | | | |
|---|---|---|---|---|---|---|---|
| | 6 | 7A | 7B | 7C | 7D | 7E | 8B |
| Ephemeroptera | | | | | | | |
| Baetidae | | | | | | | |
| *Baetis parvus* Dodds | 100-A | 83-P | 50-P | 80-N | 100-A | 100-A | 100-A |
| *Baetis alexanderi* n. sp. Edmunds and Jensen | 42-N | 17-R | 17-P | 40-N | 73-N | 67-A | 58-A |
| Ephemerellidae | | | | | | | |
| *Ephemerella (Drunella) doddsi* Needham | -- | -- | -- | -- | 9-R | -- | -- |
| *E. (Drunella) flavilinea* McDunnough | 25-R | 25-R | 17-R | 30-R | 18-R | 8-R | -- |
| *E. (Drunella) grandis ingens* McDunnough | 83-P | 25-C | 83-P | 80-P | 82-P | 67-P | 75-P |
| *E. (Timpanoga) hecuba hecuba* Eaton | 17-R | 25-P | 17-R | -- | -- | 25-R | 17-R |
| *E. (Caudatella) heterocaudata heterocaudata* McDunnough | 8-R | -- | 8-R | 20-R | -- | -- | -- |
| *E. (Ephemerella) inermis* Eaton | 83-A | 67-C | 75-C | 100-P | 73-N | 75-A | 92-A |
| *E. (Attenuatella) margarita* Needham | 25-P | 8-R | 8-R | 10-R | 27-R | 33-R | 33-R |
| *E. (Serratella) tibialis* McDunnough | 25-P | -- | -- | 30-R | 27-R | 17-R | 25-R |
| Heptageniidae | | | | | | | |
| *Cinygmula* sp. | 25-P | 17-P | 17-P | 10-R | 36-R | 8-R | 8-R |
| *Epeorus (Iron) longimanus* (Eaton) | 8-R | -- | -- | -- | -- | 8-R | 8-R |
| *Heptagenia criddlei* McDunnough | 33-P | 8-P | 25-C | 20-P | 27-P | 42-C | 50-N |
| *Heptagenia* sp. nr. *simplicioides* McDunnough | 42-P | 25-C | 25-C | 30-P | 45-P | 50-C | 75-N |
| *Rhithrogena* sp. nr. *morrisoni* (Banks) | 75-P | 25-R | 8-R | 40-R | 73-P | 83-C | 75-A |
| Leptophlebiidae | | | | | | | |
| *Choroterpes* sp. | -- | -- | -- | -- | -- | -- | 8-R |
| *Paraleptophlebia bicornuta* (McDunnough) | 8-R | -- | -- | -- | -- | 25-R | 25-R |
| *P. debilis* (Walker) | 25-C | -- | -- | -- | -- | -- | 25-R |
| *P. heteronea* (McDunnough) | 25-R | -- | -- | -- | -- | 17-R | 25-R |
| Tricorythidae | | | | | | | |
| *Tricorythodes minutus* Traver | 42-N | 50-N | 50-N | 60-C | 64-A | 67-A | 67-A |
| Plecoptera | | | | | | | |
| Chloroperlidae | | | | | | | |
| *Alloperla (Triznaka) signata* (Banks) | 58-P | 25-R | 33-R | 60-R | 45-R | 50-R | 50-P |
| Nemouridae | | | | | | | |
| *Nemoura (Prostoia) besametsa* Ricker | 8-R | -- | -- | -- | 9-R | -- | 8-R |
| *Nemoura (Zapada) cinctipes* Banks | 25-R | -- | -- | 30-R | 36-R | 33-R | 42-R |
| *Leuctra* sp. | 8-R | -- | -- | -- | -- | -- | -- |
| *Capnia (Capnia) confusa* Claassen | 17-R | 17-R | 8-R | 10-R | 8-R | -- | 8-R |
| *Brachyptera (Taenionema) pacifica* (Banks) | 8-R | -- | -- | 10-R | -- | 17-R | 17-R |
| Perlidae | | | | | | | |
| *Acroneuria (Hesperoperla) pacifica* Banks | 25-R | -- | -- | 10-R | 18-R | 17-R | 8-R |
| Perlodidae | | | | | | | |
| *Arcynopteryx (Skwala) parallela* (Frison) | 67-C | -- | -- | 10-C | 54-P | 58-P | 58-P |
| *Isogenus (Isogenoides) elongatus* Hagen | 17-R | 8-R | -- | -- | -- | -- | 42-R |
| *Isoperla fulva* Claassen | 75-C | 25-R | 33-R | 30-R | 42-C | 67-N | 67-A |
| *Isoperla mormona* Banks | 75-C | 33-R | 33-R | 20-R | 45-P | 50-C | 67-N |
| Pteronarcidae | | | | | | | |
| *Pteronarcella badia* (Hagen) | 92-N | 42-R | 25-R | 30-C | 82-N | 75-C | 92-N |
| *Pteronarcys californica* Newport | 17-R | -- | 8-R | 10-R | 9-R | -- | -- |

(continued)

Table 6 (continued)

| | Benthos Sampling Stations | | | | | | |
|---|---|---|---|---|---|---|---|
| | 6 | 7A | 7B | 7C | 7D | 7E | 8B |
| Trichoptera | | | | | | | |
| Brachycentridae | | | | | | | |
| *Amiocentrus aspilus* (Ross) | 25-R | 8-P | 17-R | 20-R | 18-R | 25-R | 25-R |
| *Brachycentrus* sp. | 100-P | 67-R | 50-R | 80-P | 82-C | 67-R | 83-P |
| *Micrasema* sp. | 8-R | -- | -- | -- | -- | -- | -- |
| Glossosomatidae | | | | | | | |
| *Agapetus* sp. | 8-R | -- | -- | 10-R | -- | -- | 17-R |
| Helicopsychidae | | | | | | | |
| *Helicopsyche* sp. | -- | 8-R | -- | -- | 9-R | 8-R | 42-P |
| Hydropsychidae | | | | | | | |
| *Arctopsyche grandis* (Banks) | 67-R | 8-R | 8-R | 20-R | 55-R | 17-R | -- |
| *Cheumatopsyche* sp. | 42-R | 25-R | 8-R | 10-P | 55-P | 58-P | 67-R |
| *Hydropsyche* sp. | 100-A | 100-P | 83-P | 100-N | 91-A | 92-N | 100-A |
| Hydroptilidae | | | | | | | |
| *Ochrotrichia* sp. | 8-R | -- | -- | -- | 18-R | -- | -- |
| Lepidostomatidae | | | | | | | |
| *Lepidostoma* sp. | 42-R | 25-R | 8-R | 30-R | 36-P | 33-P | 50-N |
| Limnephilidae | | | | | | | |
| *Hesperophylax* sp. | -- | -- | -- | -- | 9-R | -- | -- |
| Rhyacophilidae | | | | | | | |
| *Rhyacophila angelita* Banks | -- | -- | -- | 10-R | -- | -- | -- |
| *R. coloradensis* Banks | 17-R | -- | 8-R | 10-R | -- | -- | 8-R |
| *Rhyacophila* sp. A | 25-R | -- | 17-R | 10-R | -- | -- | -- |
| Diptera | | | | | | | |
| Chironomidae | 100-A | 100-A | 100-A | 100-A | 100-A | 92-A | 100-A |
| Empididae | | | | | | | |
| *Chelifera* sp. | 17-R | 75-R | 50-R | 50-P | 55-R | 42-P | 33-R |
| Heleidae | | | | | | | |
| *Palpomyia* sp. | 17-P | 33-P | 17-P | 50-R | 27-R | 17-R | 17-R |
| Psychodidae | | | | | | | |
| *Psychoda* sp. | -- | 25-R | 8-R | -- | -- | -- | -- |
| Rhagionidae | | | | | | | |
| *Atherix variegata* Walker | 75-R | 75-P | 83-C | 70-P | 82-P | 75-P | 75-P |
| Simuliidae | | | | | | | |
| *Simulium* sp. | 33-N | 42-P | 50-P | 40-P | 64-C | 92-P | 58-C |
| Tabanidae | | | | | | | |
| *Tabanus* sp. | -- | 8-R | 8-R | -- | 9-R | 17-R | -- |
| Tipulidae | | | | | | | |
| *Antocha monticola* Alexander | 42-R | 50-R | 33-R | 60-R | 27-R | 8-R | 33-R |
| *Dicranota* sp. | -- | 17-R | 17-R | 10-R | 8-R | -- | 25-R |
| *Hexatoma* sp. | 83-P | 50-R | 25-R | 60-R | 73-P | 67-R | 83-P |
| *Tipula* sp. | 42-P | 58-R | 75-P | 70-P | 73-P | 67-P | 75-C |
| Coleoptera | | | | | | | |
| Dytiscidae | | | | | | | |
| *Deronectes* sp. | -- | 8-R | -- | -- | 27-R | -- | 17-R |
| Elmidae | | | | | | | |
| *Lara* sp. | 8-R | -- | -- | -- | 27-R | 8-R | -- |
| *Optioservus* sp. | 92-P | 67-R | 92-P | 90-P | 100-P | 83-R | 75-R |
| *Zaitzevia parvula* Horn | 67-R | 17-R | 25-R | 40-R | 36-R | 17-R | 8-R |
| Haliplidae | | | | | | | |
| *Haliplus* sp. | -- | -- | -- | -- | 9-R | -- | -- |
| Gastropoda | 42-R | -- | -- | -- | 27-R | 50-R | 58-P |
| Hirudinea | 8-R | -- | -- | -- | 18-R | 25-R | 42-R |
| Isopoda | 8-R | 17-R | -- | -- | 9-R | 8-R | 33-R |
| Oligochaeta | 67-R | 100-A | 100-A | 100-A | 100-A | 100-A | 100-C |

[1] Frequency of Occurrence = $\frac{\text{occurrence}}{\text{no. of samples}} \times 100$

[2] R: Rare (1-5), P: Present (6-20), C: Common (21-50), N: Numerous (51-100), A: Abundant (>100)
[Mean numbers of individuals per occurrence]

## WATER CHEMISTRY

Concurrent with this macroinvertebrate study, a study of the water chemistry of the East Gallatin River was also conducted. This water chemistry study is the subject of separate reports (Russo and Thurston 1974, 1975). Sampling stations for the water chemistry study included all of the benthos sampling sites reported here. A summary of the water chemistry findings (op. cit.) for January 1973 to August 1974 is presented in this report as Table 7.

Table 7

Chemical Analysis Summary
East Gallatin River (Montana)
January 1973 - August 1974

| Analysis | Zone 1[1] | Zone 2[1] | Zone 3[1] |
|---|---|---|---|
| Temperature, °C | 0.0 - 15.8 | 0.0 - 18.0 | 0.1 - 20.0 |
| Dissolved Oxygen, mg/l | 7.0 - 13.4 | 6.8 - 12.7 | 7.8 - 12.9 |
| pH | 8.10 - 8.65 | 8.00 - 8.55 | 8.10 - 8.70 |
| S.E.C., μmhos | 260 - 468 | 266 - 533 | 325 - 430 |
| Hardness, mg/l $CaCO_3$ | 163 - 230 | 165 - 230 | 165 - 226 |
| Alkalinity, mg/l $CaCO_3$ | 130 - 215 | 132 - 231 | 165 - 223 |
| $Ca^{2+}$, mg/l | 38.6 - 61.9 | 39.7 - 62.7 | 45.6 - 60.7 |
| Fe, μg/ml | < 0.07 - 3.54 | < 0.07 - 3.74 | < 0.07 - 4.08 |
| Zn, μg/ml | < 0.008 - 0.020 | < 0.008 - 0.038 | < 0.008 - 0.021 |
| Cu, μg/ml | < 0.002 - 0.021 | 0.002 - 0.024 | 0.002 - 0.017 |
| Cd, μg/ml | 0.00001 - 0.00009 | 0.00001 - 0.00016 | 0.00002 - 0.00011 |
| $NO_3$-N, mg/l | 0.04 - 0.79 | 0.12 - 1.04 | 0.10 - 1.22 |
| $NO_2$-N, mg/l | 0.00 - 0.01 | 0.00 - 0.11 | 0.01 - 0.10 |
| $NH_3$-N, mg/l | 0.00 - 0.72 | 0.24 - 2.35 | 0.13 - 1.31 |
| $PO_4$-P, mg/l | 0.01 - 0.14 | 0.01 - 0.59 | 0.08 - 0.56 |
| $Cl^-$, mg/l | 0.2 - 3.8 | 0.8 - 10.4 | 0.6 - 6.9 |
| $F^-$, mg/l[2] | 0.20 - 0.24 | 0.21 - 0.28 | 0.20 - 0.26 |

[1]Zone 1 = One station 0.2 km upstream from Bozeman sewage treatment plant outfall.

Zone 2 = Four stations at 0.3, 1.2, 3.0, and 5.3 km downstream from sewage plant outfall.

Zone 3 = Two stations at 8.6 and 12.4 km downstream from sewage plant outfall.

[2]Based on samples collected in June, July, August, and September 1973

[Summarized from Russo and Thurston 1974, 1975]

# DISCUSSION

A marked change in the macroinvertebrate community structure was observed in the region immediately downstream from the sewage outfall point. Clean-water forms (*e.g.*, *Baetis parvus*, *Pteronarcella badia*) decreased in number and diversity, whereas tolerant forms (*e.g.*, Oligochaeta) increased substantially. Recovery, in terms of increasing numbers of clean-water forms and decreasing numbers of tolerant forms, began at Station 7C and appeared to be complete by Station 8B.

Even though changes in macroinvertebrate community structure corresponded to changes in ammonia concentrations (Table 7), other measured chemical parameters with corresponding changes cannot be ignored. In addition, it is reasonable to assume that other chemical species (*e.g.*, chloramines), known to be toxic to aquatic fauna but for which no East Gallatin River data are available, would show an increase below the Bozeman sewage outfall. Preliminary bioassay studies at Fisheries Bioassay Laboratory have indicated that the ammonia levels observed in the East Gallatin are marginal at best with regard to evidencing acute effects on nymphs of the mayfly *Ephemerella grandis*.

We believe that additional acute and chronic laboratory bioassays on representative macroinvertebrates, especially using ammonia and chloramines as the toxicants, will be necessary before additional conclusions can be drawn from this study or any subsequent field study on the East Gallatin. In addition, a subsequent study should involve instream bioassays of representative invertebrate species and more comprehensive chemical analyses of sewage, river water, and riverbed sediments, in order to identify and quantify all chemical species which are suspected to be toxic.

## ACKNOWLEDGMENT

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# APPENDIX

## CHECKLIST AND NUMBERS OF AQUATIC MACROINVERTEBRATES

## JUNE 1973 - AUGUST 1974

TABLE 8

CHECKLIST AND NUMBERS OF AQUATIC MACROINVERTEBRATES

EAST GALLATIN RIVER JUNE 26, 1973

| | Benthos Sampling Stations | | | | | | |
|---|---|---|---|---|---|---|---|
| | 6 | 7A | 7B | 7C | 7D | 7E | 8B |
| **Ephemeroptera** | | | | | | | |
| Baetidae | | | | | | | |
| *Baetis parvus* Dodds | 59 | 20 | 66 | 21 | 20 | 21 | 4 |
| *Baetis alexanderi* n. sp. Edmunds and Jensen | | | | 1 | 2 | 1 | 5 |
| Ephemerellidae | | | | | | | |
| *Ephemerella (Drunella) doddsi* Needham | | | | | | | |
| *E. (Drunella) flavilinea* McDunnough | 3 | 2 | | 1 | 1 | | |
| *E. (Drunella) grandis ingens* McDunnough | 9 | | 7 | 1 | 2 | | |
| *E. (Timpanoga) hecuba hecuba* Eaton | | | | | | | |
| *E. (Caudatella) heterocaudata heterocaudata* McDunnough | | | 3 | 1 | | | |
| *E. (Ephemerella) inermis* Eaton | 32 | 51 | 106 | 5 | 12 | 88 | 126 |
| *E. (Attenuatella) margarita* Needham | | | | | | | |
| *E. (Serratella) tibialis* McDunnough | | | | | | | |
| Heptageniidae | | | | | | | |
| *Cinygmula* sp. | 9 | 9 | 15 | | 2 | | 1 |
| *Epeorus (Iron) longimanus* (Eaton) | | | | | | | |
| *Heptagenia criddlei* McDunnough | | | | | | | |
| *Heptagenia* sp. nr. *simpliciodes* McDunnough | | | | | | | |
| *Rhithrogena* sp. nr. *morrisoni* (Banks) | 1 | | | | | 1 | |
| Leptophlebiidae | | | | | | | |
| *Choroterpes* sp. | | | | | | | |
| *Paraleptophlebia bicornuta* (McDunnough) | | | | | | | |
| *P. debilis* (Walker) | | | | | | | |
| *P. heteronea* (McDunnough) | | | | | | | |
| Tricorythidae | | | | | | | |
| *Tricorythodes minutus* Traver | | | | | | | |
| **Plecoptera** | | | | | | | |
| Chloroperlidae | | | | | | | |
| *Alloperla (Triznaka) signata* (Banks) | 5 | | 2 | | 1 | 1 | |
| Nemouridae | | | | | | | |
| *Nemoura (Prostoia) besametsa* Ricker | | | | | | | |
| *Nemoura (Zapada) cinctipes* Banks | | | | | | | |
| *Leuctra* sp. | | | | | | | |
| *Capnia (Capnia) confusa* Claassen | | | | | | | |
| *Brachyptera (Taenionema) pacifica* (Banks) | | | | | | | |
| Perlidae | | | | | | | |
| *Acroneuria (Hesperoperla) pacifica* Banks | | | | | | | |
| Perlodidae | | | | | | | |
| *Arcynopteryx (Skwala) parallela* (Frison) | | | | | | | |
| *Isogenus (Isogenoides) elongatus* Hagen | | 1 | | | | | |
| *Isoperla fulva* Claassen | 4 | | 2 | | | | |
| *Isoperla mormona* Banks | 7 | | 8 | | 2 | | |
| Pteronarcidae | | | | | | | |
| *Pteronarcella badia* (Hagen) | | | | | | | |
| *Pteronarcys californica* Newport | | | 1 | | | | |

(continued)

Table 8 (continued)

| | Benthos Sampling Stations | | | | | | |
|---|---|---|---|---|---|---|---|
| | 6 | 7A | 7B | 7C | 7D | 7E | 8B |
| Trichoptera | | | | | | | |
| Brachycentridae | | | | | | | |
| *Amiocentrus aspilus* (Ross) | | | | | | | |
| *Brachycentrus* sp. | 5 | 4 | 3 | | | 1 | |
| *Micrasema* sp. | | | | | | | |
| Glossosomatidae | | | | | | | |
| *Agapetus* sp. | | | | | | | |
| Helicopsychidae | | | | | | | |
| *Helicopsyche* sp. | | | | | | | |
| Hydropsychidae | | | | | | | |
| *Arctopsyche grandis* (Banks) | | | | | | | |
| *Cheumatopsyche* sp. | | | | | | | |
| *Hydropsyche* sp. | 20 | 9 | 26 | 5 | | | 2 |
| Hydroptilidae | | | | | | | |
| *Ochrotrichia* sp. | | | | | | | |
| Lepidostomatidae | | | | | | | |
| *Lepidostoma* sp. | 2 | | | | | | |
| Limnephilidae | | | | | | | |
| *Hesperophylax* sp. | | | | | | | |
| Rhyacophilidae | | | | | | | |
| *Rhyacophila angelita* Banks | | | | | | | |
| *R. coloradensis* Banks | | | | 1 | | | |
| *Rhyacophila* sp. A | | | | | | | |
| Diptera | | | | | | | |
| Chironomidae | 6 | 2 | 1 | 2 | 3 | | 4 |
| Empididae | | | | | | | |
| *Chelifera* sp. | | | | 1 | | | |
| Heleidae | | | | | | | |
| *Palpomyia* sp. | | | | | | | |
| Psychodidae | | | | | | | |
| *Psychoda* sp. | | | | | | | |
| Rhagionidae | | | | | | | |
| *Atherix variegata* Walker | 1 | 1 | | | | | |
| Simuliidae | | | | | | | |
| *Simulium* sp. | | | 2 | | | 4 | 2 |
| Tabanidae | | | | | | | |
| *Tabanus* sp. | | | | | | | |
| Tipulidae | | | | | | | |
| *Antocha monticola* Alexander | | | | | | | |
| *Dicranota* sp. | | 1 | | | | | |
| *Hexatoma* sp. | 1 | | | | | | |
| *Tipula* sp. | | | | | | 1 | 1 |
| Coleoptera | | | | | | | |
| Dytiscidae | | | | | | | |
| *Deronectes* sp. | | | | | | | |
| Elmidae | | | | | | | |
| *Lara* sp. | | | | | | | |
| *Optioservus* sp. | 6 | | | 1 | 1 | | |
| *Zaitzevia parvula* Horn | 1 | | | | | | |
| Haliplidae | | | | | | | |
| *Haliplus* sp. | | | | | | | |
| Gastropoda | 2 | | | | | 1 | |
| Hirudinea | | | | | | | |
| Isopoda | | | | | | | |
| Oligochaeta | 6 | 17 | 2160 | 481 | 401 | 35 | 77 |

TABLE 9

CHECKLIST AND NUMBERS OF AQUATIC MACROINVERTEBRATES

EAST GALLATIN RIVER JULY 18, 1973

| | Benthos Sampling Stations | | | | | | |
|---|---|---|---|---|---|---|---|
| | 6 | 7A | 7B | 7C | 7D | 7E | 8B |
| **Ephemeroptera** | | | | | | | |
| **Baetidae** | | | | | | | |
| *Baetis parvus* Dodds | 313 | 2 | | 45 | 143 | 208 | 141 |
| *Baetis alexanderi* n. sp. Edmunds and Jensen | 239 | 1 | | 19 | 208 | 495 | 470 |
| **Ephemerellidae** | | | | | | | |
| *Ephemerella (Drunella) doddsi* Needham | | | | | | | |
| *E. (Drunella) flavilinea* McDunnough | 1 | 2 | 2 | 1 | | | |
| *E. (Drunella) grandis ingens* McDunnough | | | 2 | | | | 1 |
| *E. (Timpanoga) hecuba hecuba* Eaton | | 1 | | | | | |
| *E. (Caudatella) heterocaudata heterocaudata* McDunnough | | | | | | | |
| *E. (Ephemerella) inermis* Eaton | 33 | 73 | 49 | 22 | 11 | 25 | 21 |
| *E. (Attenuatella) margarita* Needham | 13 | | | 2 | 1 | 1 | 7 |
| *E. (Serratella) tibialis* McDunnough | 11 | | | 1 | 1 | | 2 |
| **Heptageniidae** | | | | | | | |
| *Cinygmula* sp. | 4 | | | | 1 | | |
| *Epeorus (Iron) longimanus* (Eaton) | 1 | | | | | | |
| *Heptagenia criddlei* McDunnough | 17 | | 55 | 4 | | 6 | 77 |
| *Heptagenia* sp. nr. *simplicioides* McDunnough | 39 | 36 | 43 | 8 | 16 | 69 | 419 |
| *Rhithrogena* sp. nr. *morrisoni* (Banks) | | | | | | | |
| **Leptophlebiidae** | | | | | | | |
| *Choroterpes* sp. | | | | | | | |
| *Paraleptophlebia bicornuta* (McDunnough) | | | | | | | |
| *P. debilis* (Walker) | | | | | | | |
| *P. heteronea* (McDunnough) | | | | | | | |
| **Tricorythidae** | | | | | | | |
| *Tricorythodes minutus* Traver | 1 | 22 | 26 | 3 | 10 | 19 | 100 |
| **Plecoptera** | | | | | | | |
| **Chloroperlidae** | | | | | | | |
| *Alloperla (Trisnaka) signata* (Banks) | | | | | | | |
| **Nemouridae** | | | | | | | |
| *Nemoura (Prostoia) besametsa* Ricker | | | | | | | |
| *Nemoura (Zapada) cinctipes* Banks | | | | | | | |
| *Leuctra* sp. | | | | | | | |
| *Capnia (Capnia) confusa* Claassen | | | | | | | |
| *Brachyptera (Taenionema) pacifica* (Banks) | | | | | | | |
| **Perlidae** | | | | | | | |
| *Acroneuria (Hesperoperla) pacifica* Banks | | | | | | | |
| **Perlodidae** | | | | | | | |
| *Arcynopteryx (Skwala) parallela* (Frison) | | | | | | | |
| *Isogenus (Isogenoides) elongatus* Hagen | | | | | | | |
| *Isoperla fulva* Claassen | 1 | | | | | | 3 |
| *Isoperla mormona* Banks | 7 | 1 | | | | | |
| **Pteronarcidae** | | | | | | | |
| *Pteronarcella badia* (Hagen) | 17 | | | | 9 | 3 | 7 |
| *Pteronarcys californica* Newport | | | | 1 | | | |

(continued)

Table 9 (continued)

| | Benthos Sampling Stations | | | | | | |
|---|---|---|---|---|---|---|---|
| | 6 | 7A | 7B | 7C | 7D | 7E | 8B |
| Trichoptera | | | | | | | |
| Brachycentridae | | | | | | | |
| *Amiocentrus aspilus* (Ross) | 5 | 11 | 1 | 2 | 1 | 2 | 2 |
| *Brachycentrus* sp. | 36 | 18 | 3 | 6 | 7 | | 2 |
| *Micrasema* sp. | | | | | | | |
| Glossosomatidae | | | | | | | |
| *Agapetus* sp. | 1 | | | | | | 1 |
| Helicopsychidae | | | | | | | |
| *Helicopsyche* sp. | | | | | | | |
| Hydropsychidae | | | | | | | |
| *Arctopsyche grandis* (Banks) | 9 | | | | 1 | | |
| *Cheumatopsyche* sp. | | | | | | | 5 |
| *Hydropsyche* sp. | 26 | 13 | 13 | 11 | 3 | 5 | 18 |
| Hydroptilidae | | | | | | | |
| *Ochrotrichia* sp. | | | | | 1 | | |
| Lepidostomatidae | | | | | | | |
| *Lepidostoma* sp. | 9 | 1 | | | | | |
| Limnephilidae | | | | | | | |
| *Hesperophylax* sp. | | | | | | | |
| Rhyacophilidae | | | | | | | |
| *Rhyacophila angelita* Banks | | | | | | | |
| *R. coloradensis* Banks | | | | | | | |
| *Rhyacophila* sp. A | | | | | | | |
| Diptera | | | | | | | |
| Chironomidae | 261 | 350 | 170 | 62 | 50 | 81 | 49 |
| Empididae | | | | | | | |
| *Chelifera* sp. | 2 | 1 | | | | | |
| Heleidae | | | | | | | |
| *Palpomyia* sp. | 10 | 18 | 10 | 1 | 2 | 5 | 2 |
| Psychodidae | | | | | | | |
| *Psychoda* sp. | | | | | | | |
| Rhagionidae | | | | | | | |
| *Atherix variegata* Walker | | 5 | 1 | | | | |
| Simuliidae | | | | | | | |
| *Simulium* sp. | 31 | 2 | 4 | 4 | 5 | 17 | 35 |
| Tabanidae | | | | | | | |
| *Tabanus* sp. | | | | | | | |
| Tipulidae | | | | | | | |
| *Antocha monticola* Alexander | | 1 | 1 | 1 | | | |
| *Dicranota* sp. | | | | | | | |
| *Hexatoma* sp. | | | | | | | 1 |
| *Tipula* sp. | 1 | | | | | | |
| Coleoptera | | | | | | | |
| Dytiscidae | | | | | | | |
| *Deroneetes* sp. | | | | | | | |
| Elmidae | | | | | | | |
| *Lara* sp. | | | | | | | |
| *Optioservus* sp. | 14 | | 4 | 1 | 3 | 4 | 1 |
| *Zaitzevia parvula* Horn | 7 | | 1 | | 1 | | |
| Haliplidae | | | | | | | |
| *Haliplus* sp. | | | | | | | |
| Gastropoda | | | | | | | |
| Hirudinea | | | | | | | |
| Isopoda | | | | | | | |
| Oligochaeta | 4 | 37 | 538 | 392 | 127 | 58 | 49 |

TABLE 10

CHECKLIST AND NUMBERS OF AQUATIC MACROINVERTEBRATES

EAST GALLATIN RIVER AUGUST 8, 1973

| | Benthos Sampling Stations | | | | | | |
|---|---|---|---|---|---|---|---|
| | 6 | 7A | 7B | 7C | 7D | 7E | 8B |
| Ephemeroptera | | | | | | | |
| Baetidae | | | | | | | |
| *Baetis parvus* Dodds | 587 | 6 | 1 | ___ | 329 | 421 | 380 |
| *Baetis alexanderi* n. sp. Edmunds and Jensen | 26 | ___ | 2 | ___ | 92 | 143 | 170 |
| Ephemerellidae | | | | | | | |
| *Ephemerella (Drunella) doddsi* Needham | ___ | ___ | ___ | ___ | ___ | ___ | ___ |
| *E. (Drunella) flavilinea* McDunnough | ___ | ___ | ___ | ___ | ___ | ___ | ___ |
| *E. (Drunella) grandis ingens* McDunnough | 7 | ___ | 18 | ___ | 9 | 5 | 11 |
| *E. (Timpanoga) hecuba hecuba* Eaton | ___ | ___ | ___ | ___ | ___ | 1 | ___ |
| *E. (Vindicatella) heterocaudata heterocaudata* McDunnough | ___ | ___ | ___ | ___ | ___ | ___ | ___ |
| *E. (Ephemerella) inermis* Eaton | ___ | ___ | ___ | ___ | ___ | ___ | ___ |
| *E. (Attenuatella) margarita* Needham | ___ | ___ | ___ | ___ | 4 | 10 | 5 |
| *E. (Serratella) tibialis* McDunnough | 4 | ___ | ___ | ___ | 2 | 6 | 1 |
| Heptageniidae | | | | | | | |
| *Cinygmula* sp. | ___ | ___ | ___ | ___ | ___ | ___ | ___ |
| *Epeorus (Iron) longimanus* (Eaton) | ___ | ___ | ___ | ___ | ___ | ___ | 1 |
| *Heptagenia criddlei* McDunnough | 10 | ___ | ___ | ___ | 18 | 125 | 172 |
| *Heptagenia* sp. nr. *simpliciodes* McDunnough | 10 | ___ | 2 | ___ | 6 | 41 | 13 |
| *Rhithrogena* sp. nr. *morrisoni* (Banks) | ___ | ___ | ___ | ___ | ___ | ___ | 10 |
| Leptophlebiidae | | | | | | | |
| *Choroterpes* sp. | ___ | ___ | ___ | ___ | ___ | ___ | ___ |
| *Paraleptophlebia bicornuta* (McDunnough) | 1 | ___ | ___ | ___ | ___ | 2 | 3 |
| *P. debilis* (Walker) | ___ | ___ | ___ | ___ | ___ | ___ | ___ |
| *P. heteronea* (McDunnough) | ___ | ___ | ___ | ___ | ___ | ___ | ___ |
| Tricorythidae | | | | | | | |
| *Tricorythodes minutus* Traver | 250 | 41 | 197 | ___ | 425 | 431 | 875 |
| Plecoptera | | | | | | | |
| Chloroperlidae | | | | | | | |
| *Alloperla (Triznaka) signata* (Banks) | ___ | ___ | ___ | ___ | ___ | ___ | ___ |
| Nemouridae | | | | | | | |
| *Nemoura (Prostoia) besametsa* Ricker | ___ | ___ | ___ | ___ | ___ | ___ | ___ |
| *Nemoura (Zapada) cinctipes* Banks | ___ | ___ | ___ | ___ | ___ | ___ | ___ |
| *Leuctra* sp. | ___ | ___ | ___ | ___ | ___ | ___ | ___ |
| *Capnia (Capnia) confusa* Claassen | ___ | ___ | ___ | ___ | ___ | ___ | ___ |
| *Brachyptera (Taenionema) pacifica* (Banks) | ___ | ___ | ___ | ___ | ___ | ___ | ___ |
| Perlidae | | | | | | | |
| *Acroneuria (Hesperoperla) pacifica* Banks | ___ | ___ | ___ | ___ | ___ | ___ | ___ |
| Perlodidae | | | | | | | |
| *Arcynopteryx (Skwala) parallela* (Frison) | 13 | ___ | ___ | ___ | 8 | 14 | 27 |
| *Isogenus (Isogenoides) elongatus* Hagen | ___ | ___ | ___ | ___ | ___ | ___ | ___ |
| *Isoperla fulva* Claassen | ___ | ___ | ___ | ___ | ___ | ___ | ___ |
| *Isoperla mormona* Banks | ___ | ___ | ___ | ___ | ___ | ___ | ___ |
| Pteronarcidae | | | | | | | |
| *Pteronarcella badia* (Hagen) | 70 | 1 | ___ | ___ | 36 | 41 | 97 |
| *Pteronarcys californica* Newport | ___ | ___ | ___ | ___ | ___ | ___ | ___ |

(continued)

Table 10 (continued)

| | Benthos Sampling Stations | | | | | | |
|---|---|---|---|---|---|---|---|
| | 6 | 7A | 7B | 7C | 7D | 7E | 8B |
| Trichoptera | | | | | | | |
| Brachycentridae | | | | | | | |
| *Amiocentrus aspilus* (Ross) | | | | | | | |
| *Brachycentrus* sp. | 15 | 2 | 5 | | 16 | 1 | 2 |
| *Micrasema* sp. | | | | | | | |
| Glossosomatidae | | | | | | | |
| *Agapetus* sp. | | | | | | | 2 |
| Helicopsychidae | | | | | | | |
| *Helicopsyche* sp. | | | | | | | |
| Hydropsychidae | | | | | | | |
| *Arctopsyche grandis* (Banks) | 3 | | | | | | |
| *Cheumatopsyche* sp. | | | | | | | 7 |
| *Hydropsyche* sp. | 313 | 6 | 10 | | 170 | 263 | 554 |
| Hydroptilidae | | | | | | | |
| *Ochrotrichia* sp. | | | | | 4 | | |
| Lepidostomatidae | | | | | | | |
| *Lepidostoma* sp. | | | | | | | |
| Limnephilidae | | | | | | | |
| *Hesperophylax* sp. | | | | | | | |
| Rhyacophilidae | | | | | | | |
| *Rhyacophila angelita* Banks | | | | | | | |
| *R. coloradensis* Banks | 1 | | | | | | |
| *Rhyacophila* sp. A | | | | | | | |
| Diptera | | | | | | | |
| Chironomidae | 74 | 142 | 387 | | 245 | 178 | 441 |
| Empididae | | | | | | | |
| *Chelifera* sp. | | 1 | | | | | |
| Heleidae | | | | | | | |
| *Palpomyia* sp. | | | | | | | |
| Psychodidae | | | | | | | |
| *Psychoda* sp. | | 1 | | | | | |
| Rhagionidae | | | | | | | |
| *Atherix variegata* Walker | | 29 | 68 | | 4 | 8 | 55 |
| Simuliidae | | | | | | | |
| *Simulium* sp. | 190 | 58 | 84 | | 107 | 55 | 56 |
| Tabanidae | | | | | | | |
| *Tabanus* sp. | | | | | | | |
| Tipulidae | | | | | | | |
| *Antocha montiocla* Alexander | | | 1 | | | | |
| *Dicranota* sp. | | | | | | | |
| *Hexatoma* sp. | 10 | 1 | | | 7 | 10 | 19 |
| *Tipula* sp. | | 1 | 4 | | 2 | | |
| Coleoptera | | | | | | | |
| Dytiscidae | | | | | | | |
| *Deronectes* sp. | | | | | | | |
| Elmidae | | | | | | | |
| *Larva* sp. | | | | | | | |
| *Optioservus* sp. | 29 | 10 | 49 | | 8 | 7 | 2 |
| *Zaitzevia parvula* Horn | 3 | | 4 | | 1 | 1 | |
| Haliplidae | | | | | | | |
| *Haliplus* sp. | | | | | | | |
| Gastropoda | | | | | | | |
| Hirudinea | | | | | | | 2 |
| Isopoda | | | | | | | 1 |
| Oligochaeta | 4 | 14 | 1812 | | 133 | 145 | 13 |

TABLE 11

CHECKLIST AND NUMBERS OF AQUATIC MACROINVERTEBRATES

EAST GALLATIN RIVER SEPTEMBER 5, 1973

| | Benthos Sampling Stations | | | | | | |
|---|---|---|---|---|---|---|---|
| | 6 | 7A | 7B | 7C | 7D | 7E | 8B |
| **Ephemeroptera** | | | | | | | |
| Baetidae | | | | | | | |
| *Baetis parvus* Dodds | 557 | 3 | 1 | | 600 | 662 | 710 |
| *Baetis alexanderi* n. sp. Edmunds and Jensen | 5 | | | | 19 | 48 | 28 |
| Ephemerellidae | | | | | | | |
| *Ephemerella (Drunella) doddsi* Needham | | | | | | | |
| *E. (Drunella) flavilinea* McDunnough | | | | | | | |
| *E. (Drunella) grandis ingens* McDunnough | 12 | | 7 | | 14 | 17 | 1 |
| *E. (Timpanoga) hecuba hecuba* Eaton | | | | | | 1 | |
| *E. (Caudatella) heterocaudata heterocaudata* McDunnough | | | | | | | |
| *E. (Ephemerella) inermis* Eaton | 1 | | | | | | 6 |
| *E. (Attenuatella) margarita* Needham | | | | | | | |
| *E. (Serratella) tibialis* McDunnough | | | | | | | |
| Heptageniidae | | | | | | | |
| *Cinygmula* sp. | | | | | | | |
| *Epeorus (Iron) longimanus* (Eaton) | | | | | | | |
| *Heptagenia criddlei* McDunnough | | | | | | 6 | 8 |
| *Heptagenia* sp. nr. *simplicioides* McDunnough | 1 | | | | | 9 | 8 |
| *Rhithrogena* sp. nr. *morrisoni* (Banks) | 20 | | | | 28 | 49 | 67 |
| Leptophlebiidae | | | | | | | |
| *Choroterpes* sp. | | | | | | | |
| *Paraleptophlebia bicornuta* (McDunnough) | | | | | | 9 | 4 |
| *P. debilis* (Walker) | 81 | | | | | | 1 |
| *P. heteronea* (McDunnough) | | | | | | | 2 |
| Tricorythidae | | | | | | | |
| *Tricorythodes minutus* Traver | 25 | 6 | 15 | | 162 | 235 | 149 |
| **Plecoptera** | | | | | | | |
| Chloroperlidae | | | | | | | |
| *Alloperla (Triznaka) wipuita* (Banks) | | | | | 1 | | |
| Nemouridae | | | | | | | |
| *Nemoura (Prostoia) besametsa* Ricker | | | | | | | |
| *Nemoura (Zapada) cinctipes* Banks | 1 | | | | 1 | 1 | 5 |
| *Leuctra* sp. | | | | | | | |
| *Capnia (Capnia) confusa* Claassen | | | | | | | |
| *Brachyptera (Taenionema) pacifica* (Banks) | | | | | | | |
| Perlidae | | | | | | | |
| *Acroneuria (Hesperoperla) pacifica* Banks | 2 | | | | | | |
| Perlodidae | | | | | | | |
| *Arcynopteryx (Skwala) parallela* (Frison) | 26 | | | | 8 | 12 | 20 |
| *Isogenus (Isogenoides) elongatus* Hagen | | | | | | | 1 |
| *Isoperla fulva* Claassen | 3 | | | | 5 | 10 | 37 |
| *Isoperla mormona* Banks | | | | | | | 2 |
| Pteronarcidae | | | | | | | |
| *Pteronarcella badia* (Hagen) | 115 | 1 | | | 62 | 38 | 79 |
| *Pteronarcys californica* Newport | | | | | | | |

(continued)

Table 11 (continued)

| | Benthos Sampling Stations | | | | | | |
|---|---|---|---|---|---|---|---|
| | 6 | 7A | 7B | 7C | 7D | 7E | 8B |
| Trichoptera | | | | | | | |
| Brachycentridae | | | | | | | |
| *Amiocentrus aspilus* (Ross) | 17 | 1 | | | 36 | | 3 |
| *Brachycentrus* sp. | | | | | | | |
| *Micrasema* sp. | | | | | | | |
| Glossosomatidae | | | | | | | |
| *Agapetus* sp. | | | | | | | |
| Helicopsychidae | | | | | | | |
| *Helicopsyche* sp. | | | | | | | 1 |
| Hydropsychidae | | | | | | | |
| *Aretopsyche grandis* (Banks) | 7 | | | | 1 | 1 | |
| *Cheumatopsyche* sp. | 2 | | | | 23 | 9 | 4 |
| *Hydropsyche* sp. | 628 | 7 | 2 | | 303 | 207 | 255 |
| Hydroptilidae | | | | | | | |
| *Ochrotrichia* sp. | | | | | | | |
| Lepidostomatidae | | | | | | | |
| *Lepidostoma* sp. | | | | | 1 | | 5 |
| Limnephilidae | | | | | | | |
| *Hesperophylax* sp. | | | | | | | |
| Rhyacophilidae | | | | | | | |
| *Rhyacophila angelita* Banks | | | | | | | |
| *R. coloradensis* Banks | | | | | | | |
| *Rhyacophila* sp. A | | | | | | | |
| Diptera | | | | | | | |
| Chironomidae | 105 | 138 | 111 | | 371 | 308 | 580 |
| Empididae | | | | | | | |
| *Chelifera* sp. | | 5 | 2 | | 1 | 1 | |
| Heleidae | | | | | | | |
| *Palpomyia* sp. | | | | | | | |
| Psychodidae | | | | | | | |
| *Psychoda* sp. | | | | | | | |
| Rhagionidae | | | | | | | |
| *Atherix variegata* Walker | 2 | 62 | 90 | | 8 | 25 | 31 |
| Simuliidae | | | | | | | |
| *Simulium* sp. | | 1 | 1 | | 15 | 1 | 47 |
| Tabanidae | | | | | | | |
| *Tabanus* sp. | | | | | | 1 | |
| Tipulidae | | | | | | | |
| *Antocha monticola* Alexander | | | | | | | |
| *Dicranota* sp. | | | | | | | |
| *Hexatoma* sp. | 34 | | | | 22 | 1 | |
| *Tipula* sp. | | 4 | 12 | | 4 | 3 | 46 |
| Coleoptera | | | | | | | |
| Dytiscidae | | | | | | | |
| *Deronectes* sp. | | | | | | | |
| Elmidae | | | | | | | |
| *Lara* sp. | | | | | 1 | | |
| *Optioservus* sp. | 29 | 9 | 10 | | 17 | 11 | 2 |
| *Zaitzevia parvula* Horn | 1 | 2 | | | | | 2 |
| Haliplidae | | | | | | | |
| *Haliplus* sp. | | | | | | | |
| Gastropoda | 2 | | | | 9 | 7 | 17 |
| Hirudinea | | | | | 1 | | |
| Isopoda | 1 | | | | | | 2 |
| Oligochaeta | 2 | 201 | 1618 | | 215 | 336 | 13 |

TABLE 12

CHECKLIST AND NUMBERS OF AQUATIC MACROINVERTEBRATES

EAST GALLATIN RIVER OCTOBER 12, 1973

| | Benthos Sampling Stations | | | | | | |
|---|---|---|---|---|---|---|---|
| | 6 | 7A | 7B | 7C | 7D | 7E | 8B |
| **Ephemeroptera** | | | | | | | |
| Baetidae | | | | | | | |
| *Baetis parvus* Dodds | 8 | | | | 48 | 76 | 19 |
| *Baetis alexanderi* n. sp. Edmunds and Jensen | | | | | 3 | 18 | 8 |
| Ephemerellidae | | | | | | | |
| *Ephemerella (Drunella) doddsi* Needham | | | | | | | |
| *E. (Drunella) flavilinea* McDunnough | | | | | | | |
| *E. (Drunella) grandis ingens* McDunnough | 9 | | 5 | 36 | 12 | 12 | 9 |
| *E. (Timpanoga) hecuba hecuba* Eaton | | | | | | | |
| *E. (Caudatella) heterocaudata heterocaudata* McDunnough | | | | | | | |
| *E. (Ephemerella) inermis* Eaton | 102 | | 1 | 1 | 47 | 267 | 424 |
| *E. (Attenuatella) margarita* Needham | | | | | | | |
| *E. (Serratella) tibialis* McDunnough | | | | | | | |
| Heptageniidae | | | | | | | |
| *Cinygmula* sp. | | | | | | | |
| *Epeorus (Iron) longimanus* (Eaton) | | | | | | | |
| *Heptagenia criddlei* McDunnough | | | | | | | 1 |
| *Heptagenia* sp. nr. *simpliciodes* McDunnough | | | | | | 2 | 4 |
| *Rhithrogena* sp. nr. *morrisoni* (Banks) | 36 | 1 | | 8 | 33 | 176 | 77 |
| Leptophlebiidae | | | | | | | |
| *Choroterpes* sp. | | | | | | | |
| *Paraleptophlebia bicornuta* (McDunnough) | | | | | | | |
| *P. debilis* (Walker) | 2 | | | | | | |
| *P. heteronea* (McDunnough) | 1 | | | | | | 2 |
| Tricorythidae | | | | | | | |
| *Tricorythodes minutus* Traver | | 2 | | 3 | 3 | 23 | 2 |
| **Plecoptera** | | | | | | | |
| Chloroperlidae | | | | | | | |
| *Alloperla (Trianaka) signata* (Banks) | 16 | | | 2 | | 5 | |
| Nemouridae | | | | | | | |
| *Nemoura (Prostoia) besametsa* Ricker | | | | | | | |
| *Nemoura (Zapada) cinctipes* Banks | 9 | | | 1 | 2 | 5 | 1 |
| *Leuctra* sp. | | | | | | | |
| *Capnia (Capnia) confusa* Claassen | | | | | | | |
| *Brachyptera (Taenionema) pacifica* (Banks) | | | | 2 | | | |
| Perlidae | | | | | | | |
| *Acroneuria (Hesperoperla) pacifica* Banks | | | | | | | 2 |
| Perlodidae | | | | | | | |
| *Arcynopteryx (Skwala) parallela* (Frison) | 27 | | | | 7 | 17 | 12 |
| *Isogenus (Isogenoides) elongatus* Hagen | | | | | | | 1 |
| *Isoperla fulva* Claassen | 42 | | | | 26 | 136 | 118 |
| *Isoperla mormona* Banks | 8 | | | | 3 | 21 | 19 |
| Pteronarcidae | | | | | | | |
| *Pteronarcella badia* (Hagen) | 110 | | | | 52 | 55 | 103 |
| *Pteronarcys californica* Newport | 1 | | | | | | |

(continued)

Table 12 (continued)

| | Benthos Sampling Stations | | | | | | |
|---|---|---|---|---|---|---|---|
| | 6 | 7A | 7B | 7C | 7D | 7E | 8B |
| Trichoptera | | | | | | | |
| Brachycentridae | | | | | | | |
| *Amiocentrus aspilus* (Ross) | 1 | | | | | | 2 |
| *Brachycentrus* sp. | 29 | 1 | | 8 | 17 | 8 | 32 |
| *Micrasema* sp. | 4 | | | | | | |
| Glossosomatidae | | | | | | | |
| *Agapetus* sp. | | | | | | | |
| Helicopsychidae | | | | | | | |
| *Helicopsyche* sp. | | | | | | 1 | 1 |
| Hydropsychidae | | | | | | | |
| *Arctopsyche grandis* (Banks) | 5 | | | | 2 | | |
| *Cheumatopsyche* sp. | 2 | | 1 | | 6 | 20 | 15 |
| *Hydropsyche* sp. | 462 | 1 | | 10 | 162 | 97 | 153 |
| Hydroptilidae | | | | | | | |
| *Ochrotrichia* sp. | | | | | | | |
| Lepidostomatidae | | | | | | | |
| *Lepidostoma* sp. | | | | 4 | 3 | 6 | 16 |
| Limnephilidae | | | | | | | |
| *Hesperophylax* sp. | | | | | | | |
| Rhyacophilidae | | | | | | | |
| *Rhyacophila angelita* Banks | | | | | | | |
| *R. coloradensis* Banks | | | | | | | |
| *Rhyacophila* sp. A | 1 | | 2 | | | | |
| Diptera | | | | | | | |
| Chironomidae | 181 | 94 | 104 | 181 | 65 | 319 | 242 |
| Empididae | | | | | | | |
| *Chelifera* sp. | 2 | 3 | 2 | 5 | 2 | 9 | 2 |
| Heleidae | | | | | | | |
| *Palpomyia* sp. | | | | | | | |
| Psychodidae | | | | | | | |
| *Psychoda* sp. | | 1 | | | | | |
| Rhagionidae | | | | | | | |
| *Atherix variegata* Walker | 2 | 12 | 12 | 6 | 4 | 15 | 16 |
| Simuliidae | | | | | | | |
| *Simulium* sp. | | | | | | 1 | |
| Tabanidae | | | | | | | |
| *Tabanus* sp. | | | | | | 1 | |
| Tipulidae | | | | | | | |
| *Antocha monticola* Alexander | | | | | | | 1 |
| *Dicranota* sp. | | | | | | | |
| *Hexatoma* sp. | 9 | 2 | 1 | 4 | 19 | 2 | 4 |
| *Tipula* sp. | 28 | 10 | 16 | 16 | 21 | 15 | 39 |
| Coleoptera | | | | | | | |
| Dytiscidae | | | | | | | |
| *Deronectes* sp. | | | | | 1 | | 1 |
| Elmidae | | | | | | | |
| *Lara* sp. | | | | | 1 | 3 | |
| *Optioservus* sp. | 9 | 2 | 10 | 34 | 2 | 1 | 1 |
| *Zaitzevia parvula* Horn | | 1 | | | | | |
| Haliplidae | | | | | | | |
| *Haliplus* sp. | | | | | | | |
| Gastropoda | | | | | | 7 | 1 |
| Hirudinea | | | | | | 2 | |
| Isopoda | | | | | | | |
| Oligochaeta | 5 | 118 | 761 | 430 | 198 | 327 | 2 |

TABLE 13

CHECKLIST AND NUMBERS OF AQUATIC MACROINVERTEBRATES

EAST GALLATIN RIVER NOVEMBER 3, 1973

| | Benthos Sampling Stations | | | | | | |
|---|---|---|---|---|---|---|---|
| | 6 | 7A | 7B | 7C | 7D | 7E | 8B |
| Ephemeroptera | | | | | | | |
| Baetidae | | | | | | | |
| *Baetis parvus* Dodds | 54 | 2 | | 4 | 259 | 412 | 220 |
| *Baetis alexanderi* n. sp. Edmunds and Jensen | | | | | 3 | 2 | |
| Ephemerellidae | | | | | | | |
| *Ephemerella (Drunella) doddsi* Needham | | | | | 1 | | |
| *E. (Drunella) flavilinea* McDunnough | | | | | | | |
| *E. (Drunella) grandis ingens* McDunnough | 22 | | 5 | 32 | 18 | 6 | 12 |
| *E. (Timpanoga) hecuba hecuba* Eaton | | | | | | | |
| *E. (Caudatella) heterocaudata heterocaudata* McDunnough | | | | | | | |
| *E. (Ephemerella) inermis* Eaton | 382 | 10 | 9 | 18 | 271 | 1054 | 1102 |
| *E. (Attenuatella) margarita* Needham | | | | | | | |
| *E. (Serratella) tibialis* McDunnough | | | | | | | |
| Heptageniidae | | | | | | | |
| *Cinygmula* sp. | | | | | | | |
| *Epeorus (Iron) longimanus* (Eaton) | | | | | | | |
| *Heptagenia criddlei* McDunnough | | | | | | | |
| *Heptagenia* sp. nr. *simpliciodes* McDunnough | 3 | | | | | | 2 |
| *Rhithrogena* sp. nr. *morrisoni* (Banks) | 2 | 1 | | | 35 | 133 | 461 |
| Leptophlebiidae | | | | | | | |
| *Choroterpes* sp. | | | | | | | |
| *Paraleptophlebia bicornuta* (McDunnough) | | | | | | | |
| *P. debilis* (Walker) | | | | | | | 9 |
| *P. heteronea* (McDunnough) | 1 | | | | | | |
| Tricorythidae | | | | | | | |
| *Tricorythodes minutus* Traver | 2 | 1 | 2 | 1 | 5 | 5 | 2 |
| Plecoptera | | | | | | | |
| Chloroperlidae | | | | | | | |
| *Alloperla (Triznaka) signata* (Banks) | 8 | | | 1 | 2 | 7 | 13 |
| Nemouridae | | | | | | | |
| *Nemoura (Prostoia) besametsa* Ricker | | | | | | | |
| *Nemoura (Zapada) cinctipes* Banks | 2 | | | 1 | 6 | 1 | |
| *Leuctra* sp. | | | | | | | |
| *Capnia (Capnia) confusa* Claassen | | | | | 1 | | |
| *Brachyptera (Taenionema) pacifica* (Banks) | | | | | | | |
| Perlidae | | | | | | | |
| *Acroneuria (Hesperoperla) pacifica* Banks | 2 | | | | | 1 | |
| Perlodidae | | | | | | | |
| *Arcynopteryx (Skwala) parallela* (Frison) | 9 | | | | 2 | 6 | 21 |
| *Isogenus (Isogenoides) elongatus* Hagen | 1 | | | | | | 1 |
| *Isoperla fulva* Claassen | 103 | 1 | | | 63 | 130 | 156 |
| *Isoperla mormona* Banks | 45 | 2 | | | 15 | 59 | 109 |
| Pteronarcidae | | | | | | | |
| *Pteronarcella badia* (Hagen) | 95 | | | | 63 | 36 | 131 |
| *Pteronarcys californica* Newport | 2 | | | | | | |

(continued)

Table 13 (continued)

| | Benthos Sampling Stations | | | | | | |
|---|---|---|---|---|---|---|---|
| | 6 | 7A | 7B | 7C | 7D | 7E | 8B |
| Trichoptera | | | | | | | |
| Brachycentridae | | | | | | | |
| *Amiocentrus aspilus* (Ross) | | | | | | | |
| *Brachycentrus* sp. | 27 | 3 | | 7 | 39 | 8 | 45 |
| *Micrasema* sp. | | | | | | | |
| Glossosomatidae | | | | | | | |
| *Agapetus* sp. | | | | | | | |
| Helicopsychidae | | | | | | | |
| *Helicopsyche* sp. | | | | | 1 | | 8 |
| Hydropsychidae | | | | | | | |
| *Arctopsyche grandis* (Banks) | 8 | | | | 5 | 1 | |
| *Cheumatopsyche* sp. | 2 | | | | 27 | 3 | 7 |
| *Hydropsyche* sp. | 793 | 5 | | 11 | 356 | 70 | 70 |
| Hydroptilidae | | | | | | | |
| *Ochrotrichia* sp. | | | | | | | |
| Lepidostomatidae | | | | | | | |
| *Lepidostoma* sp. | 4 | 3 | | | 14 | 19 | 89 |
| Limnephilidae | | | | | | | |
| *Hesperophylax* sp. | | | | | | | |
| Rhyacophilidae | | | | | | | |
| *Rhyacophila angelita* Banks | | | | | | | |
| *R. coloradensis* Banks | | | | | | | |
| *Rhyacophila* sp. A | 3 | | 1 | 1 | | | |
| Diptera | | | | | | | |
| Chironomidae | 259 | 135 | 212 | 241 | 184 | 419 | 390 |
| Empididae | | | | | | | |
| *Chelifera* sp. | | 10 | 7 | 25 | 14 | | 4 |
| Heleidae | | | | | | | |
| *Palpomyia* sp. | | | | 1 | 4 | | |
| Psychodidae | | | | | | | |
| *Psychoda* sp. | | 1 | | | | | |
| Rhagionidae | | | | | | | |
| *Atherix variegata* Walker | 1 | 11 | 5 | 12 | 2 | 6 | 3 |
| Simuliidae | | | | | | | |
| *Simulium* sp. | | | | | 2 | 1 | |
| Tabanidae | | | | | | | |
| *Tabanus* sp. | | | | | 1 | | |
| Tipulidae | | | | | | | |
| *Antocha monticola* Alexander | 4 | 1 | | 4 | 3 | 1 | 3 |
| *Dicranota* sp. | | | | | | | |
| *Hexatoma* sp. | 2 | 2 | 1 | 4 | 13 | 1 | 5 |
| *Tipula* sp. | | 3 | 6 | 4 | 23 | 13 | 24 |
| Coleoptera | | | | | | | |
| Dytiscidae | | | | | | | |
| *Deronectes* sp. | | | | | 1 | | |
| Elmidae | | | | | | | |
| *Lara* sp. | | | | | | | |
| *Optioservus* sp. | 32 | 4 | 6 | 22 | 12 | 1 | |
| *Zaitzevia parvula* Horn | 3 | | | | 1 | | |
| Haliplidae | | | | | | | |
| *Haliplus* sp. | | | | | | | |
| Gastropoda | | | | | | 2 | 9 |
| Hirudinea | | | | | | 1 | 1 |
| Isopoda | | | | | | | |
| Oligochaeta | | 180 | 174 | 197 | 171 | 109 | 46 |

TABLE 14

CHECKLIST AND NUMBERS OF AQUATIC MACROINVERTEBRATES

EAST GALLATIN RIVER DECEMBER 17, 1973

| | Benthos Sampling Stations | | | | | | |
|---|---|---|---|---|---|---|---|
| | 6 | 7A | 7B | 7C | 7D | 7E | 8B |
| Ephemeroptera | | | | | | | |
| Baetidae | | | | | | | |
| *Baetis parvus* Dodds | 75 | | | | 790 | 637 | 353 |
| *Baetis alexanderi* n. sp. Edmunds and Jensen | | | | | | | |
| Ephemerellidae | | | | | | | |
| *Ephemerella (Drunella) doddsi* Needham | | | | | | | |
| *E. (Drunella) flavilinea* McDunnough | | | | | | | |
| *E. (Drunella) grandis ingens* McDunnough | 7 | 1 | 2 | 27 | 10 | 8 | 8 |
| *E. (Timpanoga) hecuba hecuba* Eaton | | | | | | | |
| *E. (Caudatella) heterocaudata heterocaudata* McDunnough | | | | | | | |
| *E. (Ephemarella) inermis* Eaton | 401 | 8 | 22 | 28 | 182 | 1268 | 2248 |
| *E. (Attenuatella) margarita* Needham | | | | | | | |
| *E. (Serratella) tibialis* McDunnough | | | | | | | |
| Heptageniidae | | | | | | | |
| *Cinygmula* sp. | | | | | | | |
| *Epeorus (Iron) longimanus* (Eaton) | | | | | | | |
| *Heptagenia criddlei* McDunnough | | | | | | | |
| *Heptagenia* sp. nr. *simpliciodes* McDunnough | | | | | | | 3 |
| *Rhithrogena* sp. nr. *morrisoni* (Banks) | 13 | 1 | 1 | 2 | 38 | 81 | 412 |
| Leptophlebiidae | | | | | | | |
| *Choroterpes* sp. | | | | | | | |
| *Paraleptophlebia bicornuta* (McDunnough) | | | | | | | |
| *P. debilis* (Walker) | | | | | | | |
| *P. heteronea* (McDunnough) | 1 | | | | | 1 | |
| Tricorythidae | | | | | | | |
| *Tricorythodes minutus* Traver | | | | 1 | 3 | 2 | 3 |
| Plecoptera | | | | | | | |
| Chloroperlidae | | | | | | | |
| *Alloperla (Triznaka) signata* (Banks) | | 1 | 1 | 3 | 2 | 2 | 12 |
| Nemouridae | | | | | | | |
| *Nemoura (Prostoia) besametsa* Ricker | | | | | | | |
| *Nemoura (Zapada) cinctipes* Banks | | | | | 1 | 1 | 3 |
| *Leuctra* sp. | | | | | | | |
| *Capnia (Capnia) confusa* Claassen | | | | 1 | | | 1 |
| *Brachyptera (Taenionema) pacifica* (Banks) | 2 | | | | | | 1 |
| Perlidae | | | | | | | |
| *Acroneuria (Hesperoperla) pacifica* Banks | | | | | 1 | | |
| Perlodidae | | | | | | | |
| *Arcynopteryx (Skwala) parallela* (Frison) | 9 | | | | 2 | 7 | 7 |
| *Isogenus (Isogenoides) elongatus* Hagen | | | | | | | 1 |
| *Isoperla fulva* Claassen | 1 | | | | 34 | 91 | 223 |
| *Isoperla mormona* Banks | 2 | | | | 12 | 57 | 224 |
| Pteronarcidae | | | | | | | |
| *Pteronarcella badia* (Hagen) | 254 | 2 | | | 124 | 23 | 153 |
| *Pteronarcys californica* Newport | | | | | | | |

(continued)

Table 14 (continued)

| | Benthos Sampling Stations | | | | | | |
|---|---|---|---|---|---|---|---|
| | 6 | 7A | 7B | 7C | 7D | 7E | 8B |
| Trichoptera | | | | | | | |
| Brachycentridae | | | | | | | |
| *Amiocentrus aspilus* (Ross) | | | | | | | |
| *Brachycentrus* sp. | 26 | 1 | 1 | 5 | 37 | 8 | 11 |
| *Micrasema* sp. | | | | | | | |
| Glossosomatidae | | | | | | | |
| *Agapetus* sp. | | | | 1 | | | |
| Helicopsychidae | | | | | | | |
| *Helicopsyche* sp. | | | | | | | 7 |
| Hydropsychidae | | | | | | | |
| *Arctopsyche grandis* (Banks) | 6 | | | | 1 | | |
| *Cheumatopsyche* sp. | 7 | | | | 7 | 20 | 5 |
| *Hydropsyche* sp. | 533 | 3 | 2 | 5 | 138 | 58 | 54 |
| Hydroptilidae | | | | | | | |
| *Ochrotrichia* sp. | | | | | | | |
| Lepidostomatidae | | | | | | | |
| *Lepidostoma* sp. | 1 | 4 | | 1 | 39 | 24 | 159 |
| Limnephilidae | | | | | | | |
| *Hesperophylax* sp. | | | | | 1 | | |
| Rhyacophilidae | | | | | | | |
| *Rhyacophila angelita* Banks | | | | | | | |
| *R. coloradensis* Banks | | | 1 | | | | |
| *Rhyacophila* sp. A | 2 | | | | | | |
| Diptera | | | | | | | |
| Chironomidae | 337 | 667 | 492 | 429 | 145 | 533 | 565 |
| Empididae | | | | | | | |
| *Chelifera* sp. | | 8 | 6 | 19 | 8 | 13 | 7 |
| Heleidae | | | | | | | |
| *Palpomyia* sp. | | 2 | | 1 | | | |
| Psychodidae | | | | | | | |
| *Psychoda* sp. | | | 1 | | | | |
| Rhagionidae | | | | | | | |
| *Atherix variegata* Walker | 2 | 7 | 1 | 9 | 2 | 7 | 5 |
| Simuliidae | | | | | | | |
| *Simulium* sp. | | | | | 4 | 6 | 5 |
| Tabanidae | | | | | | | |
| *Tabanus* sp. | | | | | | | |
| Tipulidae | | | | | | | |
| *Antocha monticola* Alexander | 1 | 1 | 1 | 1 | 1 | | 2 |
| *Dicranota* sp. | | 1 | 3 | 1 | 2 | | 1 |
| *Hexatoma* sp. | 14 | | | | 2 | 4 | 2 |
| *Tipula* sp. | 1 | 3 | 8 | 6 | 25 | 15 | 20 |
| Coleoptera | | | | | | | |
| Dytiscidae | | | | | | | |
| *Deronectes* sp. | | 1 | | | 1 | | 2 |
| Elmidae | | | | | | | |
| *Larai* sp. | 1 | | | | 1 | | |
| *Optioservus* sp. | 8 | 6 | 8 | 20 | 8 | 6 | 2 |
| *Zaitzevia parvula* Horn | 2 | | | 1 | | | |
| Haliplidae | | | | | | | |
| *Haliplus* sp. | | | | | 1 | | |
| Gastropoda | 1 | | | | 2 | 10 | 21 |
| Hirudinea | | | | | | 1 | |
| Isopoda | | | | | | | 2 |
| Oligochaeta | 7 | 165 | 701 | 281 | 112 | 393 | 63 |

TABLE 15

CHECKLIST AND NUMBERS OF AQUATIC MACROINVERTEBRATES

EAST GALLATIN RIVER FEBRUARY 13, 1974

| | Benthos Sampling Stations | | | | | | |
|---|---|---|---|---|---|---|---|
| | 6 | 7A | 7B | 7C | 7D | 7E | 8B |
| Ephemeroptera | | | | | | | |
| Baetidae | | | | | | | |
| *Baetis parvus* Dodds | 62 | 2 | | 1 | 17 | 1265 | 1328 |
| *Baetis alexanderi* n. sp. Edmunds and Jensen | | | | | | | |
| Ephemerellidae | | | | | | | |
| *Ephemerella (Drunella) doddsi* Needham | | | | | | | |
| *E. (Drunella) flavilinea* McDunnough | | | | | | | |
| *E. (Drunella) grandis ingens* McDunnough | 13 | | | 9 | 6 | 11 | 4 |
| *E. (Timpanoga) hecuba hecuba* Eaton | | | | | | | |
| *E. (Caudatella) heterocaudata heterocaudata* McDunnough | | | | | | | |
| *E. (Ephemerella) inermis* Eaton | 62 | 1 | 9 | 18 | 59 | 1078 | 2981 |
| *E. (Attenuatella) margarita* Needham | | | | | | | |
| *E. (Serratella) tibialis* McDunnough | | | | | | | |
| Heptageniidae | | | | | | | |
| *Cinygmula* sp. | | | | | | | |
| *Epeorus (Iron) longimanus* (Eaton) | | | | | | | |
| *Heptagenia criddlei* McDunnough | | | | | | | |
| *Heptagenia* sp. nr. *simpliciodes* McDunnough | | | | | 1 | | 3 |
| *Rhithrogena* sp. nr. *morrisoni* (Banks) | 1 | | | | 1 | 15 | 239 |
| Leptophlebiidae | | | | | | | |
| *Choroterpes* sp. | | | | | | | |
| *Paraleptophlebia bicornuta* (McDunnough) | | | | | | | |
| *P. debilis* (Walker) | | | | | | | |
| *P. heteronea* (McDunnough) | | | | | | | 1 |
| Tricorythidae | | | | | | | |
| *Tricorythodes minutus* Traver | | | | | | | |
| Plecoptera | | | | | | | |
| Chloroperlidae | | | | | | | |
| *Alloperla (Trinnaka) signata* (Banks) | 8 | 1 | | 3 | 1 | 1 | 5 |
| Nemouridae | | | | | | | |
| *Nemoura (Prostoia) besametsa* Ricker | | | | | | | |
| *Nemoura (Zapada) cinctipes* Banks | | | | | | | 2 |
| *Leuctra* sp. | | | | | | | |
| *Capnia (Capnia) confusa* Claassen | 1 | 1 | 2 | | | | |
| *Brachyptera (Taenionema) pacifica* (Banks) | | | | | | 6 | 3 |
| Perlidae | | | | | | | |
| *Acroneuria (Hesperoperla) pacifica* Banks | | | | | | | |
| Perlodidae | | | | | | | |
| *Arcynopteryx (Skwala) parallela* (Frison) | 3 | | | | | 1 | 2 |
| *Isogenus (Isogenoides) elongatus* Hagen | | | | | | | 1 |
| *Isoperla fulva* Claassen | 29 | 2 | 2 | | 3 | 29 | 125 |
| *Isoperla mormona* Banks | 15 | 1 | 1 | | 4 | 34 | 146 |
| Pteronarcidae | | | | | | | |
| *Pteronarcella badia* (Hagen) | 34 | | | | 70 | 48 | 69 |
| *Pteronarcys californica* Newport | | | | | 1 | | |

(continued)

Table 15 (continued)

| | Benthos Sampling Stations | | | | | | |
|---|---|---|---|---|---|---|---|
| | 6 | 7A | 7B | 7C | 7D | 7E | 8B |
| Trichoptera | | | | | | | |
| Brachycentridae | | | | | | | |
| *Amiocentrus aspilus* (Ross) | | | | | | | |
| *Brachycentrus* sp. | 7 | | | 14 | 37 | 11 | 46 |
| *Micrasema* sp. | | | | | | | |
| Glossosomatidae | | | | | | | |
| *Agapetus* sp. | | | | | | | |
| Helicopsychidae | | | | | | | |
| *Helicopsyche* sp. | | | | | | | 16 |
| Hydropsychidae | | | | | | | |
| *Arctopsyche grandis* (Banks) | | | | | | | |
| *Cheumatopsyche* sp. | | 2 | | | 1 | 5 | 2 |
| *Hydropsyche* sp. | 127 | 58 | 15 | 14 | 18 | 72 | 58 |
| Hydroptilidae | | | | | | | |
| *Ochrotrichia* sp. | | | | | | | |
| Lepidostomatidae | | | | | | | |
| *Lepidostoma* sp. | 3 | | | 1 | | 14 | 107 |
| Limnephilidae | | | | | | | |
| *Hesperophylax* sp. | | | | | | | |
| Rhyacophilidae | | | | | | | |
| *Rhyacophila angelita* Banks | | | | | | | |
| *R. coloradensis* Banks | | | | | | | 2 |
| *Rhyacophila* sp. A | | | | | | | |
| Diptera | | | | | | | |
| Chironomidae | 89 | 942 | 879 | 1271 | 499 | 944 | 552 |
| Empididae | | | | | | | |
| *Chelifera* sp. | | 2 | 4 | 15 | 4 | 13 | 3 |
| Heleidae | | | | | | | |
| *Palpomyia* sp. | | 1 | | 4 | | | |
| Psychodidae | | | | | | | |
| *Psychoda* sp. | | | | | | | |
| Rhagionidae | | | | | | | |
| *Atherix variegata* Walker | 1 | | 1 | 12 | 2 | 24 | 9 |
| Simuliidae | | | | | | | |
| *Simulium* sp. | | | | | | 4 | 1 |
| Tabanidae | | | | | | | |
| *Tabanus* sp. | | | | | | | |
| Tipulidae | | | | | | | |
| *Antocha monticola* Alexander | 1 | 1 | | 1 | 2 | | 3 |
| *Pierantoa* sp. | | | | | | | 1 |
| *Hexatoma* sp. | | 3 | | 2 | 7 | 2 | 6 |
| *Tipula* sp. | 2 | 8 | 10 | 10 | 11 | 27 | 26 |
| Coleoptera | | | | | | | |
| Dytiscidae | | | | | | | |
| *Deronectes* sp. | | | | | | | |
| Elmidae | | | | | | | |
| *Lara* sp. | | | | | | | |
| *Optioservus* sp. | 2 | 1 | 2 | 8 | 4 | 7 | 1 |
| *Zaitzevia parvula* Horn | | | | 1 | | | |
| Haliplidae | | | | | | | |
| *Haliplus* sp. | | | | | | | |
| Gastropoda | | | | | 4 | 8 | 5 |
| Hirudinea | | | | | 2 | | 2 |
| Isopoda | | | | | | | 1 |
| Oligochaeta | 1 | 173 | 981 | 263 | 1299 | 234 | 162 |

TABLE 16

CHECKLIST AND NUMBERS OF AQUATIC MACROINVERTEBRATES

EAST GALLATIN RIVER MARCH 26, 1974

| | Benthos Sampling Stations | | | | | | |
|---|---|---|---|---|---|---|---|
| | 6 | 7A | 7B | 7C | 7D | 7E | 8B |
| **Ephemeroptera** | | | | | | | |
| **Baetidae** | | | | | | | |
| *Baetis parvus* Dodds | 81 | 30 | 1 | 10 | 15 | 1049 | 459 |
| *Baetis alexanderi* n. sp. Edmunds and Jensen | | | | | | | |
| **Ephemerellidae** | | | | | | | |
| *Ephemerella (Drunella) doddsi* Needham | | | | | | | |
| *E. (Drunella) flavilinea* McDunnough | | | | | | | |
| *E. (Drunella) grandis ingens* McDunnough | 10 | | 1 | 2 | 28 | 1 | |
| *E. (Timpanoga) hecuba hecuba* Eaton | | | | | | | |
| *E. (Caudatella) heterocaudata heterocaudata* McDunnough | | | | | | | |
| *E. (Ephemerella) inermis* Eaton | 40 | 12 | 4 | 2 | 25 | 318 | 1158 |
| *E. (Attenuatella) margarita* Needham | | | | | | | |
| *E. (Serratella) tibialis* McDunnough | | | | | | | |
| **Heptageniidae** | | | | | | | |
| *Cinygmula* sp. | | | | | | | |
| *Epeorus (Iron) longimanus* (Eaton) | | | | | | | |
| *Heptagenia criddlei* McDunnough | | | | | | | |
| *Heptagenia* sp. nr. *simpliciodes* McDunnough | | | | | | | |
| *Rhithrogena* sp. nr. *morrisoni* (Banks) | 1 | | | | | 13 | 64 |
| **Leptophlebiidae** | | | | | | | |
| *Choroterpes* sp. | | | | | | | |
| *Paraleptophlebia bicornuta* (McDunnough) | | | | | | | |
| *P. debilis* (Walker) | | | | | | | |
| *P. heteronea* (McDunnough) | | | | | | 1 | |
| **Tricorythidae** | | | | | | | |
| *Tricorythodes minutus* Traver | | | | | | | |
| **Plecoptera** | | | | | | | |
| **Chloroperlidae** | | | | | | | |
| *Alloperla (Triznaka) signata* (Banks) | 13 | 4 | 5 | 1 | | 4 | 5 |
| **Nemouridae** | | | | | | | |
| *Nemoura (Prostoia) besametsa* Ricker | | | | | 1 | | |
| *Nemoura (Zapada) cinctipes* Banks | | | | | | | |
| *Leuctra* sp. | | | | | | | |
| *Capnia (Capnia) confusa* Claassen | 1 | 3 | | | | | |
| *Brachyptera (Taenionema) pacifica* (Banks) | | | | | | 1 | |
| **Perlidae** | | | | | | | |
| *Acroneuria (Hesperoperla) pacifica* Banks | | | | | | | |
| **Perlodidae** | | | | | | | |
| *Arcynopteryx (Skwala) parallela* (Frison) | | | | | | | 1 |
| *Isogenus (Isogenoides) elongatus* Hagen | 1 | | | | | | |
| *Isoperla fulva* Claassen | 20 | 7 | 8 | 2 | | 29 | 92 |
| *Isoperla mormona* Banks | 17 | 2 | 7 | | | 16 | 152 |
| **Pteronarcidae** | | | | | | | |
| *Pteronarcella badia* (Hagen) | 34 | 4 | 3 | 1 | 20 | 5 | 43 |
| *Pteronarcys californica* Newport | | | | | | | |

(continued)

Table 16 (continued)

| | Benthos Sampling Stations | | | | | | |
|---|---|---|---|---|---|---|---|
| | 6 | 7A | 7B | 7C | 7D | 7E | 8B |
| Trichoptera | | | | | | | |
| Brachycentridae | | | | | | | |
| *Amiocentrus aspilus* (Ross) | | | | | | | |
| *Brachycentrus* sp. | 5 | 1 | | 3 | 17 | 3 | 4 |
| *Micrasema* sp. | | | | | | | |
| Glossosomatidae | | | | | | | |
| *Agapetus* sp. | | | | | | | |
| Helicopsychidae | | | | | | | |
| *Helicopsyche* sp. | | | | | | | |
| Hydropsychidae | | | | | | | |
| *Arctopsyche grandis* (Banks) | | 2 | | 1 | 1 | | |
| *Cheumatopsyche* sp. | | 1 | | | | 1 | |
| *Hydropsyche* sp. | 124 | 32 | 12 | 7 | 16 | 10 | 54 |
| Hydroptilidae | | | | | | | |
| *Ochrotrichia* sp. | | | | | | | |
| Lepidostomatidae | | | | | | | |
| *Lepidostoma* sp. | | | | | | | 14 |
| Limnephilidae | | | | | | | |
| *Hesperophylax* sp. | | | | | | | |
| Rhyacophilidae | | | | | | | |
| *Rhyacophila angelita* Banks | | | | | | | |
| *R. coloradensis* Banks | 1 | | | | | | |
| *Rhyacophila* sp. A | | | | | | | |
| Diptera | | | | | | | |
| Chironomidae | 315 | 258 | 304 | 67 | 159 | 161 | 90 |
| Empididae | | | | | | | |
| *Chelifera* sp. | | | | | | 2 | |
| Heleidae | | | | | | | |
| *Palpomyia* sp. | | | | | | | |
| Psychodidae | | | | | | | |
| *Psychoda* sp. | | | | | | | |
| Rhagionidae | | | | | | | |
| *Atherix variegata* Walker | 2 | | 10 | 2 | 5 | 4 | 29 |
| Simuliidae | | | | | | | |
| *Simulium* sp. | | | | | | 1 | |
| Tabanidae | | | | | | | |
| *Tabanus* sp. | | | | | | | |
| Tipulidae | | | | | | | |
| *Antocha monticola* Alexander | 1 | | | | | | |
| *Dicranota* sp. | | | | | | | |
| *Hexatoma* sp. | 2 | 1 | | | 1 | 1 | 14 |
| *Tipula* sp. | 3 | 6 | 6 | 4 | 9 | 11 | 19 |
| Coleoptera | | | | | | | |
| Dytiscidae | | | | | | | |
| *Deronectes* sp. | | | | | | | |
| Elmidae | | | | | | | |
| *Lara* sp. | | | | | | | |
| *Optioservus* sp. | 8 | | 2 | 1 | 2 | 1 | 2 |
| *Zaitzevia parvula* Horn | | | | | | | |
| Haliplidae | | | | | | | |
| *Haliplus* sp. | | | | | | | |
| Gastropoda | 2 | | | | | | 3 |
| Hirudinea | | | | | | | 1 |
| Isopoda | | | | | | | |
| Oligochaeta | | 120 | 1029 | 193 | 212 | 154 | 8 |

TABLE 17

CHECKLIST AND NUMBERS OF AQUATIC MACROINVERTEBRATES

EAST GALLATIN RIVER APRIL 16, 1974

| | Benthos Sampling Stations | | | | | | |
|---|---|---|---|---|---|---|---|
| | 6 | 7A | 7B | 7C | 7D | 7E | 8B |
| Ephemeroptera | | | | | | | |
| Baetidae | | | | | | | |
| *Baetis parvus* Dodds | 278 | 57 | 26 | 7 | | 282 | 331 |
| *Baetis alexanderi* n. sp. Edmunds and Jensen | | | | | | | |
| Ephemerellidae | | | | | | | |
| *Ephemerella (Drunella) doddsi* Needham | | | | | | | |
| *E. (Drunella) flavilinea* McDunnough | | | | | | | |
| *E. (Drunella) grandis ingens* McDunnough | 5 | 1 | 2 | 2 | | | 2 |
| *E. (Timpanoga) hecuba hecuba* Eaton | | | | | | | |
| *E. (Caudatella) heterocaudata heterocaudata* McDunnough | | | | | | | |
| *E. (Ephemerella) inermis* Eaton | 25 | 14 | 29 | 9 | | 60 | 638 |
| *E. (Attenuatella) margarita* Needham | | | | | | | |
| *E. (Serratella) tibialis* McDunnough | | | | | | | |
| Heptageniidae | | | | | | | |
| *Cinygmula* sp. | | | | | | | |
| *Epeorus (Iron) longimanus* (Eaton) | | | | | | | |
| *Heptagenia criddlei* McDunnough | | | | | | | |
| *Heptagenia* sp. nr. *simplicioides* McDunnough | | | | | | | |
| *Rhithrogena* sp. nr. *morrisoni* (Banks) | 2 | | | 1 | | 1 | 10 |
| Leptophlebiidae | | | | | | | |
| *Choroterpes* sp. | | | | | | | |
| *Paraleptophlebia bicornuta* (McDunnough) | | | | | | | |
| *P. debilis* (Walker) | | | | | | | |
| *P. heteronea* (McDunnough) | | | | | | | |
| Tricorythidae | | | | | | | |
| *Tricorythodes minutus* Traver | | | | | | | |
| Plecoptera | | | | | | | |
| Chloroperlidae | | | | | | | |
| *Alloperla (Triznaka) signata* (Banks) | 19 | | 1 | 4 | | | 3 |
| Nemouridae | | | | | | | |
| *Nemoura (Prostoia) besametsa* Ricker | 1 | | | | | | 1 |
| *Nemoura (Zapada) cinctipes* Banks | | | | | | | |
| *Leuctra* sp. | | | | | | | |
| *Capnia (Capnia) confusa* Claassen | | | | | | | |
| *Brachyptera (Taenionema) pacifica* (Banks) | | | | | | | |
| Perlidae | | | | | | | |
| *Acroneuria (Hesperoperla) pacifica* Banks | | | | | | | |
| Perlodidae | | | | | | | |
| *Arcynopteryx (Skwala) parallela* (Frison) | | | | | | | |
| *Isogenus (Isogenoides) elongatus* Hagen | | | | | | | |
| *Isoperla fulva* Claassen | 13 | | 3 | 1 | | 3 | 47 |
| *Isoperla mormona* Banks | 17 | | 5 | 1 | | 4 | 64 |
| Pteronarcidae | | | | | | | |
| *Pteronarcella badia* (Hagen) | 25 | | 1 | 1 | | | 7 |
| *Pteronarcys californica* Newport | | | | | | | |

(continued)

Table 17 (continued)

| | Benthos Sampling Stations | | | | | | |
|---|---|---|---|---|---|---|---|
| | 6 | 7A | 7B | 7C | 7D | 7E | 8B |
| Trichoptera | | | | | | | |
| Brachycentridae | | | | | | | |
| *Amiocentrus aspilus* (Ross) | | | | | | | |
| *Brachycentrus* sp. | 1 | | 3 | 2 | | | |
| *Micrasema* sp. | | | | | | | |
| Glossosomatidae | | | | | | | |
| *Agapetus* sp. | | | | | | | |
| Helicopsychidae | | | | | | | |
| *Helicopsyche* sp. | | | | | | | |
| Hydropsychidae | | | | | | | |
| *Aratopsyche grandis* (Banks) | 1 | | 1 | | | | |
| *Cheumatopsyche* sp. | | 1 | | | | | |
| *Hydropsyche* sp. | 14 | 22 | 17 | 1 | | 4 | 3 |
| Hydroptilidae | | | | | | | |
| *Ochrotrichia* sp. | | | | | | | |
| Lepidostomatidae | | | | | | | |
| *Lepidostoma* sp. | | | 1 | | | | |
| Limnephilidae | | | | | | | |
| *Hesperophylax* sp. | | | | | | | |
| Rhyacophilidae | | | | | | | |
| *Rhyacophila angelita* Banks | | | | | | | |
| *R. coloradensis* Banks | | | | | | | |
| *Rhyacophila* sp. A | | | | | | | |
| Diptera | | | | | | | |
| Chironomidae | 61 | 98 | 111 | 50 | | 51 | 23 |
| Empididae | | | | | | | |
| *Chelifera* sp. | | 1 | 1 | | | | |
| Heleidae | | | | | | | |
| *Palpomyia* sp. | | | | | | | |
| Psychodidae | | | | | | | |
| *Psychoda* sp. | | | | | | | |
| Rhagionidae | | | | | | | |
| *Atherix variegata* Walker | 1 | | 1 | 1 | | | 4 |
| Simuliidae | | | | | | | |
| *Simulium* sp. | | | | | | | |
| Tabanidae | | | | | | | |
| *Tabanus* sp. | | 1 | 1 | | | | |
| Tipulidae | | | | | | | |
| *Antocha monticola* Alexander | | 1 | | | | | |
| *Dicranota* sp. | | | | | | | |
| *Hexatoma* sp. | 14 | | | 1 | | | 3 |
| *Tipula* sp. | | | 2 | 1 | | | 4 |
| Coleoptera | | | | | | | |
| Dytiscidae | | | | | | | |
| *Deronectes* sp. | | | | | | | |
| Elmidae | | | | | | | |
| *Lara* sp. | | | | | | | |
| *Optioservus* sp. | | 3 | 1 | | | | 1 |
| *Zaitzevia parvula* Horn | | | | | | | |
| Haliplidae | | | | | | | |
| *Haliplus* sp. | | | | | | | |
| Gastropoda | 1 | | | | | | 1 |
| Hirudinea | 1 | | | | | | 1 |
| Isopoda | | | | | | | |
| Oligochaeta | 4 | 84 | 1585 | 28 | | 140 | 14 |

TABLE 18

CHECKLIST AND NUMBERS OF AQUATIC MACROINVERTEBRATES

EAST GALLATIN RIVER JULY 9, 1974

| | Benthos Sampling Stations | | | | | | |
|---|---|---|---|---|---|---|---|
| | 6 | 7A | 7B | 7C | 7D | 7E | 8B |
| Ephemeroptera | | | | | | | |
| Baetidae | | | | | | | |
| *Baetis parvus* Dodds | 289 | 12 | 18 | 159 | 138 | 90 | 234 |
| *Baetis alexanderi* n. sp. Edmunds and Jensen | 188 | 1 | 16 | 258 | 400 | 584 | 825 |
| Ephemerellidae | | | | | | | |
| *Ephemerella (Drunella) doddsi* Needham | | | | | | | |
| *E. (Drunella) flavilinea* McDunnough | 4 | 4 | 4 | 10 | 7 | 1 | |
| *E. (Drunella) grandis ingens* McDunnough | | | | | | | |
| *E. (Timpanoga) hecuba hecuba* Eaton | 1 | 6 | 5 | | | | 2 |
| *E. (Caudatella) heterocaudata heterocaudata* McDunnough | 1 | | | 2 | | | |
| *E. (Ephemerella) inermis* Eaton | 98 | 123 | 102 | 87 | 43 | 66 | 101 |
| *E. (Attenuatella) margarita* Needham | 4 | 1 | 4 | | | 2 | 1 |
| *E. (Serratella) tibialis* McDunnough | 5 | | | 1 | 3 | | 1 |
| Heptageniidae | | | | | | | |
| *Cinygmula* sp. | 8 | 7 | 6 | 2 | 1 | 3 | |
| *Epeorus (Iron) longimanus* (Eaton) | | | | | | 1 | |
| *Heptagenia criddlei* McDunnough | 5 | 6 | 17 | | 4 | 14 | 55 |
| *Heptagenia* sp. nr. *simplicioides* McDunnough | 30 | 36 | 54 | 16 | 10 | 133 | 304 |
| *Rhithrogena* sp. nr. *morrisoni* (Banks) | 1 | | | | | 1 | |
| Leptophlebiidae | | | | | | | |
| *Choroterpes* sp. | | | | | | | |
| *Paraleptophlebia bicornuta* (McDunnough) | | | | | | | |
| *P. debilis* (Walker) | | | | | | | |
| *P. heteronea* (McDunnough) | | | | | | | |
| Tricorythidae | | | | | | | |
| *Tricorythodes minutus* Traver | | | 1 | 1 | | 1 | 29 |
| Plecoptera | | | | | | | |
| Chloroperlidae | | | | | | | |
| *Alloperla (Triznaka) signata* (Banks) | 2 | | | | | | |
| Nemouridae | | | | | | | |
| *Nemoura (Prostoia) besametsa* Ricker | | | | | | | |
| *Nemoura (Zapada) cinctipes* Banks | | | | | | | |
| *Leuctra* sp. | | | | | | | |
| *Capnia (Capnia) confusa* Claassen | | | | | | | |
| *Brachyptera (Taenionema) pacifica* (Banks) | | | | | | | |
| Perlidae | | | | | | | |
| *Acroneuria (Hesperoperla) pacifica* Banks | | | | | | | |
| Perlodidae | | | | | | | |
| *Arcynopteryx (Skwala) parallela* (Frison) | 1 | | | | | | |
| *Isogenus (Isogenoides) elongatus* Hagen | | | | | | | |
| *Isoperla fulva* Claassen | | | | | | | |
| *Isoperla mormona* Banks | 4 | | | 1 | | | 8 |
| Pteronarcidae | | | | | | | |
| *Pteronarcella badia* (Hagen) | 10 | | 1 | 1 | | | 11 |
| *Pteronarcys californica* Newport | | | | | | | |

(continued)

Table 18 (continued)

| | Benthos Sampling Stations | | | | | | |
|---|---|---|---|---|---|---|---|
| | 6 | 7A | 7B | 7C | 7D | 7E | 8B |
| Trichoptera | | | | | | | |
| Brachycentridae | | | | | | | |
| *Amiocentrus aspilus* (Ross) | 3 | | 1 | 4 | 2 | 1 | 1 |
| *Brachycentrus* sp. | 1 | | | | | 3 | 1 |
| *Micrasema* sp. | | | | | | | |
| Glossosomatidae | | | | | | | |
| *Agapetus* sp. | | | | | | | |
| Helicopsychidae | | | | | | | |
| *Helicopsyche* sp. | | | | | | | |
| Hydropsychidae | | | | | | | |
| *Arctopsyche grandis* (Banks) | | | | | | | |
| *Cheumatopsyche* sp. | | | | | | | |
| *Hydropsyche* sp. | 2 | 5 | 4 | 5 | 2 | 1 | 3 |
| Hydroptilidae | | | | | | | |
| *Ochrotrichia* sp. | | | | | | | |
| Lepidostomatidae | | | | | | | |
| *Lepidostoma* sp. | | | | | | | |
| Limnephilidae | | | | | | | |
| *Neophylax* sp. | | | | | | | |
| Rhyacophilidae | | | | | | | |
| *Rhyacophila angelita* Banks | | | | 1 | | | |
| *R. coloradensis* Banks | | | | | | | |
| *Rhyacophila* sp. A | | | | | | | |
| Diptera | | | | | | | |
| Chironomidae | 156 | 232 | 82 | 62 | 29 | 74 | 126 |
| Empididae | | | | | | | |
| *Chelifera* sp. | | 2 | | | 2 | | |
| Heleidae | | | | | | | |
| *Palpomyia* sp. | 5 | 9 | 7 | 5 | 3 | 4 | 5 |
| Psychodidae | | | | | | | |
| *Psychoda* sp. | | | | | | | |
| Rhagionidae | | | | | | | |
| *Atherix variegata* Walker | | 2 | | | 2 | 1 | |
| Simuliidae | | | | | | | |
| *Simulium* sp. | 103 | 2 | 2 | 27 | 5 | 33 | 23 |
| Tabanidae | | | | | | | |
| *Tabanus* sp. | | | | | | | |
| Tipulidae | | | | | | | |
| *Antocha monticola* Alexander | | | | 1 | | | |
| *Dicranota* sp. | | | | | | | 1 |
| *Hexatoma* sp. | 7 | 2 | | 1 | | | 2 |
| *Tipula* sp. | | | | | | | |
| Coleoptera | | | | | | | |
| Dytiscidae | | | | | | | |
| *Deronectes* sp. | | | | | | | |
| Elmidae | | | | | | | |
| *Lara* sp. | | | | | | | |
| *Optioservus* sp. | 3 | 4 | 3 | 3 | 6 | 2 | 1 |
| *Zaitzevia parvula* Horn | 2 | | | 1 | 1 | 1 | |
| Haliplidae | | | | | | | |
| *Haliplus* sp. | | | | | | | |
| Gastropoda | | | | | | | |
| Hirudinea | | | | | | | |
| Isopoda | | 2 | | | | | |
| Oligochaeta | | 67 | 302 | 400 | 17 | 19 | 5 |

TABLE 19

CHECKLIST AND NUMBERS OF AQUATIC MACROINVERTEBRATES

EAST GALLATIN RIVER AUGUST 16, 1974

| | Benthos Sampling Stations | | | | | | |
|---|---|---|---|---|---|---|---|
| | 6 | 7A | 7B | 7C | 7D | 7E | 8B |
| Ephemeroptera | | | | | | | |
| Baetidae | | | | | | | |
| *Baetis parvus* Dodds | 608 | 7 | | 458 | 748 | 553 | 363 |
| *Baetis alexanderi* n. sp. Edmunds and Jensen | 2 | | | 18 | 19 | 47 | 97 |
| Ephemerellidae | | | | | | | |
| *Ephemerella (Drunella) doddsi* Needham | | | | | | | |
| *E. (Drunella) flavilinea* McDunnough | | | | | | | |
| *E. (Drunella) grandis ingens* McDunnough | 34 | 117 | 35 | 42 | 14 | 15 | 4 |
| *E. (Timpanoga) hecuba hecuba* Eaton | 1 | 13 | 4 | | | 1 | 2 |
| *E. (Caudatella) heterocaudata heterocaudata* McDunnough | | | | | | | |
| *E. (Ephemerella) inermis* Eaton | | | | 2 | | | 1 |
| *E. (Attenuatella) margarita* Needham | 4 | | | | 1 | 1 | 2 |
| *E. (Serratella) tibialis* McDunnough | | | | 1 | | 1 | |
| Heptageniidae | | | | | | | |
| *Cinygmula* sp. | | | | | | | |
| *Epeorus (Iron) longimanus* (Eaton) | | | | | | | |
| *Heptagenia criddlei* McDunnough | 3 | | 4 | 16 | 2 | 13 | 99 |
| *Heptagenia* sp. nr. *simplicioides* McDunnough | | 2 | 2 | 1 | 2 | 3 | 9 |
| *Rhithrogena* sp. nr. *morrisoni* (Banks) | | | | 1 | 3 | 3 | 3 |
| Leptophlebiidae | | | | | | | |
| *Choroterpes* sp. | | | | | | | 1 |
| *Paraleptophlebia bicornuta* (McDunnough) | | | | | | 2 | 4 |
| *P. debilis* (Walker) | | | | | | | 1 |
| *P. heteronea* (McDunnough) | | | | | | | |
| Tricorythidae | | | | | | | |
| *Tricorythodes minutus* Traver | 160 | 298 | 100 | 207 | 349 | 259 | 903 |
| Plecoptera | | | | | | | |
| Chloroperlidae | | | | | | | |
| *Alloperla (Triznaka) signata* (Banks) | | | | | | | 1 |
| Nemouridae | | | | | | | |
| *Nemoura (Prostoia) besametsa* Ricker | | | | | | | |
| *Nemoura (Zapada) cinctipes* Banks | | | | 3 | | | 1 |
| *Leuctra* sp. | 1 | | | | | | |
| *Capnia (Capnia) confusa* Claassen | | | | | | | |
| *Brachyptera (Taenionema) pacifica* (Banks) | | | | | | | |
| Perlidae | | | | | | | |
| *Acroneuria (Hesperoperla) pacifica* Banks | 2 | | | 1 | 1 | 1 | |
| Perlodidae | | | | | | | |
| *Arcynopteryx (Skwala) parallela* (Frison) | 87 | | | 22 | 7 | 15 | 26 |
| *Isogenus (Isogenoides) elongatus* Hagen | | | | | | | |
| *Isoperla fulva* Claassen | | | | 1 | | 1 | |
| *Isoperla mormona* Banks | | | | | | | |
| Pteronarcidae | | | | | | | |
| *Pteronarcella badia* (Hagen) | 121 | 1 | | 125 | 34 | 16 | 24 |
| *Pteronarcys californica* Newport | | | | | | | |

(continued)

Table 19 (continued)

| | Benthos Sampling Stations | | | | | | |
|---|---|---|---|---|---|---|---|
| | 6 | 7A | 7B | 7C | 7D | 7E | 8B |
| Trichoptera | | | | | | | |
| Brachycentridae | | | | | | | |
| *Amiocentrus aspilus* (Ross) | | | | | | 1 | |
| *Brachycentrus* sp. | 37 | | 5 | 11 | 11 | | 2 |
| *Micrasema* sp. | | | | | | | |
| Glossosomatidae | | | | | | | |
| *Agapetus* sp. | | | | | | | |
| Helicopsychidae | | | | | | | |
| *Helicopsyche* sp. | | 1 | | | | | |
| Hydropsychidae | | | | | | | |
| *Arctopsyche grandis* (Banks) | 4 | | | 3 | | | |
| *Cheumatopsyche* sp. | 4 | | | 9 | 9 | 5 | 1 |
| *Hydropsyche* sp. | 418 | 10 | 1 | 293 | 110 | 93 | 69 |
| Hydroptilidae | | | | | | | |
| *Ochrotrichia* sp. | 1 | | | | | | |
| Lepidostomatidae | | | | | | | |
| *Lepidostoma* sp. | | | | | | | |
| Limnephilidae | | | | | | | |
| *Hesperophylax* sp. | | | | | | | |
| Rhyacophilidae | | | | | | | |
| *Rhyacophila angelita* Banks | | | | | | | |
| *R. coloradensis* Banks | | | | | | | |
| *Rhyacophila* sp. A | | | | | | | |
| Diptera | | | | | | | |
| Chironomidae | 143 | 149 | 130 | 124 | 95 | 79 | 321 |
| Empididae | | | | | | | |
| *Chelifera* sp. | | | | | | | |
| Heleidae | | | | | | | |
| *Palpomyia* sp. | | | | | | | |
| Psychodidae | | | | | | | |
| *Psychoda* sp. | | | | | | | |
| Rhagionidae | | | | | | | |
| *Atherix variegata* Walker | 1 | 8 | 36 | 94 | 25 | 35 | 16 |
| Simuliidae | | | | | | | |
| *Simulium* sp. | 12 | 5 | 6 | 7 | 24 | 33 | 2 |
| Tabanidae | | | | | | | |
| *Tabanus* sp. | | | | | | | |
| Tipulidae | | | | | | | |
| *Antocha monticola* Alexander | 3 | 1 | 2 | 1 | | | |
| *Dicranota* sp. | | | 1 | | | | |
| *Hexatoma* sp. | 16 | | 1 | 5 | 29 | 18 | 55 |
| *Tipula* sp. | | | 1 | 9 | 15 | 4 | 2 |
| Coleoptera | | | | | | | |
| Dytiscidae | | | | | | | |
| *Deronectes* sp. | | | | | | | |
| Elmidae | | | | | | | |
| *Lara* sp. | | | | | | | |
| *Optioservus* sp. | 36 | | 1 | 13 | 6 | 5 | |
| *Zaitzevia parvula* Horn | 4 | | 1 | 2 | | | |
| Haliplidae | | | | | | | |
| *Haliplus* sp. | | | | | | | |
| Gastropoda | | | | | | | |
| Hirudinea | | | | | | | |
| Isopoda | | 2 | | | 1 | 1 | |
| Oligochaeta | | 272 | 17 | 60 | 339 | 79 | 2 |