Insect Drift in Tenderfoot Creek and Possible Causes of Drift

Dennis Dolan
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Insect Drift in Tenderfoot Creek and Possible Causes of Drift

Abstract

The objective of this project was to perform a twenty four drift study to try and determine the Pattern of drift in Tenderfoot Creek. It was also intended to try and determine possible reasons for the phenomenon of drift and to try to relate it to the population of the stream substrate. To determine the population of the stream, Surber samples were done at three different sites. At a later date, the actual drift study was performed by placing drift nets at each site within the stream and emptying them of their contents every hour. All the insects of these samples were then identified and recorded. The results showed a pattern of night time drift but also showed little correlation between the substrate population and the contents of the drift. It appeared that the pattern of the drift is controlled by light and the drift started when it got dark and ended when it became light. Temperature seemed to have no affect. Since there was little correlation between the substrate population and the drift content, it appeared that population pressure was not the cause of drift and there was no conclusive reason for the cause of the drift.

(stream,drift,population,light,drift nets,Surber,substrate)

(insects identified and recorded,pattern of drift controlled by light,population pressure was not the cause, no conclusive reason for the cause of drift)

Introduction

The nature of my project was to study stream drift in Tenderfoot Creek. Drift is a process by which aquatic insects, that usually are attached to the substrate, drift with the stream. It has been found in previous studies that there can be patterns to this drift and part of my investigation was to see if a pattern exists in Tenderfoot Creek. I used three different books as sources for this paper. They were An Introduction to Aquatic Insects of North America by Merritt and Cummins, Annual Review of Entomology Volume 15 and Volume 17. Previous to the actual drift study, I chose three diffferent areas of the creek. I then determined the population of the designated areas to compare this to the organisms in the drift. The method used, in the population estimates, was Surber Sampling and the drift samples were taken by placing drift nets at each of the three sites. I also recorded the water temperature,every hour, by using a YSI device

Materials and Methods

The first thing I did was to examine the stream itself to determine areas to be used in the study. The areas were close enough to make it as easy as possible to get from site to site quickly. After I chose the sites, the next step was to take Surber Samples to get an estimate or idea of the population in that area. I took the five samples at random from a chosen reference point within the site. I then placed the sampler in the stream and disturbed the substrate within the confines of the sampler. The organisms drifted back into the attached net from which they were taken and placed in vials for later identification. I executed this process twice. The first time was earlier in the summer and the second was a few days before the drift study. I did this to see if there was a change in the population through the summer.

The drift study was over a twenty four hour period where I emptied the contents of the nets every hour. The nets were held in the stream by stakes that were pounded into the bottom of the stream through a two by four piece of wood. I placed two nets at each site for a total of six nets. At the end of each hour, I took two empty nets and exchanged them for the nets at site one. The site one nets were emptied of their contents and exchanged for the nets at site two. I did the same thing for the site three nets. The whole process took less than ten minutes,and was performed every hour along with water temperature readings taken by using a YSI device. Once the contents were emptied from the net, I looked through the material and removed the insects for identification. The insects were placed in vials containing seventy percent alcohol. To identify the insects, I used Hilsenhof's <u>Key to Aquatic Insects of Northern Wisconsin</u>

Results

The data that I collected is represented in Table 1 and shows a few different things. First it demonstrates that there was an increase in drift activity at night. This is best demonstrated by the first site. While in the second and third sites, the Baetis sp. seemed to drift more regularly throughout the day, although it did drift heavier at night. The rest of the organisms at those sites showed a noticeable gap in activity during the day. This table also shows the most abundant five species throughout the drift.

Of the five most abundant organisms, Baetis sp., Caenis sp., and Trycorythodes sp. did appear in the Surber Sampless taken earlier in the summer. The Baetis sp. and Trycorythodes sp. reappear in the second set of Suber Samples as two of the most abundant organisms, while the Caenis sp. did not. Missing from the first set of samples but showing up in the second is the Sialis sp. The Agraylea sp. did not show up in either of the previous samples. The Stenelmis sp. appeared in both of the Surber Samples and in relatively high quantities, but appeared minimally in the drift. The Helicopsyche borealis did not appear in the first sample but did appear as a dominant species in the second and it also appeared in the drift in small quantities.

The totals of the organisms, given in Table 1, shows in what abundance the organisms were collected for all three sites during the entire drift study. The Baetis sp. drifted most heavily in site one and this was also the site in which it was most abundant in the substrate. In the population sample from the other sites, it was absent as a most abundant species but was still collected in high numbers, even higher than the organisms that were abundant there The _Caenis sp._ and _Trycorythodes sp._ drifted in about the same amounts in all three sites, while the _Sialis sp._ and _Agraylea sp._ varied more from site to site. _The Sialis sp._ was most abundant in the site two drift but it did not appear in the population of the substrate for this site. It was next highest in site one, where it was not a abundant species in the substrate and at site four, where it was found least in the drift, it was abundant in the substrate population. The _Agraylea sp._ grew significantly in abundance in site two from site one and again in site three,even though, it was absent from the population data.

Discussion

In previous studies on stream drift, patterns have emerged. These patterns show how the insects tend to drift throughout the day. The dominant pattern is one that shows a night time drift. Here the organisms drift very little during the day but after dark there is a dramatic increase. The general pattern was then for the drift to die down from the original peak but still remain higher than during the day. Usually there was another smaller peak before dawn and then a return to day time drift.(Waters 1972) My data indicates an increase in drift during the night but without the peaks. The drift remained constant throughout the night.

Many reasons have been thought of to try and explain stream drift. Some believe it is a way for the insects to distribute themselves down stream to utilize new areas of resources. Another explanation is they drift because of population crowding. If this were true, then the content of the drift should be in some relation to what is found in the substrate. My data does not seem to show any correlation between the organisms in the Surber Samples and the ones in the drift. The Baetis sp. drifted hilghest in the site where it was most abundant in the substrate, but where it wasn't, it's drift was still quite high and higher than any of the other organisms. The Baetis sp. was obviously drifting from areas that were placed elsewhere in the stream or at least not directly connected with the site. The areas that the Baetis sp. was drifting from could not be too far away from the nets because earlier studies have shown that insects drift for at most fifteen meters(Waters,1972)and that is an extreme. Most will not come close to this number.

My results did not indicate a strong correlation between the organisms that drifted and the ones that are found in the bottom of the stream, but Obviously the insects that did drift were represented in the population of the stream, but the organisms that did the most drifting were not necessarily the most dense in the population. If the drifting insects were not strongly related to the number of them in the substrate, then this would seem to eliminate population pressure as a possible explanation for drift. At least they were not being pressured by their own species. This could indicate that the drift phenomenon is more of a species specific characteristic and not something that all insects use in equal percentages. The organisms that drift the most are the Ephemeroptera and the Baetis in particular. Other studies have also seen that Baetis is responsible for a large percentage of drifting insects.(Waters,1972) This is because there are many species of Baetis and that they live in a large variety of habitats (Merritt and Cummins 1984)

One of the earliest theories was that drift occurred to keep the population at the carrying capacity. It states that as the organism grows to a certain size, it must drift to a new area so to not deplete the resources of the first area (Waters,1972). Another explanation for the pattern of drift is another matter of survival. In this theory, the insects drift in high numbers at the same time to try and overwhelm their predators. The chances for survival are greater if a large number drift at once because their predators can only eat so many individuals at one time. This assures that some will make it through (Waters,1972). These are just two possible theories to explan drift that would require further testing to see if they apply in Tenderfoot Creek.

Although not much is certain about what is the motivation for drift, it is known what is the stimulus for the pattern of night drift. Experiments have been done with both light and water temperture as the stimulus for drift. It was shown that varying the temperature of the water did not have an affect on night drift. The YSI data on water temperature supported this fact. At first it appeared that the drift was affected by the lowering of the water temperature, but the temperature remained low and the drift still ended. It has been shown that varying light does have an effect on drift. By using light at night, they were able to stop drift and by darkening the habitat during the day, they were able to cause drift (Waters, 1972). So it is light that is the controlling factor in drift and this was indicated by my results.

My work represents the least of what can be learned or experimented on in the field of stream ecology. My work involved simply the recording of the organisms in a twenty four hour drift and minimal population studies of the substrate. But much more can be done in this area. Experiments have been done to determine the characteristics of the drift and what can affect it. Things like water temperature, light, current velocity and also water quality have been investigated(Hynes,1970), this is not all that is involved. Studies could be done to discover the relation between drift and population biology, which is the amount of insects that are being produced in the stream. The amount of insects also has an effect on the productivity of the stream since the insects are the major feeders on periphyton. Experiments could be done to find a correlation between these two. The drift of insects is also related to areas of fish ecology. It has been shown that many fish feed on the drifting organisms and even time their most active feeding to correspond with the peak drifting times. In this capacity, drift studies could be important to fish management and studies of fish feeding habits (Hynes,1970). These are important ecological questions that my results can only hint at. To try and find reasonable answers would require further experiments.

This experiment showed that the pattern of drift in Tenderfoot Creek was a night time pattern. The number of organisms increased dramatically with the setting of the sun and it stayed hilgh until the sun came up. This is illustrated by Table 1. The content of the drift was not strongly related to the population of the substrate determined in the Surber Samples. The densest population was not always or usually the densest in the drift. These results seemed to rule out population pressure as a cause for drift and indicated that it may be a species characteristic that caused the organism to drift as much as it did.

This work was significant because it indicated an overall pattern for the insect drift in Tenderfoot Creek. It was also a good indication of the population of the creek and could thus be used as a basis or at least helpful in further studies of this kind performed on this stream. This work was also able to indicate some possible explanation for stream drift and was able to demonstrate some of the stimuli that cause the phenomenon.

Acknowledgements

I would like to thank everyone that helped me on this project, first, everyone who helped do all the field work that made the project possible Carol Blanchette, Neil McKay, Nina Mutone, Rudy Schlais, Lisa Schuster, Pat Sorano, Anne St Amond, Julie Oxler, and Bill Weinsheimer. I would like to thank Mary Bremigan for providing comic relief and Mike Deeni for moral support. I want to thank Dr. Ronald Hellanthol and Dr. Jane Aloi for advising me on the workings of the project and writing the paper, respectively. Finally, I want to thank the Hanks for donating the money for the grant that made the project possible and also afforded me one of the greatest summers of my life

Literature Cited

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Merritt, R.W., and Cummins, K.W. 1984. An Introduction to the Aquatic Insects of North America. Kendall/Hunt Publishing Company.

Waters, Thomas F. 1972. The Drift of Stream Insects. Entomology 17:253-272 in Annual Review of Entomology. Annual Reviews Inc. Palo Alto, California

TABLE 1-SITE 1

	A	B	C	D	E	F
1	11					
2	10				1	
3	9					
4	8			1		
5	7					
6	6			3		1
7	5	2	2	30		1
8	4	3	3	38		4
9	3	1	2	37		3
10	2	4	2	15		
11	1	4	6	19		
12	0	3	5	22		
13	23	1	5	22		3
14	22			8		1
15	21			2		
16	20			2		
17	19		1	2		
18	18			1		
19	17			1		
20	16			1		
21	15			1		
22	14			1		
23	13					
24	12	1	1			
25		MSISI	ECACA	EBABA	THYAG	ETRTR
26						
27	TOTALS	19	29	206	1	13

TABLE 1 – SITE 2

	A	B	C	D	E	F
1	11					1
2	10			1		
3	9			1	1	1
4	8					
5	7			2		
6	6			1		
7	5			2		1
8	4	5	10	9		
9	3	5	5	2		
10	2	6	2	3		1
11	1	11		6	7	
12	0	5	3	1	11	
13	23		3	28		3
14	22		2	27		1
15	21		1	17	1	
16	20			2		
17	19			7		1
18	18			3		1
19	17		1	3		1
20	16			5		
21	15			1		
22	14			10		
23	13			18		
24	12			6	1	
25		MSISI	ECACA	EBABA	THYAG	ETRTR
26						
27	TOTALS	32	27	157	21	11

	A	B	C	D	E	F
1	11				2	
2	10					
3	9			1	1	
4	8			1		
5	7					
6	6				4	
7	5		1	9	3	
8	4		8	16		
9	3	2		8	27	
10	2		4	7		
11	1			13	4	
12	0				8	
13	23		1	37	3	1
14	22		1	36		1
15	21		1	22		1
16	20					
17	19			2		
18	18			1		
19	17			1		
20	16			5	1	1
21	15			1		1
22	14			3	1	
23	13			4	3	
24	12		1	8		
25		MSISI	ECACA	EBABA	THYAG	ETRTR

STREAM ECOLOGY - UNDERC

Sample 2

TAXONOMIC DATA

STREAM Tenderfoot Creek DATE 12/7/87 PAGE 1

LOCATION U.N.D.E.R.C. NAME Dennis Dolan

TAXON & STAGE OR/FA/GE/SP/ST (1)	ORDER (9)	FAMILY (13)	GENUS (29)	SPECIES (41)	STAGE (53)	(58)	(80)
ERABA	EPHE	BAETIDAE	BAETIS				
ETRTR	EPHE	TRICORYTHIDAE	TRICORYTHODE				
OGOOP	ODON	GOMPHIDAE	OPHIOGOMPHUS				
CELST	COLE	ELMIDAE	STENELMIS		Adult	+ Larvae	
MESISI	MEGA	SIALIDAE	SIALIS				
THEHE	HELI	HELICOPSYCHIDAE	HELICOPSYCHE				

COMMENTS:

Sample 2

STREAM ECOLOGY - UNDERC

SURBER SAMPLE DATA

STREAM ______ DATE ______ PAGE 2

LOCATION ______ NAME ______

1 SI-TE	3 DATE YR/MO/DA	9 TAXON & STAGE OR/FA/GE/SP/ST	17 SAMPL 1	20 SAMPL 2	23 SAMPL 3	26 SAMPL 4	29 SAMPL 5	32 SAMPL 6	35 SAMPL 7	38 SAMPL 8	41 SAMPL 9	44 SAMPL 10	47 SAMPL 11	50 SAMPL 12	53 SAMPL 13	56 SAMPL 14	59 SAMPL 15	62	80
01		EBABA	002	003	007														
		ETRTR	000	002	002														
		BGOOP	000	002	005														
02		ETRTR	000	002	005														
		CELSTL	000	002	011														
		CELSTA	000	001	008														
		THEHE	000	000	018														
03		ETRTR	005	006	001														
		MSISI	003	011	000														
		THENE	000	000	018														

COMMENTS:

Sample 1

STREAM ECOLOGY - UNDERC

TAXONOMIC DATA

STREAM Tenderfoot Creek DATE 12/7/87 PAGE 3

LOCATION U.N.D.E.R.C NAME Dennis Dolan

1 TAXON & STAGE OR/FA/GE/SP/ST	9 ORDER	13 FAMILY	29 GENUS	41 SPECIES	53 STAGE	58	80
TPHCH	TRIC	PHILOPOTAMIDAE	CHIMARRA				
THYCH	TRIC	HYDROPSYCHIDAE	CHEUMATOPSYC				
TLIPSUN	TRIC	LIMNEPHILIDAE	PSEUDOSTENOP	uniformis			
THYPOF	TRIC	HYDROPSYCHIDAE	POTAMYIA	flava			
TLELE	TRIC	LEPIDOSTOMATIDAE	LEPIDOSTOMA				
THYSY	TRIC	HYDROPSYCHIDAE	SYMPHITOPSYC				
TSEAG	TRIC	SERICOSTOMATIDAE	AGARODES				
TLIPY	TRIC	LIMNEPHILIDAE	PYCNOPSYCHE				
TPOPO	TRIC	POLYCENTROPIDAE	POLYCENTROPUS				

COMMENTS:

STREAM ECOLOGY - UNDERC

Sample I

STREAM Tenderfoot Creek DATE 12/7/87 PAGE 4

TAXONOMIC DATA

LOCATION U.N.D.E.R.C. NAME Dennis Dolan

1 TAXON & STAGE OR/FA/GE/SP/ST	9 ORDER	13 FAMILY	29 GENUS	41 SPECIES	53 STAGE	58	80
EEPEP	EPHE	EPHEMERILLIDAE	EPHEMERELLA				
EEPDA	EPHE	EPHEMERILLIDAE	DANNELLA				
ETRTR	EPHE	TRYCORYTHIDAE	TRYCORYTHODE				
ECACA	EPHE	CAENIDAE	CAENIS				
EBABA	EPHE	BAETIDAE	BAETIS				
ELEPA	EPHE	LEPTOPHLEBIIDAE	PARALEPTOPHL				
EHEMAPE	EPHE	HEPTOGENIIDAE	MACDUNNOA	PERSIMPLEX			
EEPSE	EPHE	EPHEMERILLIDAE	SERRATELLA				
MCOCH	MEGA	CORYDALIDAE	CHAULIODES				
HMEME	HEMI	MESOVELIIDAE	MESOVELIA				
PPEPE	PLEC	PERLIDAE	PERLESTA	PLACIDA			
PPEAC	PLEC	PERLIDAE	ACRONEURIA				

COMMENTS:

STREAM ECOLOGY - UNDERC

Sample 1

TAXONOMIC DATA

STREAM Tenderfoot Creek DATE 12/7/87 PAGE 5

LOCATION U.N.D.E.R.C. NAME Dennis Dolan

1 TAXON & STAGE OR/FA/GE/SP/ST	9 ORDER	13 FAMILY	29 GENUS	41 SPECIES	53 STAGE	58
OGOHYBR	ODON	GOMPHIDAE	HYLOGOMPHUS	BREVIS		
OGOGO	ODON	GOMPHIDAE	GOMPHURUS			
OLILI	ODON	LIBELLULIDAE	LIBELLULA			
OGOAR	ODON	GOMPHIDAE	ARIGOMPHUS			
OGOOP	ODON	GOMPHIDAE	OPHIOGOMPHUS			
OGOHABR	ODON	GOMPHIDAE	HAGENIUS	BREVISTYLUS		
OGOST	ODON	GOMPHIDAE	STYLURUS			

COMMENTS:

STREAM ECOLOGY - UNDERC Sample 1

SURBER SAMPLE DATA

STREAM Tenderfoot Creek DATE 12/7/87 PAGE 6

LOCATION U.N.D.E.R.C. NAME Dennis Nolan

SI-TE	DATE YR/MO/DA	TAXON & STAGE OR/FA/GE/SP/ST	SAMPL 1	SAMPL 2	SAMPL 3	SAMPL 4	SAMPL 5	SAMPL 6	SAMPL 7	SAMPL 8	SAMPL 9	SAMPL 10	SAMPL 11	SAMPL 12	SAMPL 13	SAMPL 14	SAMPL 15
0.1		OGOMYBR	001	000	021	000	000										
		OGOGO	000	000	000	001	000										
		TPHCH	016	003	071	009	000										
		THYCH	007	020	031	006	003										
		TLIPSUV	006	000	001	000	002										
		THYPOEL	001	000	000	000	000										
		TLELE	000	000	001	000	000										
		THYSY	000	001	000	000	000										
		TSEAG	000	001	000	000	000										
		TLIPY	000	001	000	000	000										
		EEPEA	000	001	000	000	000										
		EEPOA	000	001	000	000	000										
		PPEPE	000	000	000	001	000										

COMMENTS:

STREAM ECOLOGY - UNDERC Sample 1

SURBER **SAMPLE DATA**

STREAM Tenderfoot Creek DATE 12/7/87 PAGE 2

LOCATION U.N.D.E.R.C. NAME Dennis Dolan

SI-TE (1)	DATE YR/MO/DA (3)	TAXON & STAGE OR/FA/GE/SP/ST (9)	SAMPL 1 (17)	SAMPL 2 (20)	SAMPL 3* (23)	SAMPL 4 (26)	SAMPL 5 (29)	SAMPL 6 (32)	SAMPL 7 (35)	SAMPL 8 (38)	SAMPL 9 (41)	SAMPL 10 (44)	SAMPL 11 (47)	SAMPL 12 (50)	SAMPL 13 (53)	SAMPL 14 (56)	SAMPL 15 (59)	(62)	(80)
02		OGOST	000	001	000	000	000												
		OLILI	000	001	000	000	000												
		OGOAR	000	001	000	000	002												
		THYCH	001	001	000	000	001												
		TLIPSDN	000	003	000	005	000												
		ETRTA	001	001	000	000	004												
		ECACA	000	000	000	000	002												
		MCECN	000	000	000	002	000												

COMMENTS:

STREAM ECOLOGY - UNDERC Sample 1

SURBER SAMPLE DATA

STREAM Tenderfoot Creek DATE 12/7/87 PAGE 8

LOCATION U.N.D.E.R.C. NAME Dennis Dolan

1 SITE	3 DATE YR/MO/DA	9 TAXON & STAGE OR/FA/GE/SP/ST	17 SAMPL 1	20 SAMPL 2	23 SAMPL 3	26 SAMPL 4	29 SAMPL 5	32 SAMPL 6	35 SAMPL 7	38 SAMPL 8	41 SAMPL 9	44 SAMPL 10	47 SAMPL 11	50 SAMPL 12	53 SAMPL 13	56 SAMPL 14	59 SAMPL 15	62	80
03		OGOOP	005	004	000	000	001												
		OGOHABR	000	000	001	000	000												
		OGOST	000	000	000	008	000												
		THYCH	004	001	001	000	000												
		TPOPO	000	001	000	001	000												
		TLIPSON	000	000	000	000	001												
		ETRTR	001	000	000	000	000												
		EBARA	000	000	000	001	000												
		PPEPE	000	001	001	000	000												
		PPEAC	000	001	000	000	000												
		HMEME	001	000	000	000	000												

COMMENTS:

.STREAM ECOLOGY - UNDERC Sample 1

SURBER SAMPLE DATA

STREAM Tenderfoot Creek DATE 12/7/82 PAGE 9

LOCATION U.N.D.E.R.C. NAME Dennis Dolan

SI-TE (1)	DATE YR/MO/DA (3)	TAXON & STAGE OR/FA/GE/SP/ST (9)	SAMPL 1 (17)	SAMPL 2 (20)	SAMPL 3 (23)	SAMPL 4 (26)	SAMPL 5 (29)	SAMPL 6 (32)	SAMPL 7 (35)	SAMPL 8 (38)	SAMPL 9 (41)	SAMPL 10 (44)	SAMPL 11 (47)	SAMPL 12 (50)	SAMPL 13 (53)	SAMPL 14 (56)	SAMPL 15 (59)	(62)
OH		OGOST	000	000	000	000	001											
		TPHCH	016	001	013	000	004											
		THYCH	060	016	024	016	037											
		TPOPO	001	000	000	001	002											
		TLIPSUN	000	001	000	000	000											
		ETRTR	033	019	034	010	062											
		EBABA	018	002	008	001	000											
		ELEPA	001	000	000	000	000											
		EHEMAPE	000	008	000	001	011											
		EEPSE	000	002	000	000	003											
		PPEPE	004	000	000	000	001											
		PPEPHCA	001	000	000	000	000											
		HMEME	000	002	000	000	000											
		MECOCH	000	000	000	000	001											

COMMENTS: