Watershed Education and Stewardship Program
Project # 95-E-07

Salmon River Restoration Council and
Forks of Salmon School

Final Report
October 1, 1994- June 1, 1998

Agreement # 14-48-0001-95702

submitted by:

Salmon River Restoration Council

August 28, 1998

ABSTRACT

During the 1994-95 and 1995-96 school year students from Forks of Salmon School participated in a macroinvertebrate and temperature monitoring program within the Salmon River watershed. Six creeks were sampled using the EPA Rapid Bio-assessment protocol under the technical expertise of entomologist, Jon Lee. Habitat conditions were evaluated in each stream based on the metrics developed from the samples. Water temperatures were measured using Hobo Temp electronic sensing devises during August and September of 1995. Ambient temperature in the riparian and upslope was also monitored in Butler Creek.

Students from Forks of Salmon School participated in all aspects of the study, including field collection and lab work. Additional watershed field activities occurred throughout the school year. These included amphibians and geologic studies with technical support from professionals. These cross-curricular activities integrated the watershed theme into the classroom. The Salmon River Restoration Council provided countless volunteer hours in support of the student projects and has currently taken over the responsibility of finalizing this report.

INTRODUCTION

The Salmon River is a Key Watershed and refugia for important fish stocks within the Klamath Basin. Forks of Salmon Schools lies within the heart of the Salmon River subbasin. Watershed education has been an integral part of the school curriculum since the early 1990's. Students have participated in local restoration and monitoring efforts, investigated the unique niches of their own backyards, participated in workshops and basin-wide conferences and shared their knowledge with their community and other students. Sue Terence, the teacher at Forks of Salmon School, developed an integrated, cross-curricular program, which engaged students in critical thinking and developed a genuine sense of stewardship for their watershed. The Salmon River Restoration Council and community volunteers supported the students' efforts during this time. Additionally, two exceptional AmeriCorps members, Becca Quinones and Kate McElderry Harrison, served as community coordinators during the 1994-95 and 1995-96 school years, respectively. Several grants were secured in order to carry out the overall watershed education program: USFWS, 319H, KRIS Project; SCSSO, SEAMS Project; Humboldt Area Foundation and the USFWS, Watershed Education and Stewardship Program, which focused on macroinvertebrates and temperature monitoring.

Changes in staffing at Forks of Salmon School in 1996 and the increased support of the Salmon River Restoration Council have brought this particular project to its current status. An amendment to this project was approved by USFWS in which the Salmon River Restoration Council completed the work that was begun in October 1994 by the Forks of Salmon School. This involved compiling the existing data, interviewing the school staff and technical specialists and identifying student work and activities.

The focus of the Watershed Education and Stewardship Program was to:

- Deepen student knowledge of and appreciation of aquatic ecosystems and watershed processes.
- Strengthen partnerships within the community.
- Foster a sense of respect for the watershed
- Understand the importance of macroinvertebrates and water temperature to anadromous fish.
- Understand the importance of diversity.
- Begin to learn to use a database and a GIS system to organize information.
- Learn techniques to share information.
- To benefit from contact with professionals and community members.

Jon Lee, entomologist, served as the technical advisor to this program. He spent three days in the field with students in the fall of 1994 and the spring and fall of 1995 collecting aquatic macroinvertebrates. Included in this report is the technical write up of their findings and the analysis by Jon Lee.

DESCRIPTION OF STUDY AREA

The entire Salmon River Watershed was studied by the students of Forks of Salmon School. Aerial photographs, maps and photos were utilized. Specialists from the USFS, Karuk Tribe, the Salmon River Restoration Council and local community members provided background history, as well as on the ground field support for a variety of watershed activities.

Specifically, macroinvertebrate sampling was completed in Butler Cr., Grant Cr. and Somes Cr. in the fall of 1994. Butler Cr. and Grant Cr. were sampled in the spring of 1995 and again in the fall of 1995 along with McNeal Cr., Nordheimer Cr. and Crapo Cr. All of these streams are tributaries to the mainstem of the Salmon River subbasin within the Klamath River System, except McNeal Cr. which is a tributary to the South Fork of the Salmon River.

Temperature monitoring in 1995 occurred near the mouths of the following tributaries of the Salmon River:

Matthews Creek	Olsen Cr.
Crapo Cr.	Indian Cr.
Nordheimer Cr.	Big Creek
Black Bear Creek	Knownothing Creek
Little North Fork	Boulder Gulch
Methodist Creek	Butler Creek
Grant Creek	Duncan Creek
Wooley Cr.- upstream 7 miles	
Salmon River- above and below Wooley Cr.	

METHODS AND MATERIALS

Macroinvertebrate Sampling

The EPA Rapid Bioassessment method, modified for California, was used. The collection method was demonstrated by entomologist, Jon Lee, in the field during the fall of 1994. Students participated by collecting samples in riffles according to the protocol. Students keyed insects to order in the classroom with Jon Lee's assistance. The method requires a validation sample be keyed by a qualified lab, which was done by Jon Lee. His report is included.

Temperature Monitoring

Protocols established by CDGF and the WQCB were implemented. Electronic temperature thermistors, called Hobo Temps were calibrated and deployed by students with the help of AmeriCorps members and Salmon River Restoration Council community volunteers during the late summer and fall of 1995. Cooperative temperature studies with the USFS and Karuk Tribe were developed. The LogBook software was used to launch and retrieve the electronic data. Data was downloaded using a lap top computer in late October 1995. Temperature data were input into the KRIS system.

RESULTS AND DISCUSSION

Macroinvertebrate Sampling

Field collections occurred on October 17-18, 1994, May 30, 1995 and October 16, 1995. Students were accompanied by entomologist, Jon Lee, teacher, Sue Terence, AmeriCorps members, Becca Quinones and Kate McElderry Harrison and teacher aide, Tina Bennett. Approximately 24 hrs. were spent in the field and classroom with students and an additional 67 hours of lab time for identifying samples by Jon Lee.

Data analysis included the following primary metrics:[1]

1. Taxa Richness (total number of taxa). Taxa richness generally decreases with increased disturbance.
2. EPT Index (total number of Ephemeroptera, Plecoptera and Trichoptera taxa). The majority of taxa in these three orders are sensitive to habitat degradation.
3. Percent Contribution of the Dominant Taxon. A high percent contribution of the dominant taxon suggests a stressed environment.

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1 Lee, Jon, Macroinvertebrate Report to Forks of Salmon School Project.

4. Diversity Index (Simpson's Diversity Index (1949)). Based on taxa richness and evenness. A low score suggests a lack of community balance.
5. Modified Hilsenhoff Biotic Index (regionally modified from Hilsenhoff (1982)). Assigns pollution tolerance values to taxa. Needs further modification of Northern California.

The following quantitative ranges are considered (based on the impact compared with theoretically undisturbed conditions):

1. Taxa Richness: >40= low impact; 25-39= moderate; <25= high
2. EPT Index: >25= low impact; 15-25= moderate; <15=high
3. % Dominant Taxa: (from Plafkin, 1989) <20%=non impaired; 20-30%= slightly impaired; 30-40%=moderately impaired; >40%= greatly impaired
4. Simpson's Diversity Index: 0.9= low impact; 0.8-.8999=moderate; <0.8=high
5. Modified Hilsenhoff Index: <1.75=low impact; 1.75-2.5=moderate;>2.5=high

A reference stream was not selected within the Salmon River watershed. A community similarity index was therefore not possible.

Comparisons of streams are based on stream order. Somes Creek, Grant Creek and McNeal Creek as 2nd order streams are similar, as are Butler Creek, Crapo Creek and Nordheimer Creek, as 3rd and 4th order streams. The smaller, headwater streams show lower taxa richness, but have many intolerant taxa. Somes Creek appeared to be disturbed by dredge mining prior to sampling. With the larger streams, Butler Creek indicates the best conditions, including a large number of intolerant taxa. The spring collection (V-30-95) in Butler Creek showed more disturbance than the fall sample (X-18-94), but this may be due to a late spring sampling. Crapo Creek appears to be less disturbed than Nordheimer Creek Crapo Creek indicates signs of imbalance, but suggests a non-temperature related (per Jon Lee report). A chart developed in the KRIS system is an example of the data analysis that is possible. This chart shows one of the metrics, "taxa richness", in three of the streams samples in the fall of 1994.

<u>Temperature Monitoring</u>

Included in this report are the results of temperature monitoring in lower reaches of the Salmon River Watershed. Students, AmeriCorps members and community members monitored the water and air temperatures, recording temperature at 1.6 hour intervals over the summer of 1995. This data is analyzed from three perspectives: the comparison of temperatures at the mouths of four tributary streams; the comparison of water, riparian and upslope temperatures in Butler Creek; and the influence of Wooley Creek on the mainstem Salmon River temperatures above and below the confluence.

The chart constructed in the KRIS system (included in the Appendix) showing the comparison of the tributary stream temperatures indicates that Grant Creek is the coolest , with maximum daily temperatures not exceeding 15C; Crapo Creek was the next coolest, with maximum temperature not exceeding 18C; Wooley Cr. was below stressful for salmonids, but a little warmer than the previous two and Nordheimer Creek was the warmest of the four streams between late August and early October. The temperature monitors were not deployed in Grant Creek or Wooley Creek until late August, which may have been after the hotter temperatures in early August, as shown in the trends of the temperatures of Nordheimer and Crapo Creek, which were monitored from mid May through early October in 1995.

Another KRIS chart shows that relationship between the water, and air temperatures in the riparian area and upslope in the Butler Creek Watershed, near the mouth between August 20th and September 28, 1995. The difference between the maximum daily water and riparian temperatures was about 7 degrees Celsius, with the air temperature showing greater diurnal fluctuations. The difference between the air temperature in the riparian area and upslope was almost 10 degrees Celsius, with the riparian area cooler and having less diurnal fluctuation. The influence of air temperature on the stream temperature needs further investigation, as other factors such as volume, aspect and geology should be included.

The third KRIS chart shows the relationship between the maximum daily stream temperature in Wooley Creek at the mouth and the Mainstem Salmon River above and below Wooley Creek. It also shows as well as the comparison between the stream temperatures in Wooley Creek at the mouth and 7 miles upstream from August 20th through September 28, 1995. The difference in temperature upstream and downstream of Wooley Creek was only about 1 degree Celsius. Wooley Creek at the mouth was on the average 3 degrees Celsius lower than the mainstem below the confluence. An understanding of volume and the relationship it has to the ability to change temperatures in streams is important to understand for future study design. Wooley Creek appears to have some influence on the mainstem temperature, which may be significant, considering the large volume of the river in the lower part of the watershed. Within Wooley Creek itself, there is a 1 degree warming over the lower seven miles. Deploying the temperature monitoring devices earlier in August may have picked up higher maximum temperatures.

Student Activities

Students from Forks of Salmon School participated in numerous, cross-curricular watershed education activities during the course of the 1994-95 and 1995-96 school years. These included amphibian studies, bald eagle surveys, wildlife observations, fall chinook spawning ground surveys and carcass counts, riparian restoration (tree planting), journal writing, geography/geology studies, temperature studies and macroinvertebrate studies. Many natural resource professionals shared their knowledge, both in the field and in the classroom.

Jon Lee, entomologist, assisted the students with field collection and lab identification of macroinvertebrates. Field sampling occurred on 10/17-18/94, 5/30/95 and 10/16/95. Students collected macroinvertebrate samples from riffle habitat in the following streams: Somes, Grant, McNeal, Butler, Crapo and Nordheimer Creeks. Samples collected on 10/17-18/94 were keyed to family by students in the classroom with the expert assistance of Jon Lee. Students learned to identity anatomical parts and functions, as well as to use a dichotomous key and proper lab procedures. Additional samples were identified and analyzed by Jon Lee in his laboratory, providing the metrics included in this report. Samples of student work and photographs of the collection days are included in the Appendix.

Temperature monitoring occurred in eleven locations between August and September 1995. Students deployed Hobo Temps, electronic temperature sensors, with the assistance of AmeriCorps community coordinator, Becca Quinones and Salmon River Restoration Council volunteers. Students from Forks of Salmon School, Sawyers Bar School and Junction School have participated in monitoring stream temperatures throughout the Salmon River in partnership with the Salmon River Restoration Council and the USFS since 1995.

Students were exposed to the new GIS-based system, KRIS (Klamath Resource Information System). A work station was set up at Forks of Salmon School. During the spring of 1998, Salmon River Restoration Council staff input the macroinvertebrate and temperature data into the KRIS system. Jim Villeponteaux, SRRC Technical Director and Sue Maurer, SRRC Watershed Education Coordinator met with students from Forks of Salmon School, Sawyers Bar School and Junction School to familiarize them with the latest version of the KRIS system and to demonstrate its use as a tool for understanding and housing data from the Salmon River watershed. All future data collected by SRRC and students will be housed in the KRIS system.

The involvement of students in "real" science within their watershed is an exciting approach to education and stewardship. The effectiveness of strong professional support and roll modeling is evident in the deeper level thinking skills that students developed. Samples of student reports are contained in the Appendix that illustrate the integration of the watershed theme throughout the curriculum in the classroom. Sue Terence, teacher, did a masterful job in developing these skills and the excitement of inquiry in her students. Informal tracking of past students in the program indicates an interest and involvement in watershed stewardship activities. Several students now work with the Salmon River Restoration Council and participate in local field work, when available.

SUMMARY AND CONCLUSIONS

Measuring the value of student learning, awareness and the development of a long-term stewardship ethic is difficult. The students of Forks of Salmon School were exposed to a wide range of watershed processes and the biological composition within their watershed. This was possible because of the strong support and partnerships developed within the community. This included the vision and commitment of teacher, Sue Terence, the coordination and attention to detail of AmeriCorps members, Becca Quinones and Kate McElderry Harrison, the role modeling of SRRC members like Petey Brucker and other community volunteers, the daily attention on teacher aide, Tina Bennett, the professional support of natural resource professionals, like Jon Lee and the enthusiasm of the individual students.

Integration of watershed education concepts and activities across the curriculum is a key to student learning. The opportunity for students to "learn by doing" now exists for the 1998-99 school year with the support of the SRRC and funding through CDFG (Thompson Bill). A watershed education coordinator will be working with students and teachers from the three river schools, coordinating field work with existing restoration activities, developing/applying appropriate classroom curriculum and training teachers. A model for long term sustainability of school-based watershed education with the SRRC as the lead partner will be developed in order to meet the challenge of staff changes at the schools.

Macroinvertebrate studies in the Salmon River are in their infant stages. Further assessment will be necessary in order to monitor change over time. Additionally, a reference stream (perhaps Wooley Creek) should be selected in order to provide a local community similarity index. Macroinvertebrate assessment is technical and time consuming. Coordination and funding by the Salmon River Restoration Council and the technical support of an entomologist will be required in order to be successful with student involvement in the future.

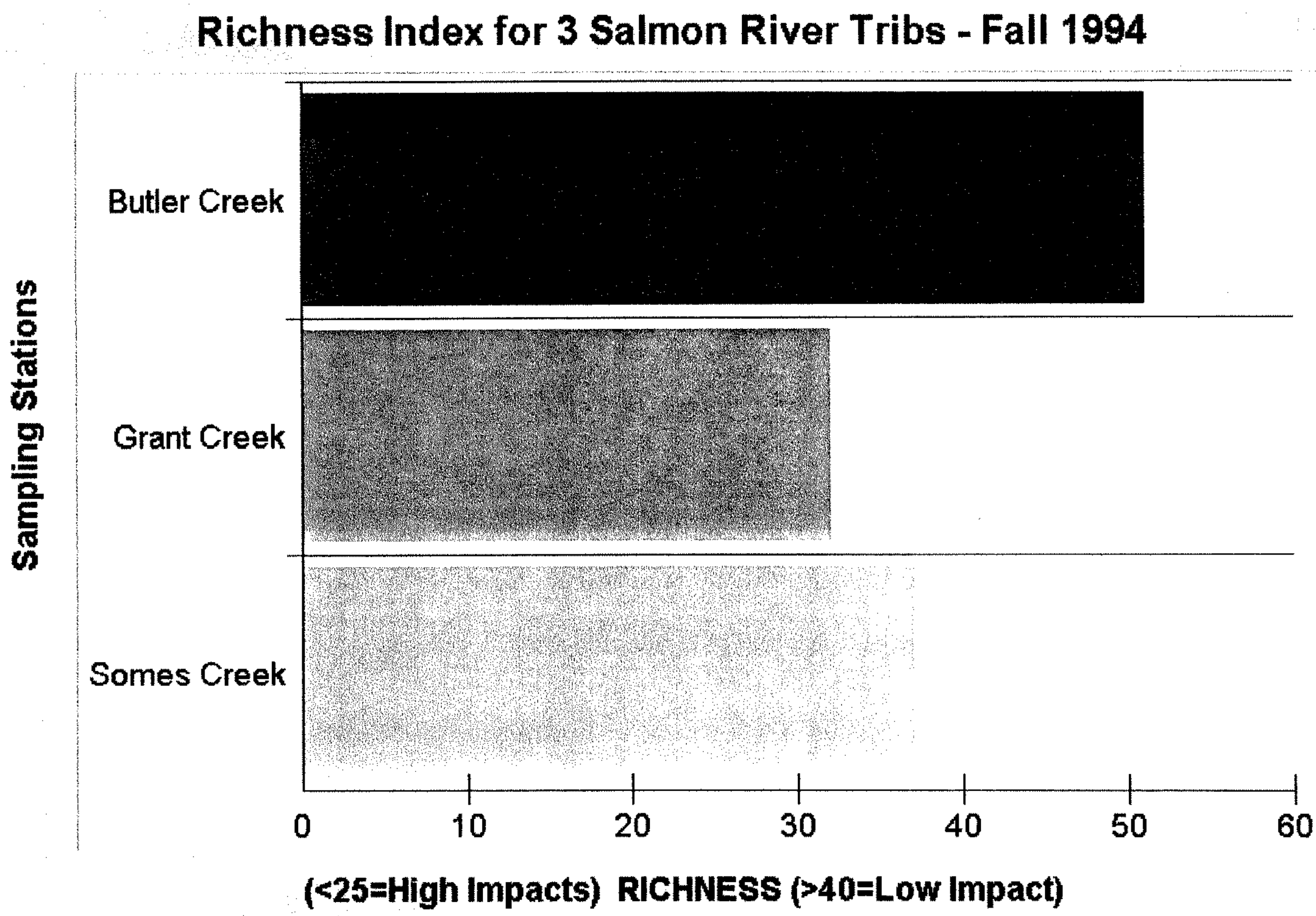
Temperature monitoring has and will continue to occur throughout the Salmon River watershed. A coordinated program with the schools, the SRRC and the USFS now exists. SRRC has taken the lead on this program and will continue to house the temperature data and analysis within the KRIS system and to provide community outreach to the schools and the community. Assistance and professional guidance in developing appropriate study designs based on evaluating the results each year is critical for meaningful understanding of the temperature regime within the Salmon River.

Continued support by USFWS for the 319H KRIS Project and the commitment of the SRRC through the Subbasin Planning efforts and the Community Restoration Program (CRP) which involves schools and community are vital links to long term success of the recovery efforts and in developing a sense of local responsibility and a stewardship ethic within the Salmon River Watershed.

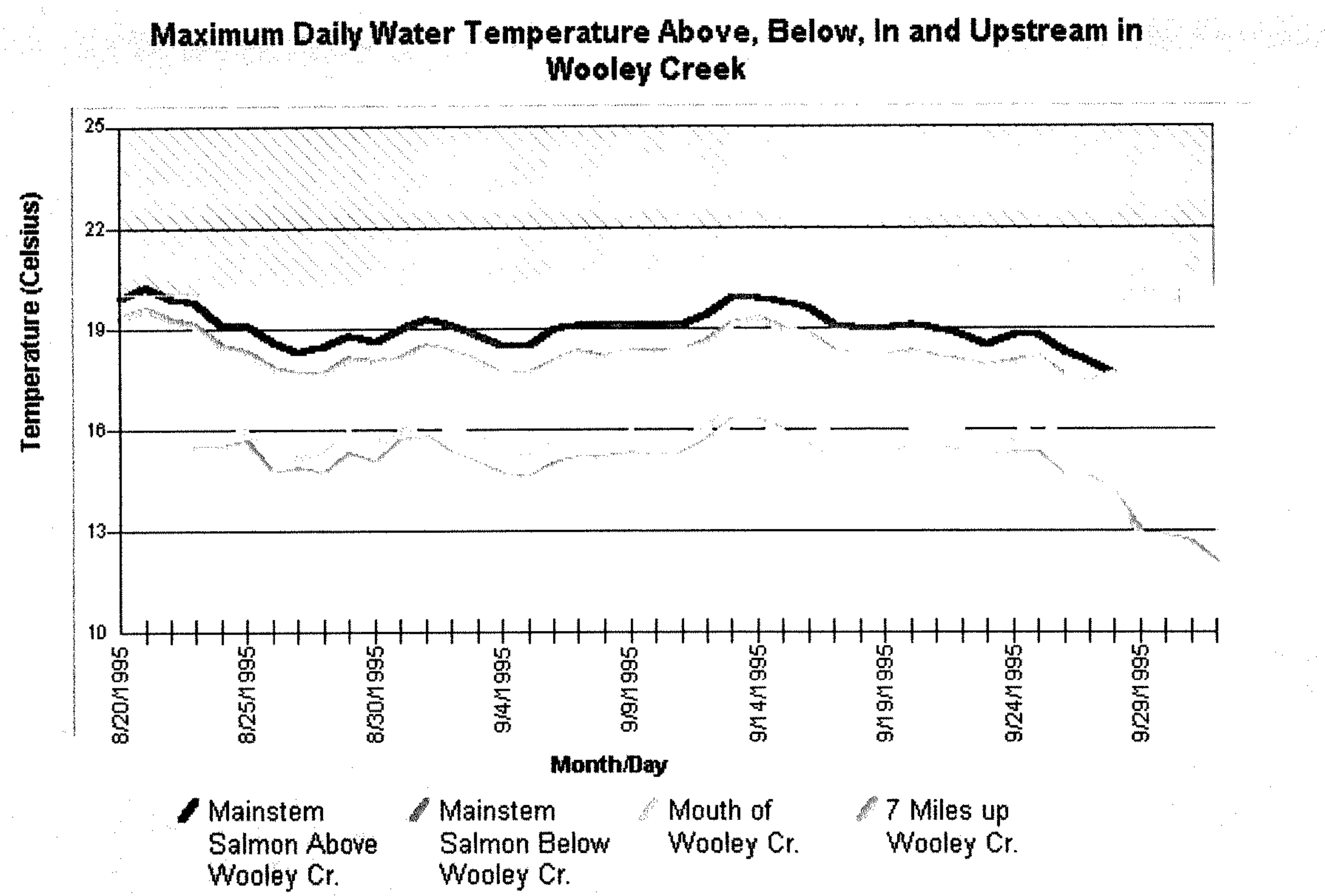
SUMMARY OF EXPENDITURES

Budget Item	Description	Amount
a. Salaries	Jon Lee	$1,811.00
	Sue Terence	$500.00
	SRRC Staff	$2,380.00
	Total Salaries:	$4,691.00
b. Travel	Mileage	$318.00
c. Non-expendable Equipment	Fuji Camera and Film & Quicktake Camera	$1,105.00
e. Operations & Maintenance	office supplies and copying	$300.00
f. General & Administrative Expenses	Overhead	$352.00
	Total Requested:	**$6,766.00**

APPENDIX

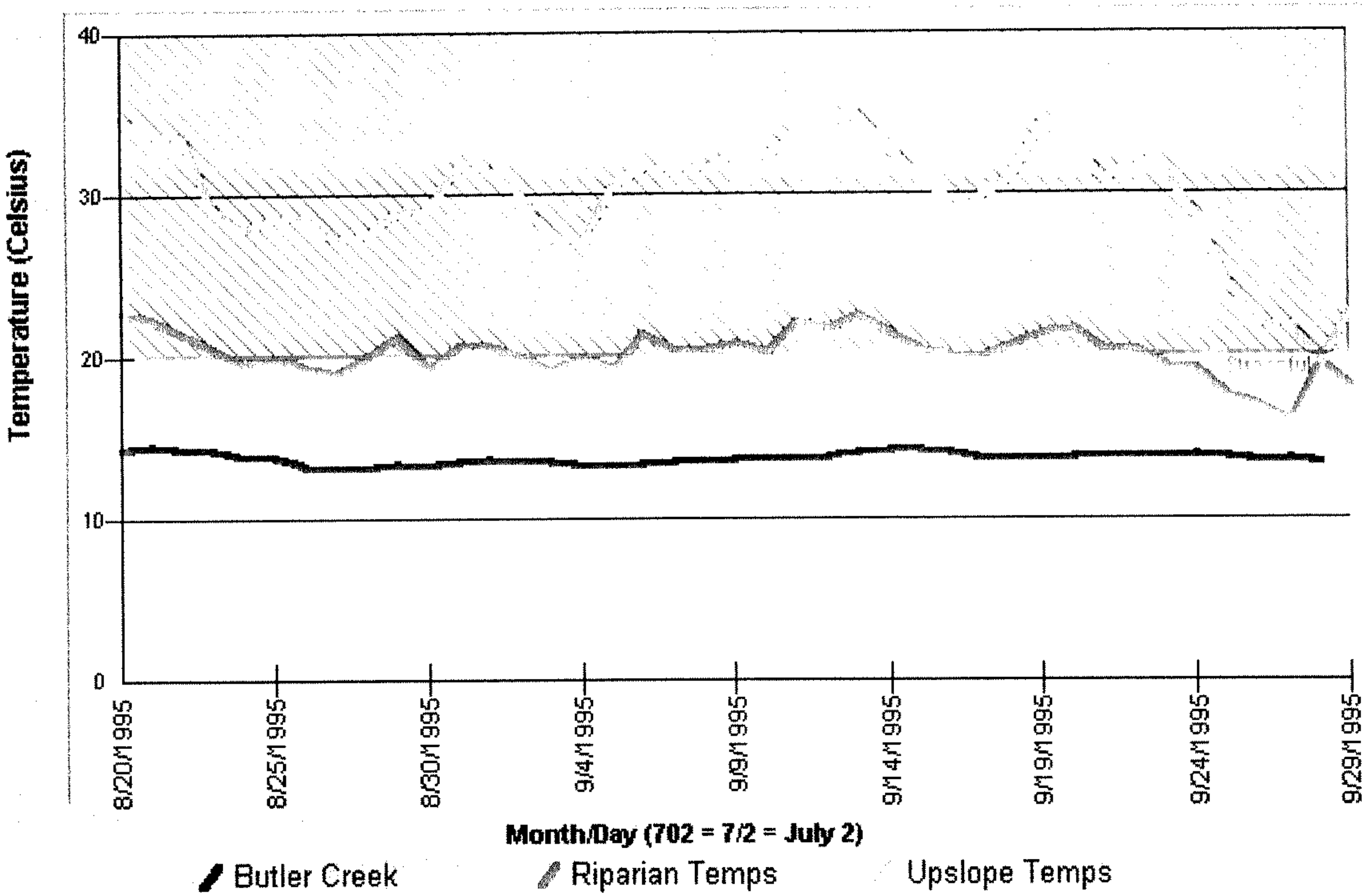


Sample Richness Graph from KRIS System

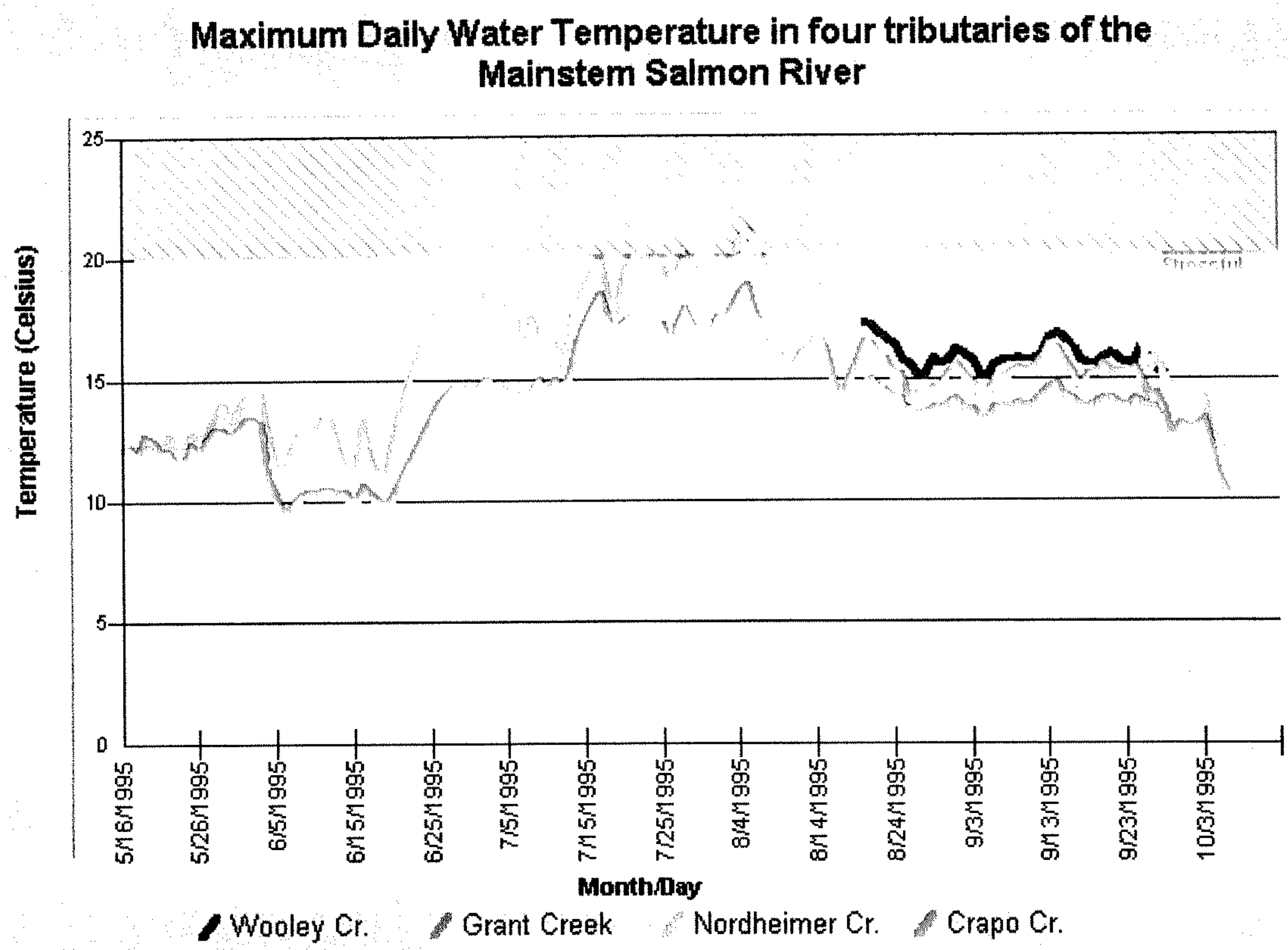


The maximum daily water temperatures during summer of 1995 above, below and in Wooley Creek and 7 miles upstream in Wooley Creek are displayed above. There appears to be a cooling effect from Wooley Creek on the mainstem water temperatures

Maximum Daily Temperature at Butler Cr. in 1995: Creek, Riparian and Upslope



This chart illustrates the maximum daily water temperatures during August and September of 1995 in Butler Creek and the air temperature in the riparian and upslope. Data was collected by students of Forks of Salmon School using Hobo Temp, temperature monitoring devices.



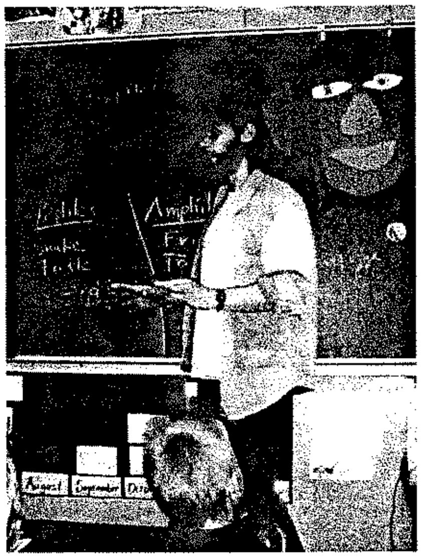
The maximum daily water temperatures during the summer of 1995 are displayed above. Temperature data was collected by students form Forks of Salmon School using Hobo Temp devices. Nordheimer Cr. appears to have the highest temperatures, reaching stressful levels in early August. Grant Cr. is the coolest, then Crapo Cr. and Wooley Cr., respectively.

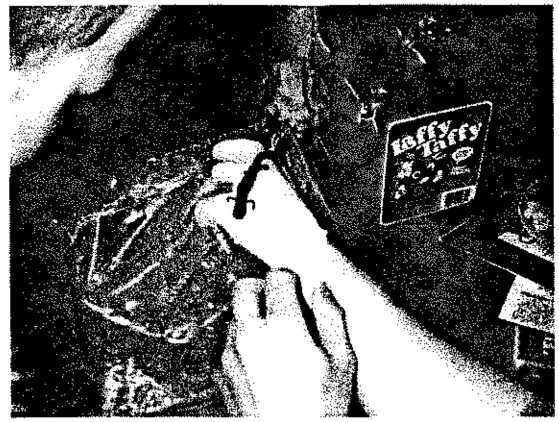
Forks of Salmon School Macroinvertebrate Field Day

1995 Fall Field Trip
Collecting Samples
at Nordheimer Creek

Forks of Salmon School Macroinvertebrate Classroom Training - 1995

Students working
with experts
in Classroom





US Forest Service Geologist, Juan de la Fuente working with Forks Student

Forks of Salmon School Amphibian Field Trip

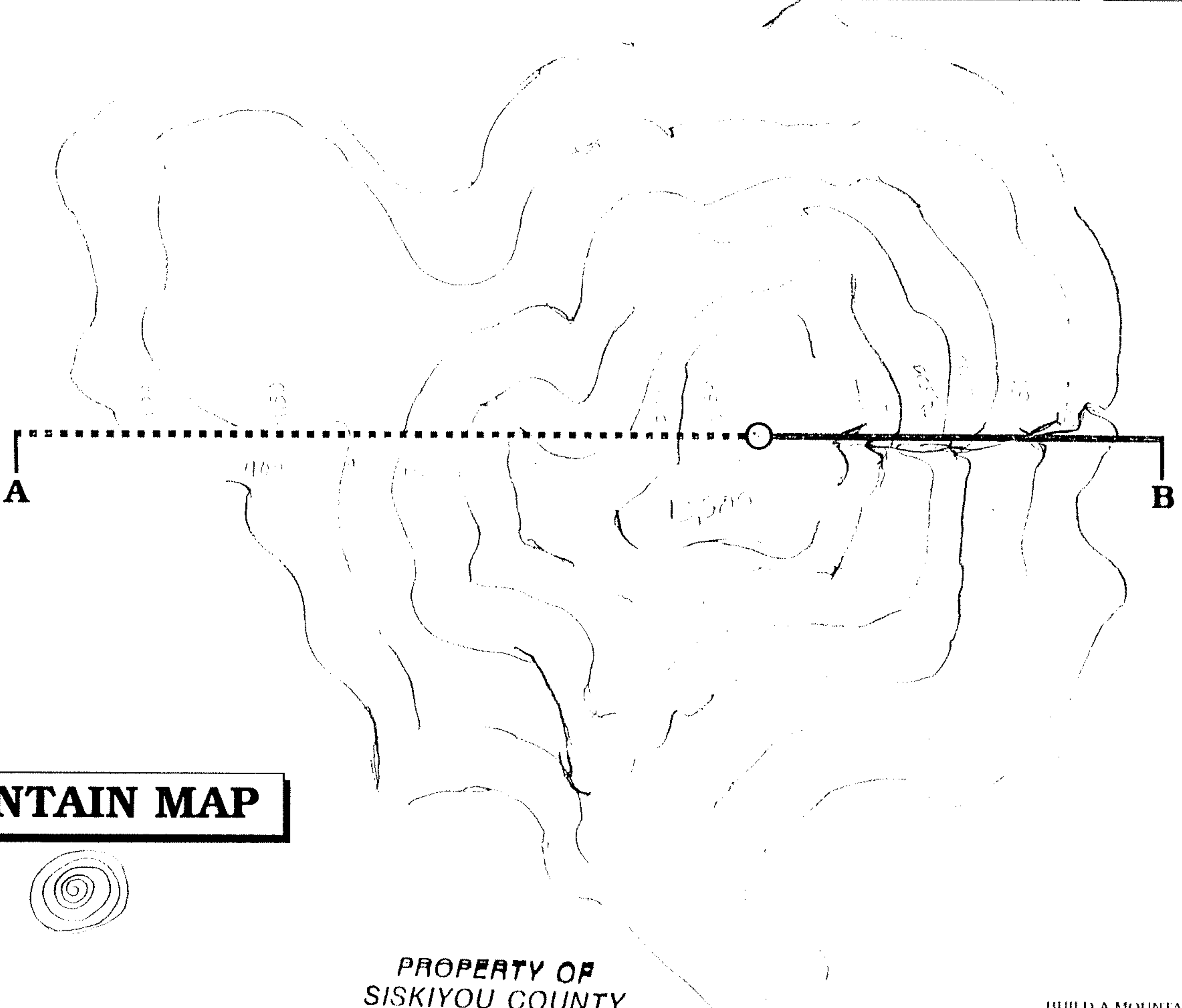
Spring, 1995

LOCATION:

Mainstem Salmon River

Above Crapo Creek

Nai ____________________ Date ____________________

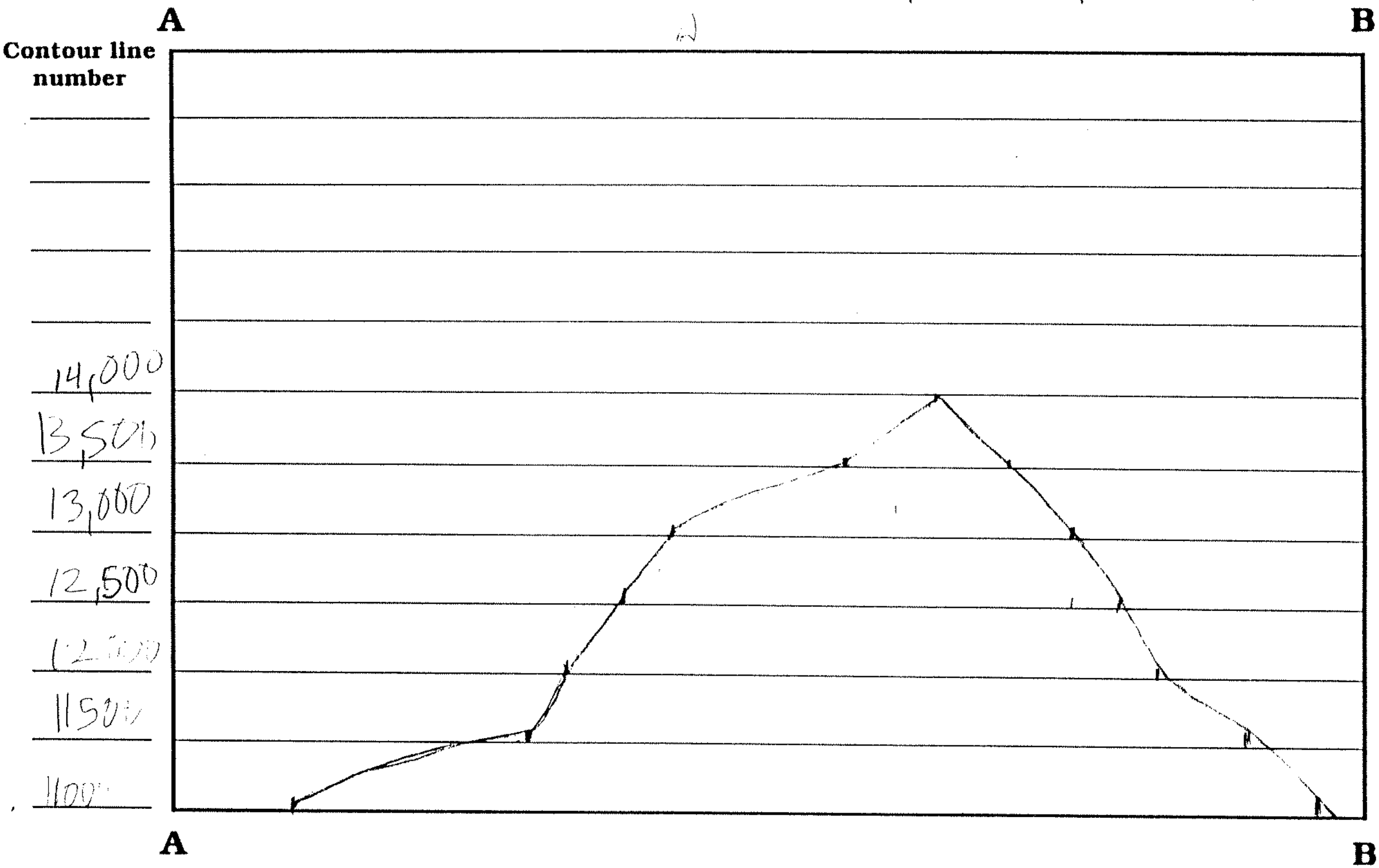


MOUNTAIN MAP

Name

Date

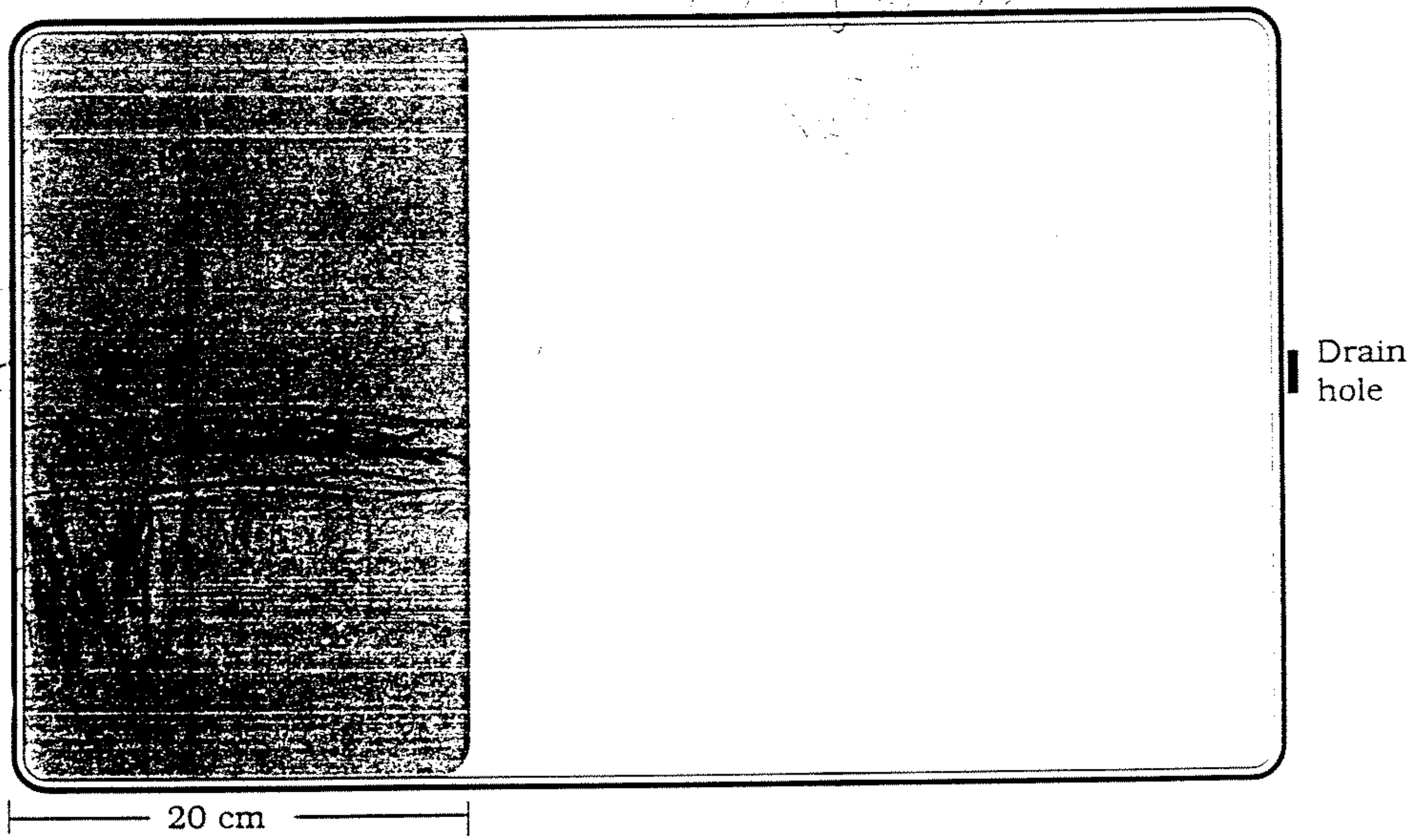
PROFILE Title Iris Mountain



Name Allegra Date 2/8/94

STREAM TABLE MAP

This is an investigation of ~~Alt...~~ Standard condition



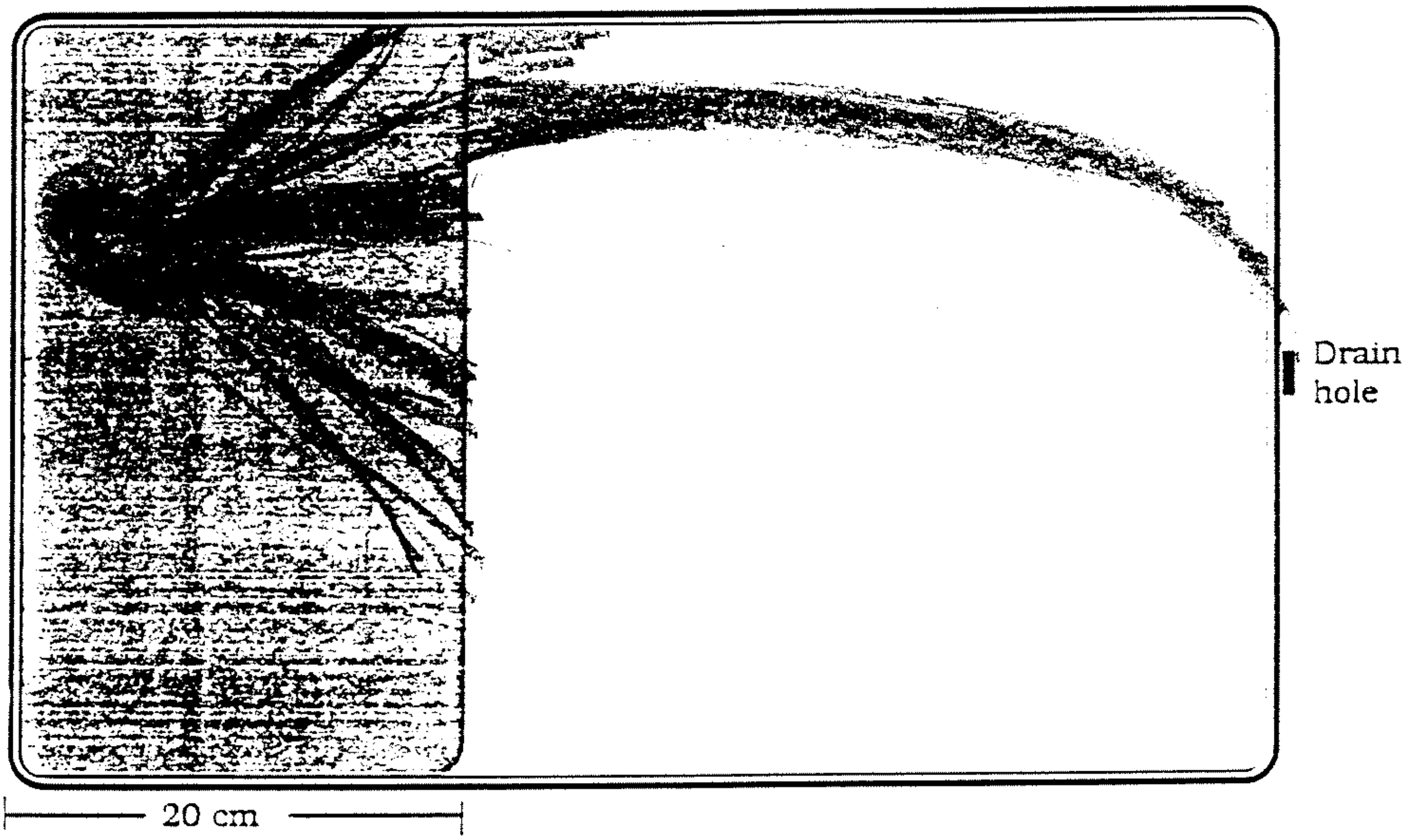
Key	
	Sand/diatomaceous earth mixture
	[redacted]
	Diatomaceous earth
	clean sand

Elapsed time (~~minutes~~ after start)	Important events
3	Pool ~~S~~ made
3	Flooding
31	Delta Forming
45	corosion inchanle
2:20	Chanle completly cut
1:60	Velocity increasin

Name [illegible] Date 3/1/94

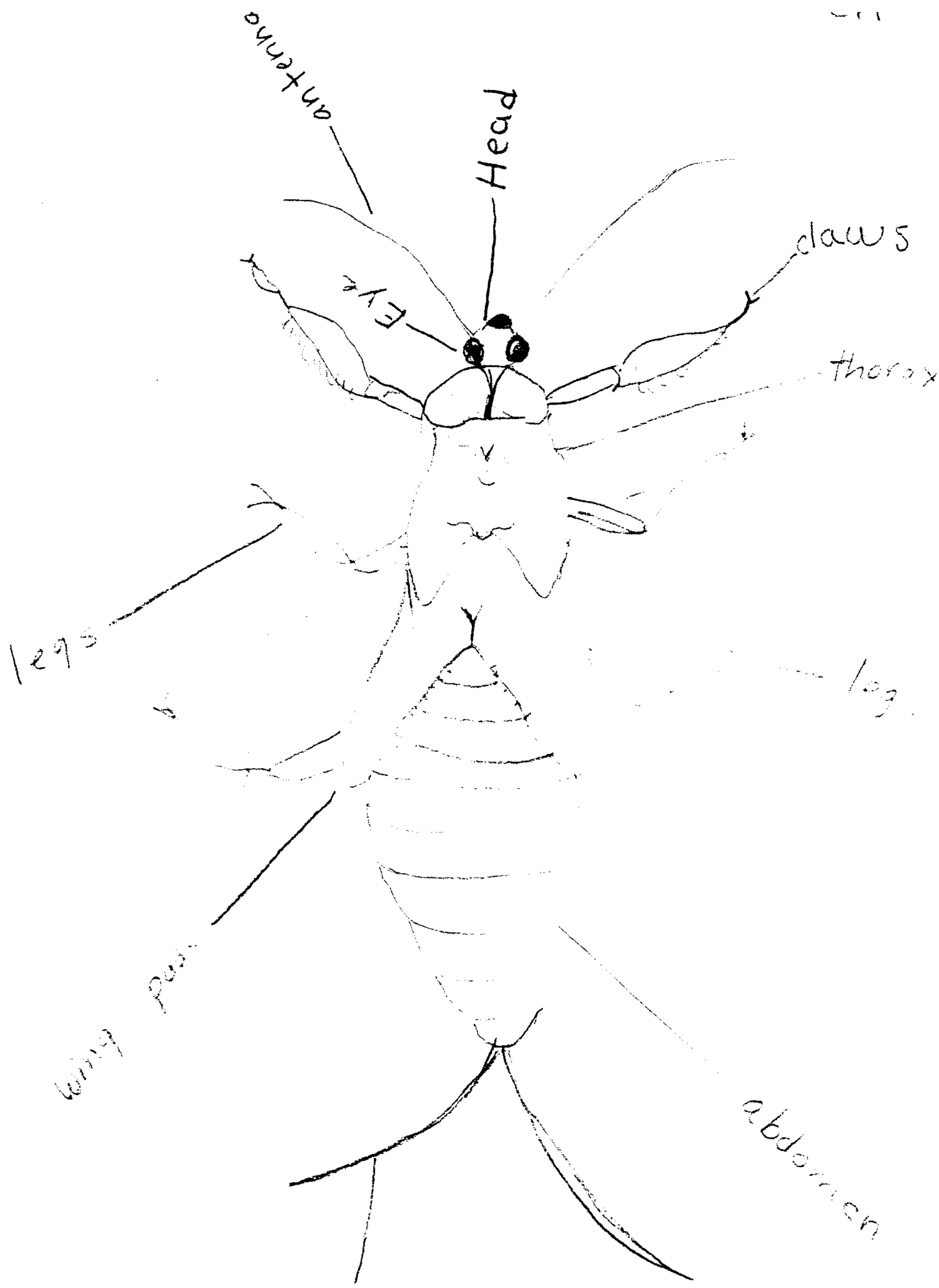
STREAM TABLE MAP

This is an investigation of [illegible] .

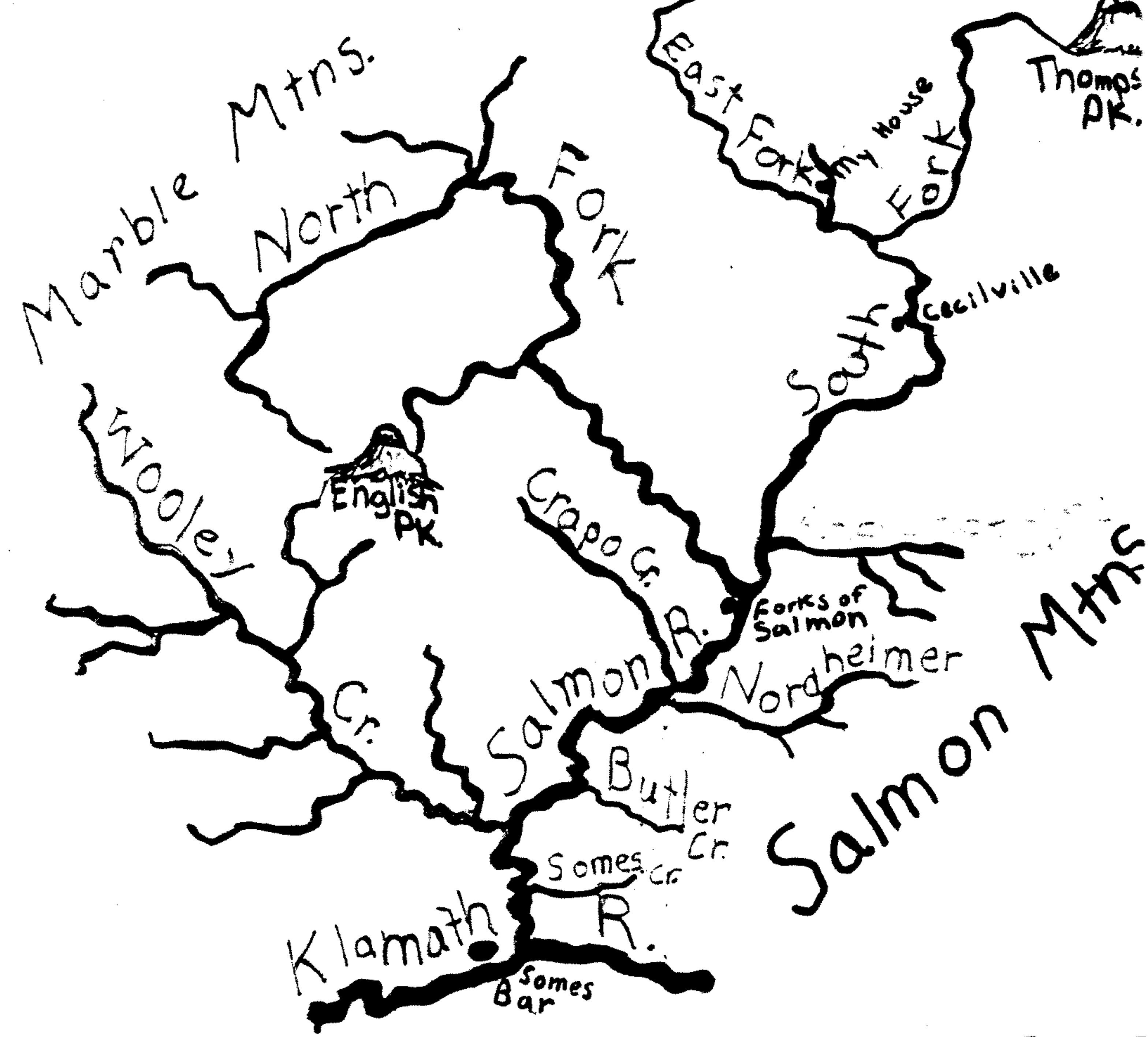


Key	
(sand/diatomaceous earth pattern)	Sand/diatomaceous earth mixture
(sand pattern)	Sand
(blank)	Diatomaceous earth
(dark fill)	Chunk
(pattern)	
(blank)	

Elapsed time (~~minutes~~ sec after start)	Important events
40	Delta [illegible]
3	flooding
35	[illegible]
5	erosion
10	2 main channels
3:20	Water stopped


antenna
Head
claws
Eye
thorax
legs
leg.
abdomen

SALMON-RIVER WATERSHED



OVERVIEW

By August

An Overview Of The Salmon River Watershed

By August Nunes

Published by the Riewerts-Nunes Publishing Company

Watershed Interview With Eric Dittmer,

Water Quality Control Specialist

Josephine Co. - 12 Years

Water goes through creeks, lakes, rivers, and then finally meets the ocean. And we take advantage of it because it's fresh water, and it's hard to get fresh water anytime you want it. And here are some of the different uses of water; electricity, drinking, irrigated agriculture, washing, putting fires out, getting rid of all your wastes. Many treatment plants that treat all the house sewage exit into a river somewhere. So they have to really do alot of work to get that water to where it's good enough to do that. Another use of water is this (Lithia Park) a park where it's a nice place to go and be and recreate. People would like park water clean if they possibly could have it that way. Another use of water is for the habitat of fish and flies and mosquitoes ect.. And all the riparian, which is all the plants and animals within the stream area. The riperian is an ecosystem all to itself.

So there's a bunch of uses of water, and a long time ago people just took that for grantit. In fact people used water for mining. You see it all the time when you see rocks in the river. They took these great big hydrolic hoses, and blasted the hillsides trying to knock the gold out, but they knocked thousands of times more dirt really sad what happened to the streams after mining. And the mining laws are still really old, and allow miners to do alot of not good things to the river.

So you list all the beneficial uses of water and then you realize that many of those uses tend to make the water either less in volume or dirtier. For example if you irrigate agriculture and you put it on crops and you flood irrigate, some of the bad things that might happen are that the water might carry away the fertilizer and the pestisides and the herbasides and it might pollute the river. It could carry away the sediment into the river, and it adds nutrients to the stream. And these nutrients tend to make a stream grow a bunch of algae. and then the green algae and moss at the bottumn of the stream dies and takes away alot of the oxegen in the water. And without oxegen in the water the fish drown.

So when you irrigate, instead of flooding, alot of people are changing to sprinklers. The sprinklers use up less water , and it doesn't tend to run off so much. So when cities and people started out using rivers there was enough water to go around. So they had what are called water rights, which means that the first person to apply for x amount of water got it. and the older the water right the more guarentee they have of having water. But as people move in and the population grows, pretty soon there's not enough water to go around, and people start fighting over it.

The agriculture people say, "We use the most water therefore we should keep the most water." And the people who need water to drink say, "Wait a minute, what's more important us having water to drink or you having water for artichokes?" And the agriculture says, "Well if we didn't grow food you wouldn't eat so drinking doesn't matter." So when there's not enough of something all you get is big fights. So the more people putting more demands on water the more fighting you get. When you have people fighting over it they each want to keep their share of the water and make everyone else take less water.

Now the people who just want water in the stream for the fish say, "The fish have come in last. The fish never filed for any water rights. They're just fish they can't even write." And what happens is that you have water taken out of the stream like this to irrigater a pond or something and less and less water remains in the main stream. Agriculture takes it out, cities take it out, industry takes it out. Alot of times streams are just used to convey water for irrigation. Thats what happened to Bear Creek, its just irrigation water. So we have had to change natural watersheds. Here in this valley (Rogue) we import water from another watershed. In Los Angeles they import water all the way from Colorodo. Incredible! Los Angeles just became bigger and bigger and then there demand for water was so great that they had to import water from all over including from Northern California and the Colorado River. If you want to get into some really major fights you just watch people fight over water.

Now in your watershed one of the big things they do is log. When they clearcut, the tree roots are gone and the dirt is totally exposed. So when it rains the sediment is washed down into the water. Alot of times for some reason the clearcuts never get replanted. This big scar just stays on the hillside. I think we have taken advantage of trees the way we have taken advantage of water. Another result of clearcutting close to streams or rivers is that the water gets hotter because it doesn't get as much shade. When you couple this factor with say a drought the water can get so hot the fish can't survive. Salmon and Trout can't live in water thats more than 75 degrees.

Here in Ashland there is a battle going on over this creek we are walking on, Ashland Creek.
It is part of Ashland's water supply and they want to keep it clean. They have to store it and so there is a big reservoir about five miles up the creek. Sediment that comes down the stream above the reservoir fills the reservoir, so they have to clean the reservoir once in a while. So they drain it and hit it with fire hoses. They can't dredge it or truck it out because it's so hard to truck it out, it would be like six-hundred truck loads. So they have to spray the sediment down the river because it's too hard to truck it out. But that gets everybody mad. So the city of Ashland gets in an uproar about what to do with

their own water supply. And the people who want fish in the streams say one thing, and the people who want to drink water in Ashland say another.

One of the water problems we have here in Ashland is not just water quality, but water quantity as well. When you have a drought like we've had for the last eight years, whatever pollution that might be coming in from agriculture or cities or failing septic systems of natural runoff is concentrated because there is less water. So it gets people all upset because not only do they have inadequate water quanity, the water they have is dirty. That's simply a factor of having less solution in the stream. The water quality in Bear Creek went down for the first time this last couple of years because of the drought. Now it's getting better because we've had a wetter winter.

One of the things you can do to solve your watershead problems is to get people to work together and that's hard. But you have to get them together to talk about why they think the watershead is important and how they use water. If there's not enough to go around you need to make them realize that one of the best things to do is make them all equally unhappy. Because if someone's happy it is because they gor more than their share of the limited water suppply. So you have to compromise. People need to recognize the fact that that needs to be done. What you don't realize is what happens to growth. At what point do you allow people to come into where you live and use up all the water so that it's dirty and you can't clean it. It changes your life and that could happen here. We have people moving into this valley (Rogue Valley) that could turn it into San Jose. You can't stop people from moving in, but at some point they move in and there is not enough water to go around.

Also when you have lower amounts of water due to a drought the remaing water in the stream gets hotter. If you have clear-cutting along the riverbed, the shade from the trees is less around the stream and the stream gets hotter. The fish can't live in it because salmon and trout can't live in water that's more than 75 degrees farenheit. The result is a need to put water back in the stream but the people who take the water out of the stream don't want to do that because it's their water. They don't realize they need to conserve. If you conserve you can save lots of water.

Some of the agricultural firms here have built big ponds at the lower end of their fields and all the water runoff goes into the ponds and then when they need water again they pump out of that pond. Therefore, they can use the water more than once and the pond acts as a sediment sink. Finally, there are other people trying to work on treatment systems which allow for cities to have marshes. Marshes tend to clean water of lots of stuff. It's also realatively cheap.

Transcribed by August Nunes & Company
(Rocky Riewerts)

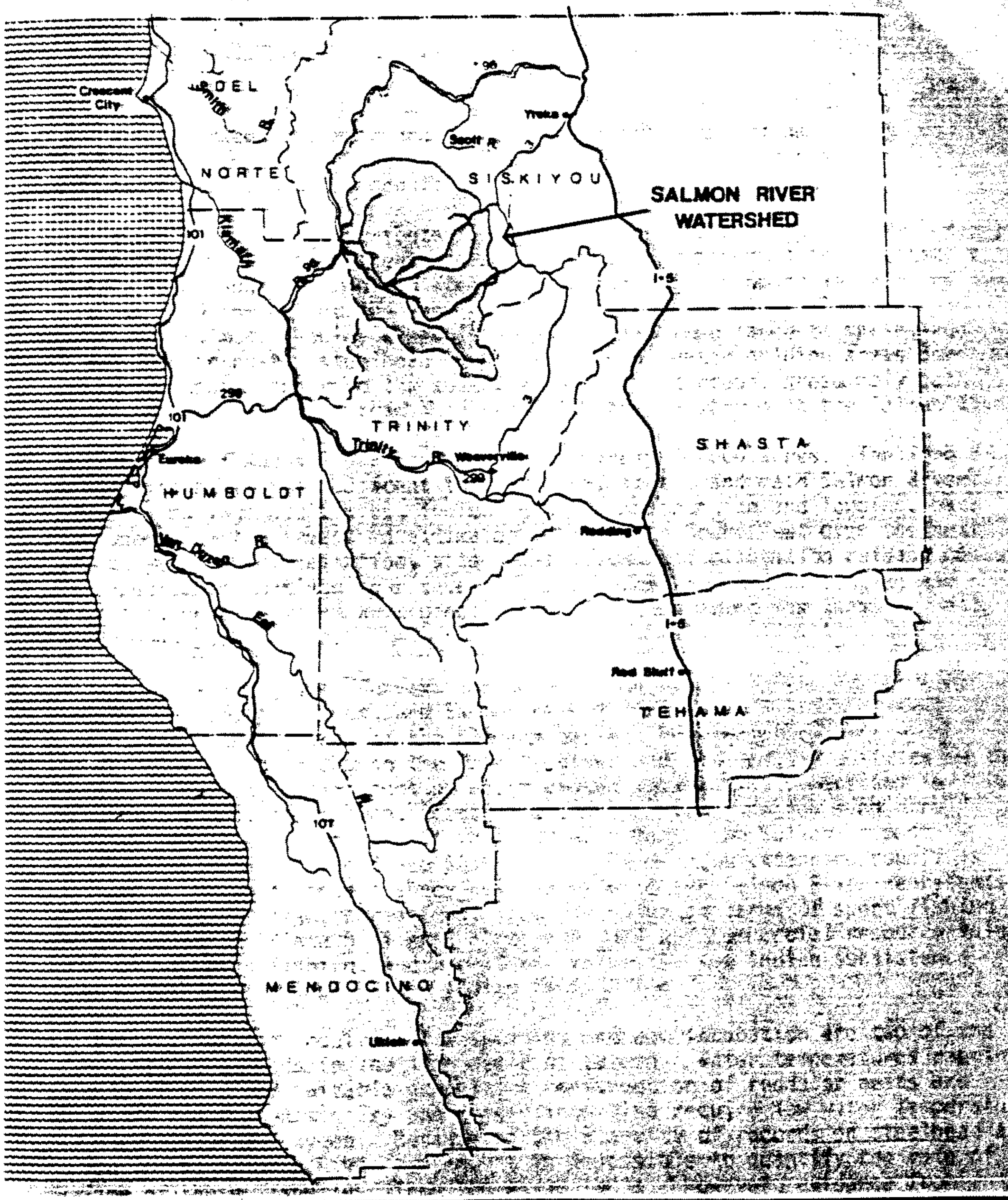


EXHIBIT A
REGIONAL SETTING

SEDWAY/COOKE
Environmental Planning Consultants

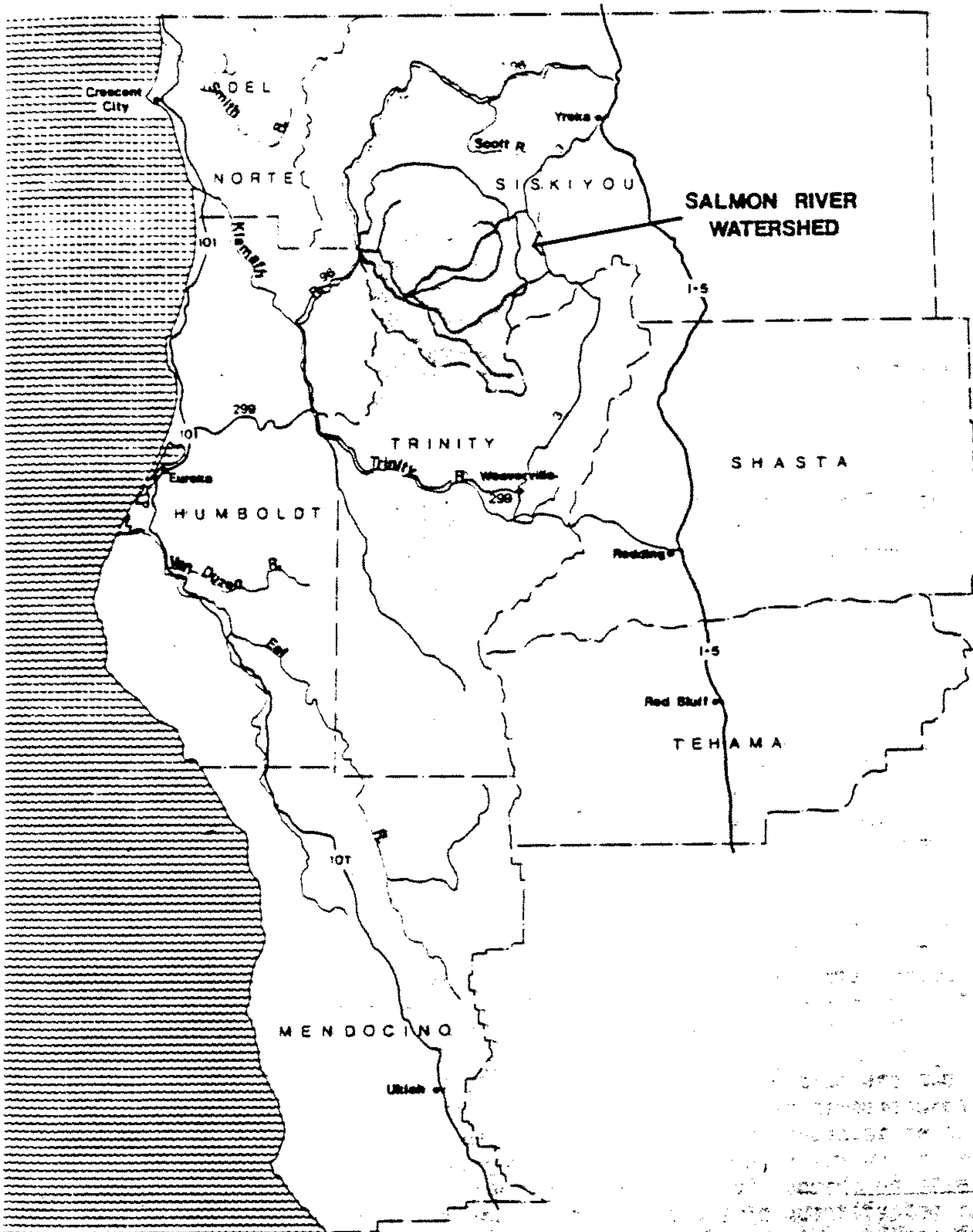


EXHIBIT A
REGIONAL SETTING

SEDWAY/COOKE
Environmental Planning
Consultants

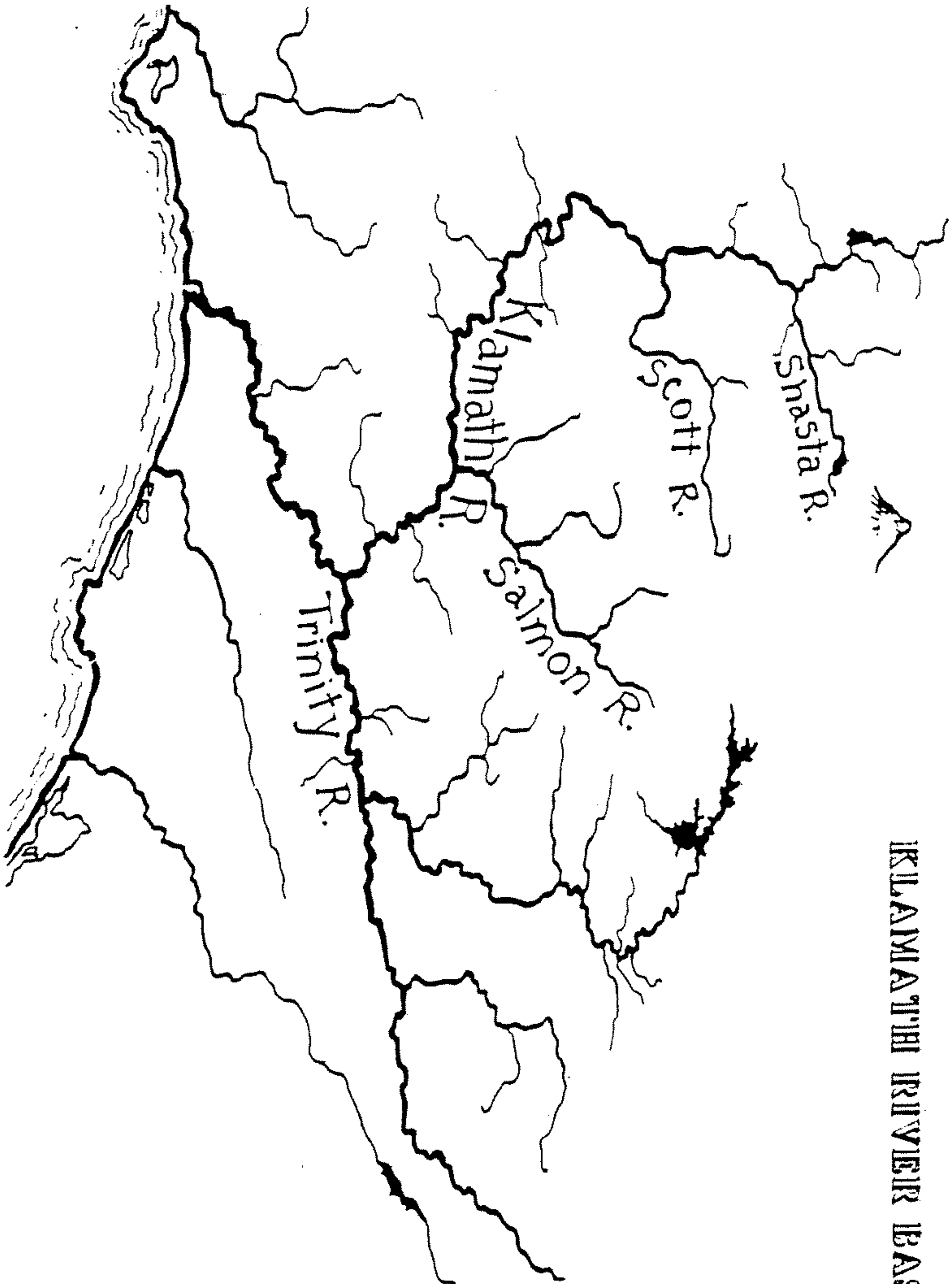
August & Allegra
E.C.

words spelled by the letters in

Watershed-Notes

1. rat 2. rate 3. tear 4. she 5. tar 6. war 7. wars
8. rats 9. rates 10. her 11. her's 12. he 13. he's 14. he'd 15. she
16. she'd 17. she's 18. heat 19. heated 20. heats 21. tear
22. tears 23. tore 24. torn 25. eat 26. eats 27. ate 28. read
29. reads 30. reed 31. reeds 32. red 33. wed 34. ted 35. wet
36. wets 37. weed 38. weeds 39. what 40. hare 41. hares
42. steer 43. tree 44. trees 45. steers 46. head 47. heads
48. date 49. dates 50. stew 51. snot 52. not 53. no 54. sat
55. set 56. sets 57. sheet 58. sheets 59. shat 60. tad 61. water
62. waters 63. star 64. stars 65. saw 66. was 67. heard 68. herd
69. herds 70. hear 71. trade 72. trades 73. note 74. shed 75. tone
76. seed 77. seeds 78. rash 79. rashes 80. are 81. oar 82. ore
83. oars 84. ores 85. oat 86. oats 87. toe 88. toes 89. toad 90. two
91. to 92. two's 93. stead 94. steads 95. street 96. streets 97. need
98. needs 99. on 100. one 101. hate 102. hates 103. hated 104. hat
105. hats 106. the 107. nat 108. nats 109. does 110. doesn't 111. de
112. see 113. sea 114. seas 115. seer 116. ear 117. ears 118. were
119. wear 120. now 121. nod 122. nods 123. shed 124. sheds.
125. at 126. watt 127. watts 128. and 129. an 130. wade 131. wades
132. has 133. had 134. as 135. erase 136. erases 137. erased
138. dear 139. deer 140. shear 141. sheer 142. nest 143. net 144. nes
145. tea 146. teas 147. tee 148. tees 149. rent 150. rented 151. wren
152. wrens 153. wash 154. washes 155. washed 156. who 157. who's
158. when 159. went 160. test 161. west 162. road 163. roads 164. rest
165. rode 166. rested 167. rests 168. saw 169. new 170. news 171. newe
172. newest 173. dot 174. dots 175. ash 176. wad 177. wads 178. own
179. owns 180. word 181. words 182. owned 183. owner 184. ant
185. ants 186. dash 187. wheat 188. wheats 189. stone 190. stones
191. ton 192. tons 193. seat 194. seats 195. shot 196. shots
197. shoe 198. shoes 199. sent 200. hot 201. treat 202. trend
203. trends 204. sweat 205. swatted 206. swatter 207.

KLAMATH RIVER BASIN



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II. *Interview With Eric Ditmer* - Published by The Riewerts-Nunes Publishing Company - Written by August Nunes - pages 1-6

III. *Salmon River Waterway Management Plan* - Published and Written by - State of California Resources Agency Department of Fish and Game - Lightly skimmed pages 1-60

IV. *The Audubon Society Field Guide to North American Wildflowers Western Region* - Published by Alfred Knopf - Written by Richard Spellenberg - pages - 485, 353, & 47

Macroinvertebrate Report on Salmon River Streams
by
Jon Lee

1995

Primary metrics:

1. taxa richness (total number of taxa). Taxa richness generally decreases with increased disturbance.
2. EPT index (total number of Ephemeroptera, Plecoptera and Trichoptera taxa). The majority of taxa in these three orders are sensitive to habitat degradation.
3. percent contribution of the dominant taxon. A high percent contribution of the dominant taxon suggests a stressed environment.
4. diversity index (Simpson's Diversity Index (1949)). Based on taxa richness and evenness. A low score suggests a lack of community balance.
5. modified Hilsenhoff Biotic Index (regionally modified from Hilsenhoff (1982)). Assigns pollution tolerance values to taxa. Needs further modification for Northern California.

A community similarity index is also suggested however this index requires a reference stream for comparison. A reference stream was not selected within the Salmon River watershed. Determining whether a metric value indicates an impaired stream habitat is an iterative process (Fore et al., 1996), particularly without a reference stream for comparison. As more work is performed with the Rapid Bioassessment Protocol on Northern California streams and more data is gathered metric values should have greater precision in assessing impact. That being said the following qualitative ranges will be considered (ranges based on impact compared with theoretically undisturbed conditions):

1. taxa richness: >40 =low impact ; 25-39=moderate ; <25=high
2. EPT index: >25=low impact; 15-25=moderate; <15=high
3. % dominant taxa (from Plafkin, 1989): <20%=non impaired; 20-30% =slightly impaired; 30-40%=moderately impaired; >40%=greatly impaired.
4. Simpson's Diversity Index: 0. 9=low impact; 0.8-.8999=moderate; <0.8=high
5. modified Hilsenhoff Index: <1.75=low impact; 1.75-2.5=moderate; >2.5=high

Somes, Grant and McNeil are small creeks (I believe 2nd order) and this is reflected in the taxa composition. They generally will have lower taxa richness (inherent in headwater type streams - reduced habitat variability) but display many intolerant taxa. This should be reflected in the modified Hilsenhoff Biotic Index. Examples of intolerant taxa found in these creeks include: *Caudatella, Drunella doddsi, Drunella spinifera,* Leuctridae, Peltoperlidae, *Zapada columbiana, Kathroperla, Doroneuria, Chernokrilus, Parapsyche, Dolophilodes, Himalopsyche, Rhyacophila,* and *Anchycteis.* A disturbed watershed would show reduced taxa richness and a reduced number of intolerant taxa.

It should be noted that Somes Creek appeared to have been dredge mined prior to the sampling date. Many areas looked disturbed (bare cobble and gravel, periphyton had been removed). This is suggested by the high number of the Diptera family Chironomidae in the sample. Chironomids could quickly start recolonizing a disturbed site. The high number of chironomids contributed to elevated Modified Hilsenhoff values and decreased Diversity values.

Butler, Crapo and Nordheimer Creeks are comparable as 3rd or 4th order streams. A look at the metrics suggests Butler to be in the best shape of the three. The primary metrics used are all "better" for Butler than for Crapo or Nordheimer. Butler also displays a large number of intolerant taxa: *Caudatella, Drunella doddsi, Drunella spinifera, Epeorus (Ironopsis),* Leuctridae, Peltoperlidae, *Visoka, Zapada columbiana, Doroneuria, Kathroperla, Chernokrilus, Parapsyche, Dolophilodes*, and *Rhyacophila*. Many of these taxa are indicative of cold, highly oxygenated headwater streams.

The V-30-95 Butler creek sample metrics suggest a more disturbed condition than the fall samples indicate. The collecting took place late in the spring collecting season after many of the adult insects had emerged. A high number of the mayfly genus *Baetis* were collected which led to higher biotic index and lower diversity index values. This may be a result of the opportunistic nature of this critter taking advantage of a resource. Spring collecting should generally take place from late March to early May.

The metrics suggest Crapo Creek to be less disturbed than Nordheimer Creek. Of note is the comparison of the Modified Hilsenhoff Index between the two. Nordheimer is higher suggesting a greater number of tolerant taxa. It is of interest to note a high number of *Hydropsyche* and *Simulium*, and the presence of *Cheumatopsyche*. All three genera are filtering-collectors and moderately tolerant (*Cheumatopsyche* more tolerant) of degraded conditions including elevated temperatures. Increased sunlight on Nordheimer may have increased temperatures and primary production resulting in a higher amount of algae and Fine Particulate Organic Matter (FPOM) as a food source. Also of interest was the collection of a Tailed Frog tadpole at Nordheimer (suggesting tolerance to elevated temperatures ?).

Crapo Creek displays a high percent dominant taxa, however for two of the samples the dominant taxa is *Rhithrogena*, a moderately intolerant mayfly. Crapo does not display a large number of warm water tolerant taxa but does show signs of imbalance (high percent dominant taxa, low EPT richness, low diversity index). This suggests a non-temperature related stress.

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Plafkin, J.L., M.T. Barbour, K.D. Porter, S.K. Gross, and R.M. Hughes. 1989. Rapid Bioassessment Protocols for Use in Streams and Rivers: Benthic Macroinvertebrates and Fish. EPA 444/4-89/001. U.S. Environmental Protection Agency, Washington D.C.

Simpson, E.H. 1949. Measurement of diversity. Nature. 163:688.

Metric values for benthic samples collected X-18-94 from Grant, Somes and Butler Creeks (single samples).

METRIC	GRANT	SOMES	BUTLER
Taxa Richness	32	37	51
Simpson Diversity Index	.9258	.9029	.9589
Ephemeroptera, Plecoptera, Trichoptera Richness	15	21	30
% Dominant Taxa	21	19.3	8.7
Modified Hilsenhoff Index	1.51	1.95	1.35

Metric values for benthic samples collected V-30-95 from Butler and Grant Creeks.

METRIC	BUTLER SAMPLE # 1	2	3	MEAN	GRANT (single sample)
Taxa Richness	45	46	38	**43.0**	38
Simpson Diversity Index	.821	.8654	.8171	**.8345**	.9232
Ephemeroptera, Plecoptera, Trichoptera Richness	24	28	26	**26**	24
% Dominant Taxa	39.7	33.7	40.7	**38.0**	16.0
Modified Hilsenhoff Index	1.95	1.97	2.01	**1.98**	1.15

Metric values for benthic samples collected X-16-95 from Butler and McNeil Creeks.

METRIC	BUTLER SAMPLE # 1	2	3	MEAN	McNEIL SAMPLE# 1	2	3	MEAN
Taxa Richness	40	50	47	**45.7**	38	42	48	**42.7**
Simpson Diversity Index	.9326	.9426	.9436	**.9396**	.9223	.9357	.9604	**.9395**
Ephemeroptera, Plecoptera, Trichoptera Richness	22	26	27	**25**	23	24	26	**24.3**
% Dominant Taxa	13.3	13.7	13.2	**13.4**	21.0	13.7	7.7	**14.1**
Modified Hilsenhoff Index	1.69	1.41	1.67	**1.59**	1.48	1.15	1.26	**1.30**

Metric values for benthic samples collected X-16-95 from Crapo and Nordheimer Creeks.

METRIC	CRAPO SAMPLE # 1	2	3	MEAN	NORDHEIMER SAMPLE# 1	2	3	MEAN
Taxa Richness	38	38	37	**37.7**	36	25	32	**31.0**
Simpson Diversity Index	.7759	.8382	.9056	**.8389**	.8030	.7256	.8918	**.8068**
Ephemeroptera, Plecoptera, Trichoptera Richness	17	17	20	**18**	18	12	18	**16**
% Dominant Taxa	41.0	32.8	24.7	**32.8**	40.6	48.7	20.0	**36.4**
Modified Hilsenhoff Index	1.69	1.68	1.80	**1.72**	2.23	2.0	1.96	**2.06**

SOMES CREEK X-18-94

	# Specimens
Ephemeroptera	
Ameletidae	
Ameletus	1
Baetidae	
Baetis	28
Ephemerellidae	
Caudatella hystrix	2
Heptageniidae	
Ironodes	4
Rhithrogena	1
Plecoptera	
Capniidae	1
Nemouridae	
Malenka	1
Zapada columbiana	2
Z. oregonensis gp.	1
Peltoperlidae	
Yoraperla	8
Perlidae	
Hesperoperla pacifica	3
Perlodidae	
Isoperla	1
Pteronarcyidae	
Pteronarcys	1
Trichoptera	
Brachycentridae	
Micrasema	2
Hydropsychidae	
Arctopsyche	1
Hydroptilidae	
Hydroptila	4
Lepidostomatidae	
Lepidostoma	4
Philopotamidae	
Dolophilodes	3
Wormaldia	1
Rhyacophilidae	
Himalopsyche phryganea	1
Rhyacophila	8

SOMES CREEK X-18-94

	# Specimens
Coleoptera	
Elmidae	
Ampumixis dispar	11
Heterlimnius	3
Psephenidae	
Eubrianax edwardsi	1
Odonata	
Gomphidae	
Octogomphus	1
Diptera	
Chironomidae	
Chironominae	
Tanytarsini	50
Orthocladiinae	5
Brillia	5
Corynoneura	10
Cricotopus/Orthocladius	36
Eukiefferiella	58
Parametriocnemus	7
Tvetenia	18
Dixidae	
Dixa	1
Empididae	
Chelifera	1
Simuliidae	
Simulium	14
Tipulidae	
Limonia	1

BUTLER CREEK X-18-94

	# Specimens
Ephemeroptera	
Ameletidae	
Ameletus	4
Baetidae	
Baetis	11
Ephemerellidae	
Drunella doddsi	1
D. spinifera	3
Ephemerella inermis	4
Heptageniidae	
Ironodes	26
Rhithrogena	9
Leptophlebiidae	
Paraleptophlebia	4
Plecoptera	
Capniidae	3
Chloroperlidae	
Kathroperla perdita	2
Sweltsa	2
Leuctridae	
Moselia infuscata	2
Nemouridae	
Malenka	9
Peltoperlidae	
Sierraperla cora	1
Soliperla	1
Yoraperla	3
Perlidae	
Calineuria californica	19
Doroneuria baumanni	2
Hesperoperla pacifica	6
Perlodidae	
Isoperla	3
Chernokrilus	1
Pteronarcyidae	
Pteronarcys	2
Trichoptera	
Brachycentridae	
Micrasema	24

BUTLER CREEK X-18-94

	# Specimens
Trichoptera (cont.)	
Calamoceratidae	
Heteroplectron californicum	1
Glossosomatidae	
Glossosoma	1
Hydropsychidae	
Parapsyche	5
Hydropsyche	9
Lepidostomatidae	
Lepidostoma	4
Philopotamidae	
Dolophilodes	1
Rhyacophilidae	
Rhyacophila	18
Coleoptera	
Elmidae	
Ampumixis dispar	3
Narpus	2
Ordobrevia nubifera	8
Megaloptera	
Corydalidae	
Orohermes crepusculus	2
Diptera	
Chironomidae	
Chironominae	
Tanytarsini	1
Diamesinae	1
Orthocladiinae	
Brillia	24
Corynoneura	6
Cricotopus/Orthocladius	17
Eukiefferiella	5
Parametriocnemus	13
Symposiocladius lignicola	3
Thienemanniella	12
Tvetenia	1
Tanypodinae	1
Dixidae	
Dixa	2

BUTLER CREEK X-18-94

	# Specimens
Diptera (cont.)	
Empididae	
Chelifera	3
Pelecorhynchidae	
Glutops	1
Simuliidae	
Simulium	12
Tipulidae	
Dicranota	1
Hexatoma	1

GRANT CREEK X-18-94

	# Specimens
Ephemeroptera	
Ameletidae	
Ameletus	2
Baetidae	
Baetis	1
Ephemerellidae	
Ephemerella inermis	1
Heptageniidae	
Cinygma	4
Ironodes	1
Leptophlebiidae	
Paraleptophlebia	29
Plecoptera	
Chloroperlidae	
Kathroperla perdita	1
Sweltsa	6
Leuctridae	
Despaxia augusta	4
Moselia infuscata	3
Nemouridae	
Zapada oregonensis gp.	1
Trichoptera	
Calamoceratidae	
Heteroplectron californicum	13
Philopotamidae	
Dolophilodes	1
Polycentropidae	
Polycentropus	6
Rhyacophilidae	
Rhyacophila	5
Coleoptera	
Elmidae	
Lara	1
Psephenidae	
Eubrianax edwardsi	2
Ptilodactylidae	
Anchycteis velutina	1

GRANT CREEK X-18-94	# Specimens
Odonata	
Gomphidae	
Octogomphus	2
Diptera	
Ceratopogonidae	1
Chironomidae	
Chironominae	
Tanytarsini	3
Orthocladiinae	
Brillia	2
Corynoneura	4
Cricotopus/Orthocladius	11
Eukiefferiella	2
Parametriocnemus	11
Thienemanniella	1
Tvetenia	1
Tanypodinae	7
Dixidae	
Dixa	4
Simuliidae	
Simulium	2
Isopoda	
Gammaridae	5

BUTLER CREEK V-30-95

	SAMPLE 1	2	3
Ephemeroptera			
Ameletidae			
Ameletus	5	15	13
Baetidae			
Baetis	119	101	124
Ephemerellidae			
Caudatella edmundsi	---	---	1
C.heterocaudata	6	1	3
C. hystrix	1	2	1
Drunella doddsi	---	1	---
D. flavilinea	5	2	4
Ephemerella aurivillii	1	---	---
E.inermis	---	5	2
Serratella teresa	6	10	26
S. tibialis	3	7	6
Heptageniidae			
Cinygma	---	1	1
Cinygmula	5	5	8
Epeorus (Iron)	12	4	3
Ironodes	---	3	---
Leptophlebiidae			
Paraleptophlebia	9	1	7
Plecoptera			
Chloroperlidae			
Alloperla	1	---	---
Sweltsa	5	4	2
Leuctridae			
Despaxia augusta	1	1	---
Nemouridae			
Malenka	2	---	2
Peltoperlidae			
Sierraperla cora	---	3	---
Yoraperla	2	1	2
Perlidae			
Calineuria californica	1	12	3
Doroneuria baumanni	2	1	---
Hesperoperla pacifica	---	1	---
Trichoptera			
Brachycentridae			
Micrasema	---	---	8

BUTLER CREEK V-30-95

	SAMPLE		
	1	**2**	**3**
Trichoptera (cont.)			
Calamoceratidae			
Heteroplectron californicum	---	---	2
Glossosomatidae			
Glossosoma	1	---	1
Hydropsychidae			
Hydropsyche	4	4	3
Parapsyche	---	1	2
Lepidostomatidae			
Lepidostoma	3	3	5
Philopotamidae			
Dolophilodes	---	1	2
Rhyacophilidae			
Rhyacophila	7	6	4
Sericostomatidae			
Gumaga	1	3	3
Uenoidae			
Neophylax	1	1	---
Coleoptera			
Elmidae			
Ampumixis dispar	1	3	---
Heterlimnius	2	1	2
Narpus	6	---	---
Optioservus	---	1	---
Ordobrevia nubifera	35	22	14
Zaitzevia parvula	1	2	---
Psephenidae			
Eubrianax edwardsi	4	4	2
Megaloptera			
Corydalidae			
Orohermes	2	---	1
Odonata			
Gomphidae			
Octogomphus	---	2	---
Diptera			
Ceratopogonidae	2	1	2

BUTLER CREEK V-30-95

	SAMPLE		
	1	**2**	**3**
Diptera (cont.)			
Chironomidae			
Chironominae			
Chironomini	1	---	---
Microtendipes	3	---	---
Polypedilum	1	---	---
Tanytarsini	---	3	3
Orthocladiinae	1	25	7
Brillia	---	9	4
Corynoneura	1	2	---
Cricotopus/Orthocladius	2	---	---
Eukiefferiella	1	---	---
Krenosmittia	2	---	---
Nostococladius	---	---	12
Tvetenia	---	1	---
Tanypodinae	1	1	---
Empididae	---	3	---
Chelifera	1	---	---
Clinocera	---	1	---
Tipulidae			
Antocha	1	3	2
Hexatoma II	20	15	17
Amphipoda			
Crangomyctidae			
Stygobromus	9	---	1

GRANT CREEK V-30-95

Taxon	# Specimens
Ephemeroptera	
Ameletidae	
Ameletus	7
Baetidae	
Baetis	45
Ephemerellidae	
Drunella flavilinea	2
Serratella teresa	6
Heptageniidae	
Cinygma	12
Ironodes	8
Leptophlebiidae	
Paraleptophlebia	48
Plecoptera	
Chloroperlidae	
Kathroperla perdita	2
Sweltsa	29
Leuctridae	
Despaxia augusta	6
Moselia infuscata	13
Nemouridae	
Malenka	8
Peltoperlidae	
Yoraperla	2
Perlidae	
Calineuria californica	5
Doroneuria baumanni	11
Perlodidae	
Chernokrilus	3
Pteronarcyidae	
Pteronarcys	1
Trichoptera	
Hydropsychidae	
Parapsyche	5
Hydroptilidae	
Ochrotrichia	2
Lepidostomatidae	
Lepidostoma	1
Philopotamidae	
Dolophilodes	24

GRANT CREEK V-30-95

Taxon	# Specimens
Trichoptera (cont.)	
Polycentropidae	
Polycentropus	1
Rhyacophilidae	
Rhyacophila	10
Uenoidae	
Neophylax	1
Coleoptera	
Elmidae	1
Ampumixis dispar	1
Lara	3
Ordobrevia nubifera	3
Zaitzevia parvula	1
Psephenidae	
Eubrianax edwardsi	23
Ptilodactylidae	
Anchycteis velutina	4
Diptera	
Ceratopogonidae	6
Chironomidae	
Chironominae	
Tanytarsini	3
Orthocladiinae	3
Brillia	3
Tanypodinae	1
Dixidae	
Dixa	1
Thaumaleidae	
Thaumalea	1

NORDHEIMER CREEK X-16-95 **SAMPLE**

	1	2	3
Ephemeroptera			
Ameletidae			
Ameletus	1	---	---
Ephemerellidae			
Drunella doddsi	---	4	4
D. spinifera	---	---	1
Ephemerella inermis	17	6	5
Baetidae			
Acentrella	3	---	---
Baetis	122	42	42
Heptageniidae			
Epeorus (Iron)	9	13	8
Ironodes	2	1	---
Rhithrogena	2	3	23
Plecoptera			
Capniidae	1	---	---
Nemouridae			
Malenka	---	---	3
Zapada columbiana	1	---	2
Z. oregonensis gp.	---	---	1
Perlidae			
Calineuria californica	---	3	22
Hesperoperla pacifica	1	2	2
Perlodidae			
Cultus	1	---	---
Isoperla	1	---	1
Trichoptera			
Glossosomatidae			
Agapetus	---	1	---
Glossosoma	---	---	1
Hydropsychidae			
Arctopsyche	1	---	1
Cheumatopsyche	2	---	4
Hydropsyche	26	37	60
Hydroptilidae			
Hydroptila	5	---	1
Lepidostomatidae			
Lepidostoma	5	4	---
Rhyacophilidae			
Rhyacophila	3	2	3

NORDHEIMER CREEK X-16-95 **SAMPLE**

	1	2	3
Coleoptera			
Elmidae			
Ampumixis dispar	1	---	---
Optioservus	1	---	---
Ordobrevia nubifera	4	---	---
Zaitzevia parvula	3	2	12
Psephenidae			
Eubrianax edwardsi	1	---	---
Diptera			
Ceratopogonidae	---	1	---
Chironomidae			
Chironominae			
Chironomini	3	6	6
Tanytarsini	3	1	5
Rheotanytarsus	1	---	---
Orthocladiinae			
Dark head	17	11	20
Light head	6	3	4
Brillia	---	3	1
Corynoneura	---	1	---
Lopescladius	1	---	1
Nostococladius	---	1	---
Parametriocnemus	6	3	---
Thienemanniella	4	---	3
Tvetenia	3	1	1
Empididae			
Chelifera	1	---	---
Hemerodromia	---	---	2
Wiedemannia	---	3	---
Simuliidae			
Simulium	39	146	53
Tipulidae			
Antocha	1	---	1
Hexatoma I	---	---	2
Hexatoma II	1	---	5

CRAPO CREEK X-16-95

	SAMPLE		
	1	**2**	**3**
Ephemeroptera			
Baetidae			
Baetis	67	55	11
Ephemerellidae			
Caudatella	1	---	1
Drunella doddsi	---	1	---
Ephemerella inermis	1	3	7
Heptageniidae			
Epeorus (Iron)	1	2	2
Ironodes	3	8	14
Rhithrogena	123	98	34
Leptophlebiidae			
Paraleptophlebia	---	1	2
Plecoptera			
Capniidae	1	---	2
Chloroperlidae			
Sweltsa	---	2	1
Nemouridae			
Malenka	---	---	4
Zapada cinctipes	---	1	8
Perlidae			
Calineuria californica	1	---	2
Doroneuria baumanni	1	---	---
Hesperoperla pacifica	10	4	8
Perlodidae			
Skwala parallela	1	---	1
Trichoptera			
Brachycentridae			
Brachycentrus	---	1	---
Micrasema	5	7	5
Glossosomatidae			
Glossosoma	8	9	5
Hydropsychidae			
Arctopsyche	6	3	1
Hydropsyche	15	39	8
Lepidostomatidae			
Lepidostoma	2	1	5
Rhyacophilidae			
Rhyacophila	1	8	1

CRAPO CREEK X-16-95

	SAMPLE		
	1	**2**	**3**
Coleoptera			
Elmidae			
Ampumixis dispar	3	3	1
Heterlimnius	2	1	---
Optioservus	2	---	1
Zaitzevia parvula	---	1	1
Lara	---	---	1
Psephenidae			
Eubrianax edwardsi	---	2	---
Odonata			
Gomphidae	---	1	---
Diptera			
Blephariceridae			
Bibiocephela	2	---	---
Ceratopogonidae	1	1	---
Chironomidae			
Chironominae			
Chironomini	3	4	22
Tanytarsini	2	7	3
Rheotanytarsus	2	1	---
Orthocladiinae			
Dark head	2	4	12
Light head	2	1	74
Brillia	---	3	17
Corynoneura	1	---	---
Lopescladius	1	1	---
Parametriocnemus	---	5	5
Thienemanniella	---	---	19
Tvetenia	1	1	11
Tanypodinae	3	---	2
Empididae			
Chelifera	4	4	4
Wiedemannia	3	3	1
Pelecorhynchidae			
Glutops	1	---	---
Psychodidae			
Maruina	1	---	---
Pericoma	---	1	---

CRAPO CREEK X-16-95

	SAMPLE		
	1	**2**	**3**
Diptera (cont.)			
Simuliidae			
Simulium	15	10	3
Tabanidae	---	---	1
Tipulidae			
Dicranota	1	---	---
Hesperocanopa	---	1	---
Hexatoma I	1	---	---
Hexatoma II	---	1	---

BUTLER CREEK X-16-95

	SAMPLE		
	1	**2**	**3**
Ephemeroptera			
Ameletidae			
Ameletus	---	1	---
Baetidae			
Baetis	38	28	40
Ephemerellidae			
Caudatella	2	2	1
Drunella doddsi	5	5	7
D. spinifera	---	---	1
Ephemerella inermis	3	3	6
Heptageniidae			
Cinygmula	---	---	1
Epeorus (Iron)	7	41	14
E. (Ironopsis) grandis	1	---	1
Ironodes	28	12	19
Rhithrogena	---	3	5
Leptophlebiidae			
Paraleptophlebia	2	12	9
Plecoptera			
Capniidae	1	---	---
Chloroperlidae			
Sweltsa	1	1	---
Leuctridae	---	---	1
Despaxia augusta	---	1	---
Nemouridae			
Malenka	1	1	1
Visoka cataractae	---	1	---
Zapada cinctipes	---	2	1
Z. columbiana	4	---	1
Z. oregonensis gp.	---	1	1
Peltoperlidae			
Sierraperla cora	1	---	---
Yoraperla	4	1	1
Perlidae			
Calineuria californica	8	10	12
Doroneuria baumanni	6	1	---
Hesperoperla pacifica	1	---	1
Perlodidae			
Isoperla	---	1	1

BUTLER CREEK X-16-95 **SAMPLE**

	1	2	3
Trichoptera			
Brachycentridae			
Micrasema	2	21	2
Glossosomatidae			
Glossosoma	2	4	5
Hydropsychidae			
Arctopsyche	---	1	4
Hydropsyche	26	25	32
Lepidostomatidae			
Lepidostoma	3	1	1
Philopotamidae			
Dolophilodes	---	1	1
Rhyacophilidae			
Rhyacophila	10	11	13
Coleoptera			
Elmidae			
Ampumixis dispar	5	5	4
Heterlimnius	1	2	1
Optioservus	---	2	1
Ordobrevia nubifera	11	8	13
Zaitzevia parvula	---	---	3
Psephenidae			
Eubrianax edwardsi	---	3	---
Odonata			
Gomphidae	---	1	---
Diptera			
Ceratopogonidae	4	1	1
Chironomidae			
Chironominae			
Chironomini	4	1	3
Tanytarsini	8	24	15
Rheotanytarsus	---	2	3
Orthocladiinae			
Dark head	14	3	12
Light head	40	22	27
Brillia	31	6	17
Corynoneura	2	3	1
Nostococladius	---	---	1

BUTLER CREEK X-16-95

	SAMPLE 1	2	3
Diptera (cont.)			
Parametriocnemus	2	5	7
Thienemanniella	3	4	2
Tvetenia	10	4	3
Tanypodinae	3	1	---
Dixidae			
Dixa	1	1	---
Empididae			
Chelifera	3	1	1
Wiedemannia	---	4	1
Simuliidae			
Simulium	2	1	4
Tipulidae			
Antocha	---	1	---
Dicranota	---	1	---
Hexatoma II	1	---	---

McNEIL CREEK X-16-95

	SAMPLE		
	1	**2**	**3**
Ephemeroptera			
Ameletidae			
Ameletus	---	1	2
Baetidae			
Baetis	36	28	22
Ephemerellidae			
Caudatella	3	1	2
Drunella doddsi	3	7	6
D. spinifera	---	---	1
Ephemerella inermis	25	34	23
Heptageniidae			
Cinygma	---	1	---
Cinygmula	9	4	9
Epeorus (Iron)	9	6	10
Ironodes	64	41	10
Rhithrogena	---	8	---
Leptophlebiidae			
Paraleptophlebia	11	13	12
Plecoptera			
Capniidae	2	4	1
Chloroperlidae			
Sweltsa	4	6	3
Leuctridae	---	---	3
Despaxia augusta	---	---	3
Perlomyia	---	---	1
Nemouridae			
Malenka	5	1	2
Zapada cinctipes	1	---	---
Z. columbiana	5	---	---
Z. oregonensis gp.	---	4	---
Peltoperlidae			
Yoraperla	4	20	5
Perlidae			
Calineuria californica	10	4	8
Hesperoperla pacifica	---	2	1
Perlodidae			
Isoperla	3	1	2
Perlinodes aurea	---	---	1
Pteronarcyidae			
Pteronarcys	1	---	---

McNEIL CREEK X-16-95

	SAMPLE		
	1	**2**	**3**
Trichoptera			
Brachycentridae			
Micrasema	3	2	3
Calamoceratidae			
Heteroplectron californicum	1	1	---
Glossosomatidae			
Glossosoma	2	3	18
Hydropsychidae			
Hydropsyche	6	16	13
Philopotamidae			
Dolophilodes	1	---	---
Rhyacophilidae			
Rhyacophila	15	12	10
Sericostomatidae			
Gumaga	---	---	2
Coleoptera			
Elmidae			
Ampumixis dispar	---	3	---
Heterlimnius	10	31	21
Ordobrevia nubifera	2	1	3
Zaitzevia parvula	---	1	4
Psephenidae			
Eubrianax edwardsi	5	4	22
Megaloptera			
Corydalidae	---	---	1
Odonata			
Gomphidae	---	---	4
Diptera			
Ceratopogonidae	3	---	---
Chironomidae			
Chironominae			
Tanytarsini	11	2	10
Rheotanytarsus	---	1	2
Orthocladiinae			
Dark head	3	5	1
Light head	16	10	16
Brillia	1	1	---
Corynoneura	---	---	2

McNEIL CREEK X-16-95 **SAMPLE**

	1	2	3
Diptera (cont.)			
Parametriocnemus	10	4	---
Thienemanniella	7	2	2
Tvetenia	---	2	---
Tanypodinae	1	---	2
Dixidae			
Dixa	2	1	11
Meringodixa	---	1	---
Empididae			
Chelifera	---	---	1
Pelecorhynchidae			
Glutops	3	7	10
Psychodidae			
Pericoma	5	3	8
Stratiomyidae			
Caloparyphus	---	---	1
Thaumaleidae			
Thaumalea	---	---	1
Tipulidae			
Antocha	---	---	3
Hesperocanopa	---	1	---
Hexatoma II	3	---	1
Tipula	---	---	1