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C. LAWRENCE COOPER AND JOHN L. CRITES, Department of Zoology, The Ohio State University, Columbus 43210. *Submitted 31 May 1974; accepted 11 June 1974.*

A Synopsis of Nearctic Taxa Found in Aquatic Drift

ABSTRACT: Organisms found in 33 studies of aquatic drift are listed taxonomically with citations for the studies in which they were found. At least 50 species belonging to 40 genera are noted which drift in diel cycles of some type.

Many stream invertebrates tend to move downstream with the current, and their transport has been termed drift. Over the last few decades drift has been studied, partly because it is poses interesting questions about diel cycles, lotic productivity, stream invertebrate sampling methods and trophic ecology. Bishop and Hynes (4) and Waters (32, 34) have reviewed the literature of aquatic drift from a systems ecology approach. This paper reviews North American drift studies to date using a taxonomic rather than a systems approach.

Waters (34) has stressed that a "drift fauna," as distinct from the benthic fauna, does not exist, because drifting occurs only occasionally in the life of many stream organisms. Nevertheless, certain taxonomic groups show a much stronger tendency to drift than others, and the drift of some follows distinct diel periodicities. A diel periodicity is a recurrent temporal pattern with a 24-hr period which is observed in the field. The most commonly cited examples of these diel rhythms are the mayfly, *Baetis,* and the amphipod, *Gammarus,* but at least 50 species belonging to 40 genera have also been found to drift in some type of diel rhythm. Data have been contradictory on whether some of these (*e.g., Glossosoma*) drift according to a diel rhythm, while for a few others (*e.g., Simulium*) there has been disagreement whether the diel cycles are diurnal, nocturnal or both (perhaps depending on season).

The tendency of any individual of a species to drift may be influenced by light, temperature, turbidity, current velocity, water depth, the size, weight, form and stage of the organism, intra- and interspecific competition for food and space, and predation, or any interaction of these. Species may differ distinctly in the factors which trigger their drift. *Baetis,* for instance, is triggered by light, while *Oligophlebodes sigma* is apparently induced to drift by temperature. Thus, the accurate use of drift sampling as a tool in ecological studies depends upon a thorough understanding of all parameters influencing different species of the population under scrutiny. These parameters have been investigated in numerous drift studies, and the following list has been compiled to allow rapid access to these studies and to discussions of the parameters influencing particular species which drift.

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TABLE 1.—Aquatic organisms found in nearctic drift

1. INSECTA

PLECOPTERA

Nemouridae

Amphinemura spp., 9, 12; **Nemoura* (*Zapada*) *cinctipes,* 6, 12*, 18, 23; **N.* (*Zapada*) *oregonensis,* 23*; **N.* spp., 2, 10, 25*, 26*, 33*

Leuctridae

**Leuctra* spp., 10, 24, 25*

Taeniopterygidae

Brachyptera spp., 8, 23

Capniidae

**Allocapnia* sp., 25*; *Capnia* spp., 2, 10; **Nemocapnia* sp., 25*

Pteronarcidae, 9

Pteronarcys sp., 10

Perlodidae

Arcynopteryx (*Skwala*) sp., 23; **A.* (*Skwala*) *parallela,* 33*; *A.* (*Megarcys*) *signata,* 12; *Isogenus* (*Cultus*) *aestivalis,* 33; **I.* (*Kogotus*) *modestus,* 33*; *I.* spp., 23, 25; *Isoperla ebria,* 12; *I. nana* (*minuta*), 15; *I. petersoni,* 12; *I.* spp., 12, 24, 25, 27

Chloroperlidae

**Alloperla* spp., 8, 10, 12, 23*, 26*, 33*

Perlidae, 15

Acroneuria (*Hesperoperla*) *pacifica,* 12; *A.* (*Hesperoperla*) spp., 10, 33; *Phasganophora* sp., 10

EPHEMEROPTERA

Siphlonuridae, 16

**Ameletus velox,* 12, 33*; *A.* spp., 8, 18, 19, 23; *Isonychia* spp., 10, 19; *Siphlonurus occidentalis,* 23; *S.* sp., 10

Baetidae, 11*, 12*, 13*

TABLE 1.—(continued)

Baetis bicaudatus, 2, 12, 20, 22*, 26*, 33*; _B. parvus,_ 2, 20; *_B. tricaudatus,_ 2, 6*, 12, 20, 33*; *_B. vagans,_ 28, 29*, 30*, 31*, 35*; *_B._ spp., 9, 10, 21, 23*, 24, 25; _Callibaetis coloradensis,_ 6; _Cloeon_ sp., 6; _Neocloeon_ sp., 10; _Pseudocloeon_ spp., 9, 10, 15

Heptageniidae, 11*

Cinygmula spp., 12, 18, 23, 26*, 33; _C. reticulata,_ 20; _Epeorus grandis,_ 23; *_E. longimanus,_ 23, 33*; _Iron_ (_Epeorus_) spp., 8, 10; _Heptagenia_ spp., 8, 10; *_Rhithrogenia doddsi,_ 23*; _R. robusta,_ 12, 26; _R._ sp., 33; *_Stenonema_ spp., 9, 10, 15, 19, 24, 25*

Ametropidae

Siphloplectron basale, 6

Leptophlebiidae, 15, 31

Habrophlebia sp., 25; _Habrophlebodes_ sp., 10; *_Leptophlebia cupida,_ 6*, 7*; _L._ spp., 9, 26; _Paraleptophlebia debilis,_ 2, 6, 20; _P. heteronea,_ 12, 26; _P. rufivenosa,_ 23; _P. temporalis,_ 2, 20; *_P._ spp., 25, 26*

Polymitaridae

Ephoron sp., 19

Caenidae

Brachycercus sp., 19; _Caenis_ spp., 9, 15, 19; _C. simulans,_ 6

Ephemerellidae

Ephemerella coloradensis, 12, 18, 23, 26, 33*; *_E. doddsi,_ 23, 33*; _E. infrequens,_ 33; _E. spinifera,_ 23; _E. tibialis,_ 12, 33; *_E._ spp., 8, 9, 10, 23*, 24, 25*

Ephemeridae

Hexagenia limbata, 15; *_H._ spp., 10, 27*; _Potamanthus_ sp., 15

Tricorythidae

Tricorythodes sp., 9, 15

ODONATA

Agrionidae

Agrion sp., 9

Coenagrionidae spp., 15, 19

HEMIPTERA

Corixidae spp., 6, 12*, 15*, 19, 26

Hesperocorixa sp., 29

MEGALOPTERA, 15

Corydalidae

Chauliodes sp., 9

NEUROPTERA

Sisyridae sp., 15

TRICHOPTERA

Rhyacophilidae, 11*, 12*

Anagapetes debilis, 12; _Glossosoma excitum,_ 1; *_G. intermedium,_ 29*; _G. montana,_ 1; _G._ spp., 9, 10; _Rhyacophila acropedes,_ 1; _R. hyalinata,_ 12; _R. vepulsa,_ 1; *_R._ spp., 1*, 10, 12, 15, 18, 26*, 33

Philopotamidae, 9

Wormaldia sp., 10

Psychomyidae, 9

Neureclipsis crepuscularis, 26; _N._ sp., 19; _Platycentropus_ sp., 12; _Psychomyia_ sp., 10; _Tinodes_ sp., 12

Hydropsychidae, 9, 10, 13, 24

Arctopsyche sp., 19; _Cheumatopsyche_ spp., 15, 16, 19; _Hydropsyche_ spp., 19, 26, 29; _Parapsyche_ spp., 10, 12; _Potomyia flava,_ 26; _P._ sp., 19

Hydroptilidae , 9, 15

TABLE 1.—(continued)

Hydroptila rono, 1; _H._ sp., 10
Phryganeidae, 9, 11
Limnephilidae, 9, 11, 13*
Ecclisomyia sp., 12; _Glyphotaelius_ sp., 7; _Limnephilus_ sp., 7, 12, 29; _Neothremma alicia,_ 12*; *_N._ spp., 18, 33*; _Oligophlebodes minutus,_ 12; *_O. sigma,_ 22*, 33*
Leptoceridae, 9, 14
Athripsodes sp., 12; _Leptocella diarina,_ 26
Lepidostomatidae, 9
Lepidostoma unicolor, 1; _L._ spp., 10, 12
Sericostomatidae, 9
Brachycentridae, 33
Brachycentrus americanus, 1, 9; _Micrasema bactro,_ 12

LEPIDOPTERA
Pyralididae
Nymphula sp., 9

COLEOPTERA
Haliplidae, 9, 12, 15
Peltodytes duodecimunctatus, 15; _P. endentatus,_ 15; _P. litoralis,_ 15
Dytiscidae, 7, 9, 12, 15, 19
Laccophilus sp., 7
Hydrophilidae, 9, 12, 15
Elmidae, 12, 13*
Cleptelmis sp., 5; _Dubiraphia quadrinotata,_ 15; _Heterlimnius corpulentus,_ 5*; *_Lara avara,_ 5*; *_Optioservus seriatus,_ 5*; _Stenelmis vittipenis,_ 15

DIPTERA
Tipulidae, 9, 12, 13, 24, 29
Antocha spp., 24, 25
Psychodidae, 12, 18
Pericoma sp., 18; _Psychoda alternata,_ 15; _P. cinerea,_ 15
Blepharoceridae, 11
Dixidae, 7, 12*
Dixa sp., 18, 29
Chaoboridae
Chaoboris spp., 3, 15
Culicidae, 7, 19
Culex sp., 15
Ceratopogonidae, 6, 7, 9, 15
Bezzia spp., 3, 7
Chironomidae, 2, 3, 6, 7, 8, 12, 13, 15, 18, 19, 20, 21, 24, 25, 27*
Ablabesmyia sp. 20; _Chironomus_ spp., 9, 16; _Cladotanytarsus_ sp., 16; _Corynoneura_ spp., 9, 20; _Cricotopus_ spp., 16, 20; _Cryptochironomus_ sp., 9; _Endochironomus_ sp., 9; _Nanocladius_ sp., 20, 26; _Orthocladius_ spp., 9, 26; _Pentaneura_ sp., 9; _Polypedilum flavis,_ 9; _Procladius_ spp., 9, 26; _Prodiamesa_ sp., 9; _Psectrocladius_ sp., 20; _Rheotanytarsus_ sp., 20; _Tanytarsus confusus,_ 9; _T. gregarius,_ 9, 20; _Thienemanniella_ sp., 20; _Trichocladius_ sp., 9
Simuliidae, 2, 6*, 7, 9, 12, 13*, 15, 18, 19, 21, 24, 25, 28
Simulium venustum, 7; _Simulium_ spp., 8, 18, 30
Stratiomyiidae, 9, 12, 18
Rhagionidae, 9
Empididae, 9, 12, 13, 15
Syrphidae, 14
Anthomyidae, 9
Muscidae, 12

TABLE 1.—(continued)

II. NONINSECTA TAXA

COELENTERATA
*_Hydra_ sp., 9, _15*_

TURBELLARIA, 9
  Tricladida, 17
Dugesia sp., 18

ROTATORIA, 6, 7

CESTODA, 9

NEMATODA, 7, 9, 15

ANNELIDA
  Oligochaeta, 5, 7, 9, 16, 29
Limnodrilus sp., 15; _Tubifex_ sp., 15, 16

CLADOCERA, 15
  Chydoridae spp., 6, 7
  Daphnidae sp., 19
Ceriodaphnia reticulata, 6, 7; _Scapholebris kingi,_ 6, 7
  Leptodoridae
Leptodora kindti, 19

COPEPODA
  Arguloida
Argulus sp., 15, 27
  Cyclopoida spp., 6, 7
  Harpactoida sp., 7

OSTRACODA, 6, 7

ISOPODA, 15
Asellus communis 9, _A._ spp., 27, 29

AMPHIPODA, 15
Gammarus lacustris, 33; *_G. pseudolimnaeus,_ 9, 28, 29*, 30*, 31*, 35*; _G._ sp., 30*

HYDRACARINA, 6, 7, 9, 15, 29

COLLEMBOLA, 6, 7, 19

MOLLUSCA
  Gastropoda, 7, 9, 17

VERTEBRATA
  Osteicthyes, 19
Catostomus commersoni (_fry_), 6

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* Numbers refer to corresponding studies in the bibliography. Asterisks indicate studies where diel periodicity was found; those with italics in addition mean the periodicity was diurnal; those without asterisks indicate either that diel periodicity of the drift did not occur or that data were insufficient.

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PAUL R. ADAMUS AND ARDEN R. GAUFIN, Department of Biology, University of Utah, Salt Lake City 84112. *Submitted 28 May 1974; accepted 5 August 1974.*

Temperature Response of Succinate Dehydrogenase in Altitudinally Diverse Populations of Taraxacum officinale

ABSTRACT: Examination of temperature coefficients and apparent enzyme-substrate affinities of succinate dehydrogenase in intact mitochondria of altitudinally diverse populations of *Taraxacum officinale* revealed minimum temperature coefficients at temperatures approximating those of the habitats in which they grew and apparent enzyme-substrate affinities which were insensitive to temperature change in the range examined.

INTRODUCTION

Terrestrial plants have been described as the "epitome of poikilothermy" and therefore ideal for the study of adaptation of enzyme kinetics to habitats with different temperatures (McNaughton, 1972). Examination of the enzyme-catalyzed reactions of poikilothermic animals such as fish or shrimp reveals that minimum activation energies and maximum enzyme-substrate affinities usually occur at temperatures approximating those of native habitats (Somero, 1969). Such adjustments should allow reactions in the organisms to be relatively independent of kinetic barriers caused by low environmental temperatures. Homeothermy probably has allowed organisms to achieve even greater independence from their thermal environments (Vroman and Brown, 1963).

Magnitudes of activation energy and enzyme-substrate affinity of reactions catalyzed by malate dehydrogenase and glycolate oxidase in ecotypes of *Typha*