

PATRICK DELLA CROCE
PRACTICAL WORK EXPERIENCE REPORT

JULY 15 - NOVEMBER 18
2005

TAYLOR RANCH



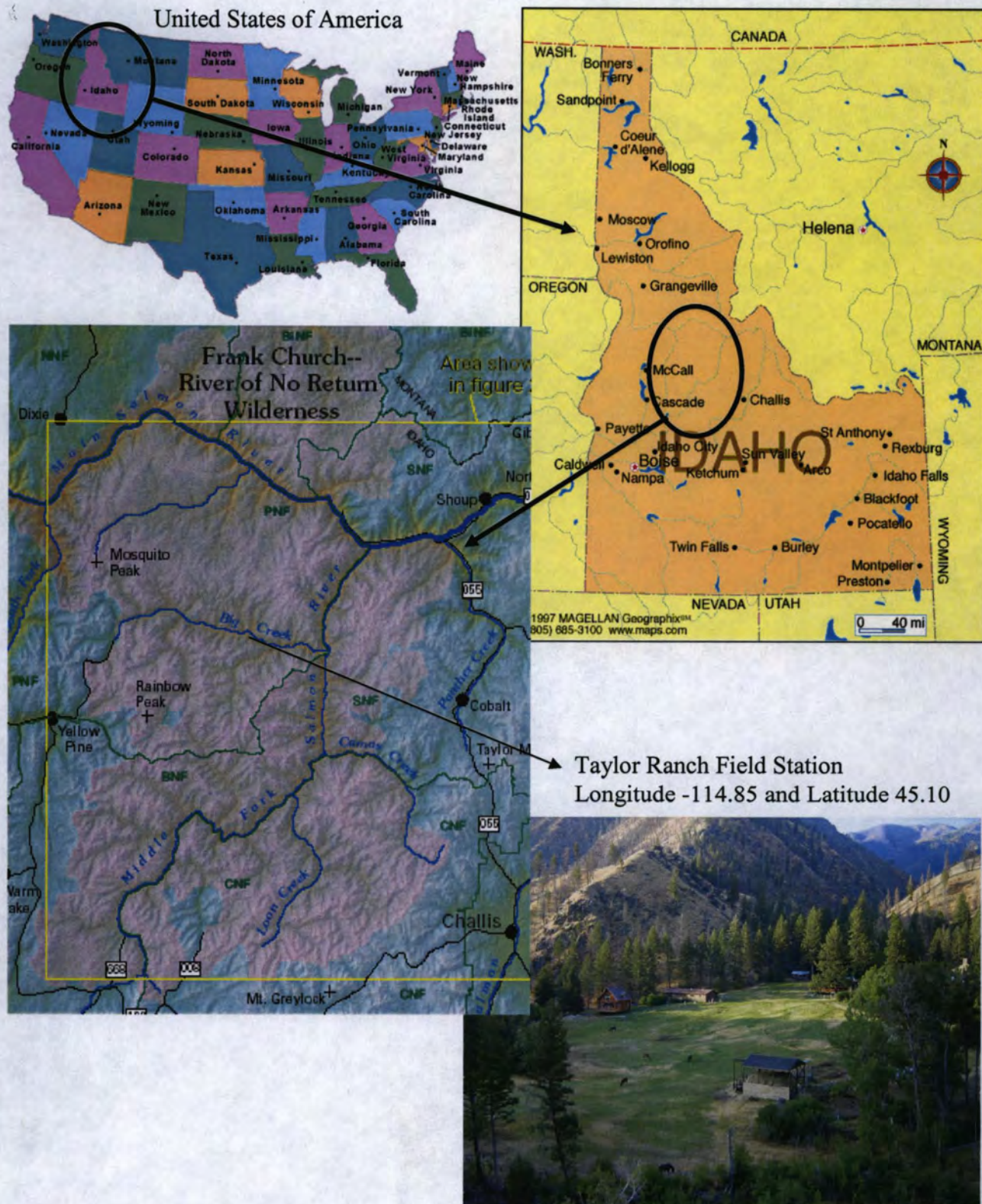
FRANK CHURCH "RIVER OF NO RETURN" WILDERNESS
(IDAHO, U.S.A.)

Chapter's Index

- 1. Introduction**
 - 1.1. Location of my practical work experience
 - 1.2. About the "River of No Return" Wilderness and Taylor Ranch
- 2. My stay at Taylor Ranch Field Station**
- 3. Description of the projects and of the activities at Taylor Ranch**
 - 3.1. Description of the general project in this area of Dr. Colden Baxter
 - 3.2. Description of my independent projects
 - 3.3. Other activities here at Taylor Ranch during my stay
- 4. Positive points and problems of my research experience**
 - 4.1. About my projects
 - 4.2. About working with Dr. Baxter and Dr. Robinson
- 5. Data sheets (fish project)**

1 Introduction

1.1 Location of my practical work experience



My practical work experience took place at Taylor Ranch Field Station, which is situated in the Frank Church "River of No Return" Wilderness, central Idaho, north-west United States. Thanks to Dr. Robinson of the EAWAG in Zurich (Switzerland), I could contact Jim and Holly Akenson, the managers of Taylor Ranch and they put me in contact with Dr. Baxter (Assistant Professor, Stream Ecology Center, Department of Biological Sciences) of Idaho State University, located in Pocatello, Idaho. Due to my will to gain some research experience "in the field" and since he is conducting studies in that area, he invited me to Idaho to do my practical work experience in the wilderness.

I arrived in Pocatello on July 15, 2005, and I flew into the wilderness area on July 21. I spent all summer and a part of the fall at Taylor Ranch, and the 2nd of November I flew back to Pocatello where I spent a couple of weeks finishing the analysis of my project's data and writing my paper (see chapter 2 for details on the project).

1.2 *About the "River of No Return" Wilderness and Taylor Ranch* (Source: www.wilderness.net)

The "River of No Return" Wilderness

Located in central Idaho (USA), the Frank Church "River of no Return" Wilderness covers a surface of about 31.444 km² (Switzerland has a surface of 41.285 km²), and it is the second largest unit of the National Wilderness Preservation System in the Lower 48 (second in size only to California's Death Valley Wilderness). This area combines the old Idaho Primitive Area, the Salmon Breaks Primitive Area, territory on six national forests, and a small swath of land managed by the Bureau of Land Management. In 1964 Senator Frank Church put this area in the Wilderness Act, and his name was added to the Wilderness in 1984, shortly before his death.

It is a land of clear rivers, deep canyons, and rugged mountains. Two white-water rivers draw many human visitors: the Main Salmon River, which runs west near the northern boundary; and the Middle Fork of the Salmon, which begins near the southern boundary and runs north for about 104 miles until it joins the Main. Reaching 6,300 feet from the river bottom, the canyon carved by the Main Salmon is deeper than most of the earth's canyons--including the Grand Canyon of the Colorado River--and this fast-moving waterway has been dubbed the River of No Return. In the north-eastern corner of the Wilderness, the Selway River flows north into the nearby Selway-Bitterroot Wilderness. Trout fishing usually rates from good to excellent. The Middle Fork, the Selway, and a portion of the Main Salmon are Wild and Scenic Rivers. Unlike the sheer walls of the Grand Canyon, these rivers rush below wooded ridges rising steeply toward the sky, beneath eroded bluffs and ragged, solitary crags.

The Salmon River Mountains dominate the interior of the Wilderness. Without a major crest, these mountains splay out in a multitude of minor crests in all directions, and rise gradually to wide summits. East of the Middle Fork, the fabulous Bighorn Crags form a jagged series of summits, at least one topping 10,000 feet. The Bighorns surround 14 strikingly beautiful clearwater lakes. Hiking up from the rivers into the mountains brings sudden elevation changes.

Great forests of Douglas fir and lodgepole pine cover much of the area, with spruce and fir higher up and ponderosa pine at lower altitudes. The forests are broken by grassy meadows and sun-washed, treeless slopes.

A dry country, as little as 15 inches of precipitation falls near the rivers. As much as 50 inches may fall on the mountaintops, but much of it is snow. Despite the dryness, wildlife

abounds. As many as 370 species have been identified in a single year, including eight big game animals. A network of 296 maintained trails (approximately 2,616 miles worth) provides access to this seemingly endless area, crossing rivers and streams on 114 bridges. This is a paradise for horse packers. Thirty-two Forest Service Roads lead to 66 trailheads. Despite the extensive trail system, an amazing 1.5 million acres remains trail-free. Small planes are allowed to land on several primitive airstrips dating back to the days before Wilderness designation.

Taylor Ranch

Taylor Ranch is located in the middle of the Franck Church "River of No Return" Wilderness, in the Big Creek's drainage. This area was first used by the Sheepeater Indians, who could live in the area of Pioneer Creek's mouth thanks to the plentiful of bighorn sheep, mule deer, Chinook salmon, spring steelhead, Cutthroat trout, berries and other natural resources. Some signs of their residence, such as depressions on the ground caused by their "house pits" are still to be seen today. During the late part of 1800 people came to this region to look for gold. The new settlers came in conflict with the local Indians and in 1879 a military campaign put an end to the "Indian's story" in the Big Creek area.

Talking about Taylor Ranch itself cannot be done without mentioning three different persons: Dave "Cougar" Lewis, Jess Taylor and Maurice Hornocker. Dave Lewis lived in the Taylor Ranch area permanently since 1911. He probably has been the first big game outfitter, and he survived in this region by doing activities such as hunting cougars for the bounty and guiding hunters. In 1934 Jess Taylor purchased the land from Dave Lewis, and turned it into guest ranch in 1964. In that year Maurice Hornocker was conducting research on mountain lions based from Taylor Ranch. He became friends with Jess Taylor, and he convinced him to sell the place to the University of Idaho in 1970. Since then Taylor Ranch has been a research Field Station.

Jim and Holly Akenson have been the managers of Taylor Ranch for the last 17 years.

2 My stay at Taylor Ranch Field Station

If I were to describe my practical work experience in one word it would be "wonderful". My summer at Taylor Ranch was better than I could ever imagine. The whole area with its nature, its wildlife and its views is just great. To spend four months at Taylor Ranch has been an experience that gave me a lot on the personal and on the academic side and during my stay in the wilderness I came to see many things under a different point of view.

The place is extremely remote (60 km or 2 days hike to the first road, and then another 4 hours driving to the first village) and when I was hiking around or doing my project, most of the times I didn't encounter anybody. At the beginning this was strange, but after a while I began to appreciate the quiet and the "being alone" in the wilderness.

When I first flew to Taylor Ranch there were a lot of people there, and at the beginning of August we reached the peak of 32 people. It was nice because I could meet a lot of friendly and interesting people, but that took away the chance to really live and discover this place. After mid August we remained only in four persons fixed at Taylor Ranch: Jim and Holly (the two managers), Stephanie (a student that was at Taylor Ranch as assistant manager) and myself. Although there were only four of us I never felt lonely, also because all the three could stand

my “talking will” very well, and without these three people my stay in here would not have been so nice.

Jim and Holly know the area better than anyone else, and I could hardly stop myself from asking them questions. They explained me so much about wolfs, mule deer, bighorn sheep, bears, cougars and all other animals, they taught me how to pack and to ride mules, they showed me the country around Taylor Ranch and their door was always open, no matter if day or night. I really couldn't find two better persons than the two of them. Of course the stay in the wilderness and the fact of being so isolated from the rest of the world presented also some “less beautiful” sides: we received our grocery (which we had to order via e-mail in advance) only once a week with the mail plane, every time I had to go somewhere I had to carry a pretty heavy backpack, to communicate with the outside world there was “only” internet or a very expensive satellite phone and none of the “obvious” things of the outside world were available. These things anyway never touched me very much and after a little while I just forgot about them.

I really liked the “wild-man life style” and I will miss this place. This place is almost as big as Switzerland, and it is all given to nature. It is as wild as a person can imagine and by hiking or riding around I could always discover something new. It is just unique, and I had experiences here that I could have had probably in only 5 or 6 other places on earth! During my summer in the wilderness I could, for example, see a pack of wolfs just 500 meters away from the Ranch, I could look at their kill and we could hear the wolfs feeding on the leftovers just 100 meters away from us. I could observe black bears in their natural environment and I could handle rattlesnakes. For a person that loves nature and wildlife Taylor Ranch is like “Santa Claus's land!”

To conclude this part I must say that also if my project would have been bad, I would have liked this experience anyway. This place is extraordinary and just the fact of be there, live there and see all the things I have seen paid my stay more than I could ever expect. As Dr. Robinson told me when I was still planning my stay in Idaho, what I had was “a once in a lifetime chance”, and now I can say that I never would have forgiven myself if for any reason I wouldn't have taken it.



Group picture: Holly, Jim, I and Mica



One of the seven wolfs that showed up right in front of Taylor Ranch



Stephanie and me



Students at Taylor Ranch in the summer

3 Description of the projects

3.1 *Description of the general project in this area of Dr. Colden Baxter*

The research projects Dr. Baxter is conducting in the Frank Church Wilderness (from Taylor Ranch Field Station) focuses on understanding vectors of ecosystem connectivity between land and water. He and his students will be conducting several studies addressing the ways in which aquatic-terrestrial linkages are altered by wildfire.

One study, conducted by Rachel Wilkinson (ISU master student) is focusing on how fire affects the role of emerging adult stream insects as prey for terrestrial predators such as spiders, bats, and birds. She put some emergence traps in all the tributaries in the Taylor Ranch area, to be able to see what comes out of the streams, when and in which quantity. Another study, conducted by Breezy Jackson, will focus on the influence of fire on the flux of plant material and terrestrial invertebrates to fish and invertebrate consumers in streams. Another plan of Dr. Baxter in this area, started this year with a “mapping-week”, tries to cover all the aspects of this area and to bring them together. During the mapping week a whole group of different scientists have mapped the fishes, the Benthos and the macro invertebrates of the river Big Creek, the vegetation in the riparian area as well as the geomorphology of the area. This project tries to give a 360° view of this area and tries to understand the complicated linkages between every one of these factors.

3.2 *Description of my independent projects*

During the first week in here, I planned my independent research projects with Dr. Baxter. Based on his and my own interests, Dr. Baxter and I planned two studies: one about fishes and their attraction to the confluences (Fish project), and the other one about local black bears and salmon (Bear project).

Fish project (see also paper in chapter 5)

This project focuses on this following question:
“Do confluences with tributary streams modify the distribution of fish in Big Creek?”, with these specific questions:

- a. Do tributary confluences attract fish?
- b. Do they attract the fish because of cooler temperatures found there or because of higher food input at these locations?
- c. Is there a difference in fish numbers and composition between tributary confluences that supply more food and those that supply less?

Tributary drainages that have experienced wildfire may have higher productivity for aquatic insects, which could result in their supplying more food to the main-stem at confluences. Addressing the questions above would therefore have practical applications that may link wildfire with changes in the productivity and distribution of fishes.

In agreement with Dr. Baxter (and with the help of Joe Ebersole, see later) I decided to study the confluences of six streams in the Taylor Ranch area: Cliff Creek, Pioneer Creek, Cougar Creek, Dunce Creek, Goat Creek and Burnt Creek. These streams have experienced fire of different intensities, but they were similar in water flow and temperature, making them ideal to study the effect of fire on their ability to attract fish. Cliff Creek, Pioneer Creek and Goat Creek totally lost their pine-tree canopy in the 2000 fire, and they represented for the burned-streams class. Cougar Creek, Burnt Creek and Dunce Creek still had their pine-tree canopy and they represented the unburned-stream class. Dr. Baxter and I decided to structure the study in four phases.

Phase 1 was the intense observation of Cliff Creek, Pioneer Creek and Cougar Creek. On these streams, I took several drift samples over a 24 hour period (every two hours for 30 minutes). I also performed intense underwater fish observations. The drift sample helped me understand when the tributaries were more productive, and if there were differences between burned and unburned streams. With the underwater observations during different times in the day, I wanted to count the fish that were present in the area I was monitoring and I wanted to observe the fish behaviour at the confluence area. This was important, because I needed to know if fish were just resting in the cooler water supplied by the tributary, or if they were feeding on the drift that came from the tributary. During this first phase, I also mapped and divided the six areas into sectors for monitoring. I measured the length, the width, and the depth of every sector. I looked at the structure of their bottom and I estimated their safety for the fish looking at the amount of hiding places and the availability of escape-ways. I also measured the magnitude and the spatial extent of the temperature effect that every tributary had on the main-stem.

During this phase I noticed the following things:

- every tributary was more productive during the night than during the day, which is also obvious if we think that most aquatic insects are more active during the night than during the day, and therefore there is a greater chance that they are drifted away by the water;
- tributaries that have experienced fire of a higher intensity had the highest drift productivity;
- the tributaries differed in their attractiveness to fish;
- this attractiveness was different between day and night, and differed also among the fish species present in Big Creek.

Phase 2 was the analysis of the collected data and the formulation of the following hypotheses:

- Confluences do modify the distribution of fish in Big Creek. During my observations, I could report the presence of many fish in a small area. The fish density was higher by the confluences than in the rest of the main-stem (see below for more detail).
- Temperature seemed to be a major factor controlling the fish distributions in the areas I observed. The tributaries were mostly (see chapter 5) cooler than Big Creek, and I think that this temperature difference was responsible for the uneven distribution of the fish around the confluence area. Also, the absolute temperature of the main-stem seemed to play an important role. When Big Creek was too warm (more than 18°C) for long time, every tributary seemed to be attractive, but when Big Creek cooled down, only four tributaries kept on showing attraction ability (see chapter 5).
- The productivity of every tributary seemed to be the factor that dictated the unequal attractiveness among the tributaries. Tributaries that were highly productive during both day and night were attractive for 24 hours a day. Tributaries that were highly productive only in the night attracted fish at the confluence only from sunset to sunrise. The active feeding behaviour of the fish observed at the confluences and their presence in the night (when the main-stem temperature was in the optimum range for the Cutthroat trout) supported the hypothesis that fish selected habitats influenced by tributaries also because of food.
- There is a trade-off between food, cold water, and safety. The area in the proximity of the confluences is always less safe than the rest of the main-stem. Confluence habitats were shallower than the main-stem and very close to the bank. None of the observed confluences presented tree cover from above, and so fish that remained there were more exposed to predators. Fish selected confluence habitat when predation risk was high, that means during the day, only if the main-stem temperature was too high or if the food input from the tributary was high enough to compensate for the lack of safety. If neither of these two requirements were satisfied, fish arrived in the confluence area only by dark, when predation risk was at its minimum.

During Phase 3, I wanted to collect more data to confirm my hypothesis. I also wanted to see if there was a change from summer to fall in the use of confluences by fish. It turned out that fish changed their behaviour (and some cases also their biology) dramatically. The cooler Big Creek became the less fish I could see during the day. Fish just hid themselves during the day and they appeared in the night again. With the help of Dr. Baxter I could understand this pattern. So we decided to use this phase to see if fish showed some attraction to warm water when the temperature of the main-stem was really low. I kept on snorkel the six confluences during my last days at Taylor Ranch. Unfortunately Big Creek did not get cooler than 5°C and so I could not collect enough data to support the hypothesis of an attraction to warm water.

Phase 4 represented the final analysis of my data, the formulation of my conclusions, and the writing of both my paper and report.

- Among the two dominant fish species present in Big Creek (mountain whitefish and westslope cutthroat trout), only cutthroat trout selected habitats influenced by tributaries. I think this is related to the fact that cutthroats are cold water and drift-feeding fish, and both cold water and drift were present at the confluences. Whitefish preferred to remain in deep and calm water.
- The use of confluence habitats by adult cutthroat trout changed with time of day and was higher in the summer than in the fall. Cutthroat trout selection for these special habitats

was higher in the night than in the day. These differences are related with the ecology of the fish and with the trade-off mentioned before. Cutthroat trout change their behaviour from summer, when they are very active in feeding, to fall, when they tend to increase their safety and therefore they hide during the day. The trade-off seemed to be responsible for the day versus night difference, for the reasons that I mentioned before.

- Confluences between Big Creek and burned tributaries showed a higher attractiveness to fish than unburned streams. This can be caused by the higher amount of food that burned tributaries supplied to Big Creek.
- Although I could observe a significant difference between burned and unburned tributaries, other factors seemed to have a major role in determining the attractiveness of the confluence areas. These factors are: the main-stem water temperature, the magnitude and the spatial extension of the temperature change in the main-stem caused by the tributary, and the physiognomy (and therefore the safety) of the confluence. These tree factors, together with the food input from the tributary, seemed to determine the use of habitats influenced by tributaries by adult westslope cutthroat trout.



Ready for night snorkel



A Big Creek's Cutthroat trout

Bear Project

This project was planned by Dr. Baxter in cooperation with Jim Akenson and focused on the following question:

“Do black bears eat adult salmon when they return to spawn in Big Creek?” with the following specific questions:

- a. Do black bears change their diet from berries and grass to fish when the salmon return to Big Creek to spawn?
- b. Do they eat only dead salmon (post-spawning), or are they active fishers?

There have been few studies of the use of streams and streamside forests for autumn foraging by black bears. The availability of food in these habitats may change following wildfire. Moreover, there has been no study of the role of salmon in the diets of black bears. In addition, their concentrated use of streamside areas during autumn may increase their vulnerability to hunting during this time. Therefore, the practical applications of this project will include information that may help guide the Idaho Department of Fish and Game, and give them information that will be used for the management of the hunt of black bear in this region.

This project was supposed to offer me the chance to capture a bear to put a radio collar on it, and also to follow a bear during several hours, to see what it was doing. But, a big fraction of my job would have been the collection of bear excrements and their analysis.

Unfortunately for me, this summer was a strange year for bears and salmon. Only six spawning salmon couples were detected in the lower part of Big Creek (the area that I kept under observation), and the bears did not come down to Big Creek as they usually do. They remained high in the mountains where the berries were. Although the lack of salmon and the concomitant absence of bears during this summer can be used for a long-term study, we decided that for me it was not worth it to spend time on this project. I could collect only 20 bear scats in an entire month (Jim by comparison started a diet-study on bears with more than 200 samples). I found anything else than grass, pine needles and berries in the scat. Also, if I could see traces of fish in some bear excrement, I would not have had enough data to support a diet change from berries to fish (12 salmon represent probably three to four meals for an adult bear). So Jim, Dr. Baxter, and I decided to cancel this project.



A black bear...



...and its track

3.3 *Other activities I did at Taylor Ranch*

During my stay at Taylor Ranch I had the chance to work on many other projects beside mine and I could also gain experience in some “outdoor” activities. Here follows a list of the task and the activities I had during my stay at Taylor Ranch.

Assisting Dr. Baxter and Rachel Wilkinson

During the first part of my stay at Taylor Ranch (end of July, mid-August) Dr. Baxter had two projects going on at Taylor Ranch. The first was a long-term monitoring of six tributaries of Big Creek. During four days I helped Dr. Baxter and Dr. Minshall (Professor, Stream Ecology Center, Department of Biological Sciences of Idaho State University) and their assistants with taking measurements on the streams. The second project of Dr. Baxter was the mapping of the lower part of Big Creek. During five days a group of scientists and Dr. Baxter tried to gain an idea of the fish and the insect populations in Big Creek, of the vegetation around the river and of the geomorphology of the region. By putting all of the results together, it was possible to have a better knowledge of the area. For me, these five days were really helpful because I could work with Joe Ebersole (a fish biologist from Oregon) and he introduced me to snorkelling in the river. He also helped me recognise all the fish species in Big Creek and he helped me plan my fish project. The mapping week signed the start of my fish project, and it

was really helpful for me since it gave me a global view of the area before I looked into some specific areas.

From my arrival at Taylor Ranch to mid August I helped Rachel Wilkinson with her emergence study, and after she left for school (mid August) I kept on collecting her traps every two weeks.



Taking measurements in a stream



Collecting and sampling the Benthos



One of Rachel's emergence traps



Joe Ebersole looking for fish in Big Creek during the mapping week

Work with rattlesnakes

During the month of August Dr. Charles Peterson (ISU) and Javal Bauder (a student of his) came to Taylor Ranch to start Javal's research project on rattlesnakes. During their stay they put radio transmitters on two snakes. With the help of Jim and Holly I was able to track the movements of the two snakes, collecting with that activity some telemetry experience and some "close-contact" with rattlesnakes.

Working and talking with Dr. Peterson and Javal, not only gave me the chance to learn a lot about rattlesnakes but also gave me the opportunity to learn how to put a pit tag in a snake and how to handle snakes in all safety. Late in August, I could put pit tag in two snakes that we captured around Taylor Ranch. It has been really interesting to work with the snakes and I came to appreciate these animals much more than before.



Dr. Peterson during a surgery intervention on a snake to put a radio transmitter



Myself measuring the length of a snake



A rattlesnake trying to eat a small local rabbit



A rattlesnake: its eye is totally grey because it is ready to change his skin

Outdoor activities and Ranch work

One of the most exciting aspects of my experience at Taylor Ranch was the chance to practice a lot of outdoor-activities and Ranch maintenance work.

Jim and Holly showed my how to pack and ride a mule, and I had several chances to ride one of their mules during the summer. Since all of the cabins are provided with a wood-stow for the winter, I helped Jim several times with cutting trees (with a cross-saw, since in the wilderness no machinery such as chain-saw can be used) and chopping wood. Other Ranch activities were fence building, taking care of the irrigation system, cabin maintenance, and wood-rat trapping. During the month of August there were a couple of big wildfires in the Frank Church Wilderness and one of them was pretty close to Taylor Ranch, and so Holly took me to check that fire on a morning (when the fire was low and was waiting for the afternoon wind to “start again”) and she explained a lot about the dynamic of wildfires. It was unbelievable for me to literally walk in the middle of a wildfire. Since Big Creek is an excellent river for fishing, I practiced a lot of fly fishing during my free time, and at the end of my stay Jim and I smoked 15 Whitefish, and the result was just great!

The most exciting thing about my summer at Taylor Ranch was the contact with wild animals. As mentioned before during my stay I could see wolves, bears, mule deer, rattlesnakes, elk, big horn sheep, several birds, fish, otters, and even a bobcat. During the fall, since Jim and Holly were hunting, I could see how a kill has to be processed and what must be done with the meat. Twice during my stay we set wolf-traps to try to catch a wolf and put a radio-collar on him. The first time we used the rest of a fawn killed by the wolves. We could hear the wolves feeding by the traps, but we weren't lucky. The second time we used the left over elk that Jim shot, and the second trapping night we caught a Bobcat and it has been very exciting.



Myself riding a mule



The Taylor Ranch Olympic games: the cross-saw cutting contest



...a walk in the smoke of a wildfire



Stephanie and I carrying the log to build a new fence



A Bobcat: the result of our trapping



Jim, I and...the smoked Whitefish

Other activities

Since Taylor Ranch is a Field Station, several groups of scientists came to Taylor Ranch during the summer, and that gave me the chance to see how to pit tag a juvenile salmon and I could also practice some electro-fishing.

4 Positive points and problems of my research experience

4.1 About my projects

In general I am very happy about my research experience. Both the bear and fish project were very interesting for me, and they both (especially the bear project) presented some very stimulating challenges for me. For the bear project just the idea that I would have had to follow and watch a black bear in its habitat was a reason good enough for me "to jump" in this project, and for the fish project I was also very excited about having the chance to watch the fish...from underwater.

The fish project gave me the chance to do a lot of snorkelling and so I not only could observe them (and play with them) underwater but I could also learn a lot about them. The idea of this project came to me during the "mapping week" and so I am kind of proud about that. Due to the country in the Big Creek area these projects presented not only a mental challenge but also a physical one. It is a two hour hiking from Taylor Ranch to reach the furthest stream and also the snorkelling itself in a river requires a lot of force. The physical side just helped me to remain in good shape, and the many hikes offered me a lot of beautiful views and interesting encounters (once I have been approached by 18 big horn sheep and from once a bear with her cub). The mental challenge was the most stimulating, and sometimes the most difficult too. It was stimulating because since Dr. Baxter left by the beginning of August to go teach at the University, I had to figure out on my own how I wanted to conduct my study, to do my observations and to plan my time. This "freedom" gave me the chance to learn on my skin many things about research work that I wasn't aware of before. For example, I noticed that the amount of data and of information I had to collect was just huge to make my research acceptable and that I needed to consider all the aspects before formulating hypothesis. This "freedom" presented some less beautiful sides, since sometimes I had to change all my plans after a discussion with Dr. Baxter or I noticed only too late that I should have done some measurements in a different way. By analysing my data I also noticed that I could have done something in a different way and that probably wouldn't have happened if Dr. Baxter would have been with me all the time.

Looking back to my experience, I think that it was better like that. Now I know how I have to plan a research project, I know that I have to consider the "little" details much more (because at the end of the work they can become bigger than could have been expected) and I also learned that before starting a research, a good background knowledge of the topic is more than needed. I think that I wouldn't have learned all these "take home messages" (and many others that I won't mention here) in the same way if didn't go through this "trial and error" process. With Dr. Baxter always on my side telling me exactly what to do and when to do it and how I wouldn't have had this creative part and my project wouldn't have been so "mine" as it has been.

The bear project also gave me the chance (thanks to Jim, who is a bear expert and was helping me in this project) to learn a lot about black bears, and that helped also to make me less scared of them. It showed me that research in the field is definitely not the same as laboratory research. Even though I engaged myself in this project and I always looked for bears activity signs (and collected all the scat I could find) when I was hiking around Big Creek, the project was cancelled. Bears and salmon just didn't play with. The salmon did not come to Big Creek in a number high enough to be relevant in the bears diet (only six to twelve spawning pairs are not enough to cause a diet change in a black bear) and the cause of that were probably new constructions between Big Creek and the ocean. The bears did not show up like they normally do every August in the riparian vegetation around Big Creek (in 5 weeks I could observe only 3 bears and a cub). They were attracted high in the mountains by Thimbleberries, and also late in September they did not show up around Taylor Ranch as they normally do.

To conclude, I want to say that sometimes the limited communication with Dr. Baxter caused some problems, but that was also challenging for me because I could test myself and see if I was able to find effective solutions to the problems I encountered. I am happy that I had this chance during my practical work experience, because there I still could do mistakes that probably won't be affordable in future works.

4.2 *About working with Dr. Baxter and Dr. Robinson*

Working with both Dr. Baxter and Dr. Robinson goes definitely under the positive points of my experience.

Dr. Robinson was my supervisor in Switzerland during my practical work experience and without him I would have never come to know about Taylor Ranch. He also gave me good tips on how to conduct my research but he also reminded me at times that I had to enjoy my stay in the wilderness as well, and that I shouldn't fix myself too much on my work.

Dr. Baxter worked with me in both of my projects. He is a "full of energy guy" and he likes to consider all the aspects of a place and I really liked to work with him. He also gave me a bunch of information and help during my project (and my entire stay), and I could learn a lot from him. He always answered my questions and, like Dr. Robinson did, he motivated me about having a publishable paper and not "only" the school report as objective for my research and he reminded me that I had also to enjoy my stay as much as I could and he always motivated me to "give a look" on other's projects.

During the last weeks of my stay in Idaho (when I went to Pocatello) Dr. Baxter helped me with the writing of my paper. The whole paper-writing process was very interesting (although much more difficult than expected). Dr. Baxter explained to me which language I had to use in a scientific paper, which results I had to show (and how), and so on. He reviewed the different versions of my paper almost every day, and he always supported me for every little question. I really appreciated his help during this last part of my experience, also because I would have never been able to even begin a paper without his help.

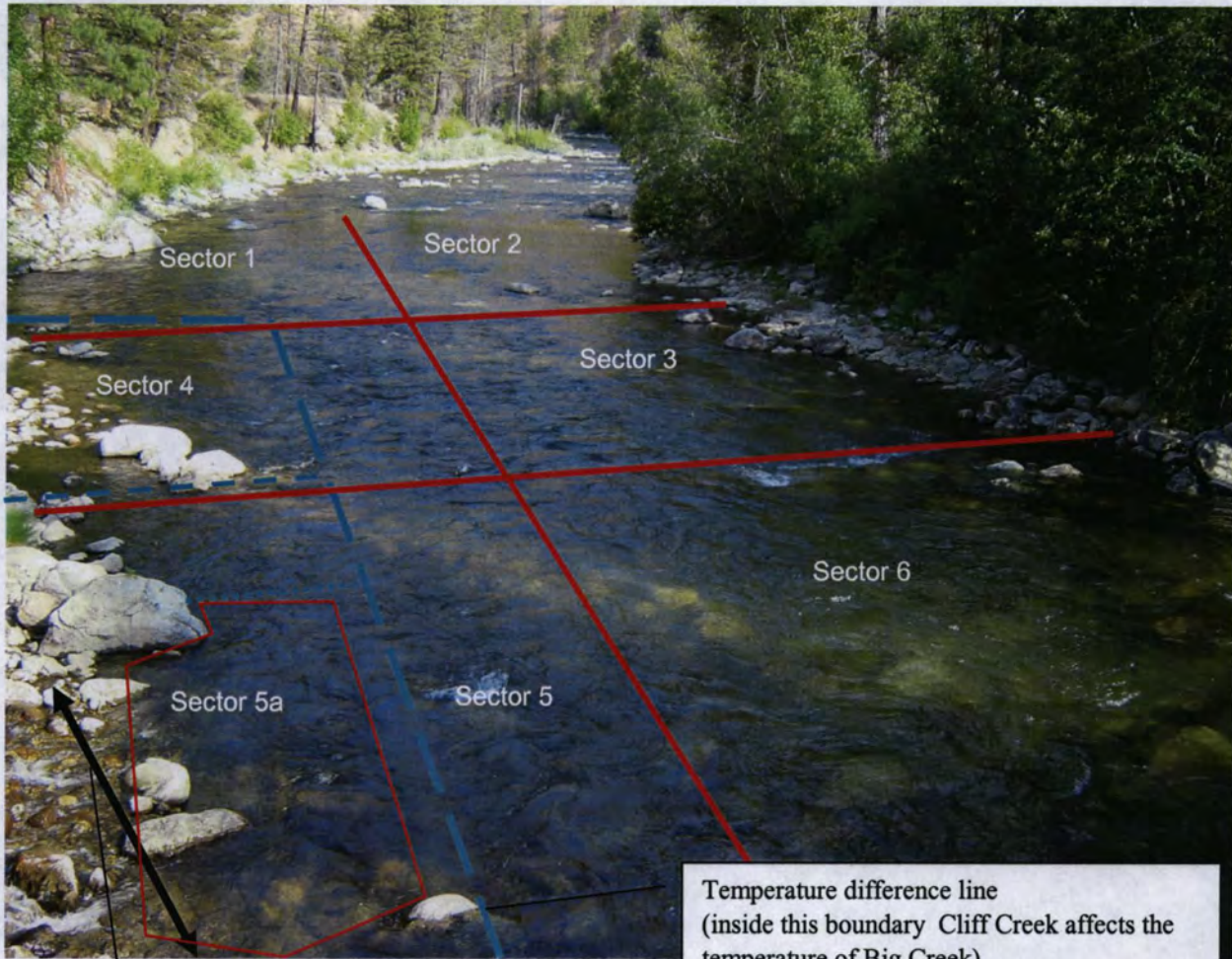
To conclude I want to say that I am very happy that I met these two persons, because they helped me a lot during my research and I could learn a lot from them, not only in respect to my project. I think that they can be good contacts for the future and I really hope I can work with them again.

5 **Data sheets (fish project)**

Index:

- a. Results of the snorkelling survey for each confluence
- b. Summary of all the observations
- c. Use versus availability index
- d. Discharge and productivity for each tributary
- e. Temperature data

Cliff Creek: all the observed sectors

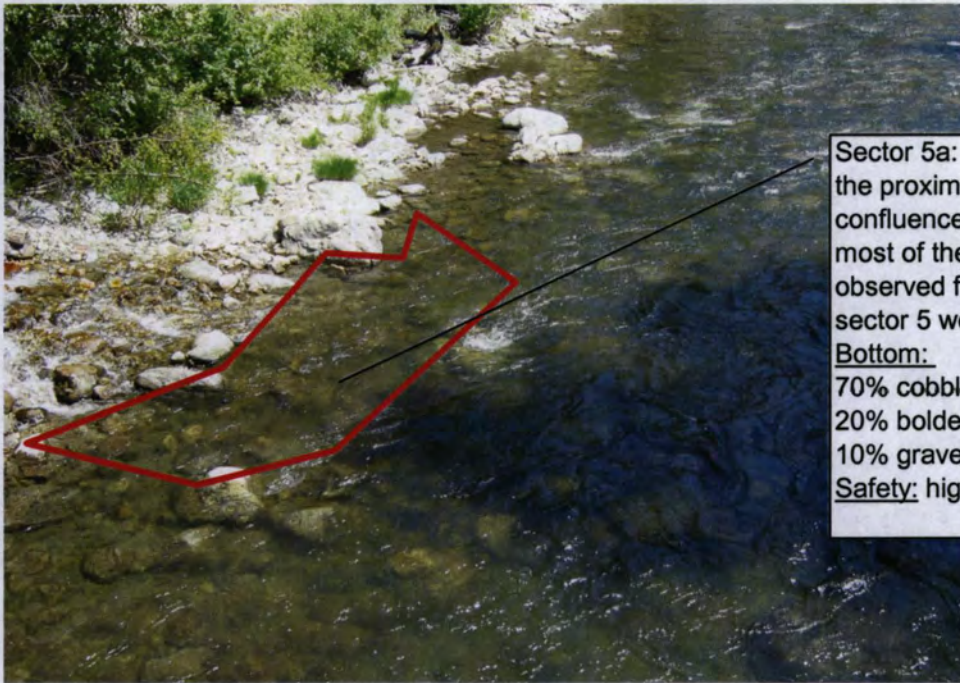


Confluence's width:
8.5 m

Temperature difference line
(inside this boundary Cliff Creek affects the temperature of Big Creek)
 ———— begin to 16th August
 - - - - 16th to end August
 end August and September

| | Length | Depth | Area | % of total |
|------------------|-------------|------------------|-------------|-------------|
| | (m) | (m) | (m2) | |
| Sector 1 | 37 | 1.2 | 444 | 27.85 |
| Sector 2 | 35 | 1.3 | 420 | 26.35 |
| Sector 3 | 21 | 1.4 | 210 | 13.17 |
| Sector 4 | 21 | 1.1 | 210 | 13.17 |
| Sector 5 | 15.5 | 0.9 | 155 | 9.72 |
| Sector 6 | 15.5 | 1.1 | 155 | 9.72 |
| Total | 73.5 | 1.17 | 1594 | 100 |
| Sector 5a | 10 | 0.9 (max) | 20 | 1.25 |

Cliff Creek: the confluence area



Sector 5a:
 the proximity of the
 confluence (where
 most of the
 observed fish of
 sector 5 were)
Bottom:
 70% cobble,
 20% bolder,
 10% gravel
Safety: high

Characteristics of the observed area:

Mean main-stem's width: 20 m
Bottom of the whole area: 50% Cobble
 35% Boulders
 15% Gravel

Waterflow (from Cliff Creek): 11.42 Liter/second

Insects drift (insects / hour)

| | |
|----------------------------------|------|
| Insects during all day - Summer: | 4362 |
| Insects during all day - Fall: | 2123 |
| Summer - Day: | 103 |
| Summer - Night: | 292 |
| Fall - Day: | 71 |
| Fall - Night: | 123 |

Note: although sector 5 is more exposed and shallower than the other sectors,
 it still allows the fish to escape in case of an Attack
 (see difference with Cougar Cr's sectors 1-2-3)

Results of the snorkeling

sectors with temperature change due to Cliff Cr.

Date: 6 August 2005 Time: 18:00
Obs 1

temp Big Cr.: 21
temp Cliff Cr.: 16
temp diff: -5

| | Sector 1 | Sector 2 | Sector 3 | Sector 4 | Sector 5 | Sector 6 |
|---------------|----------|----------|----------|----------|-----------|----------|
| Cutthroat ad. | | | 2 | | 4 | 2 |
| Whitefish ad. | | | | | | |
| Pikemin. ad. | | | | | | |
| Bulltrout ad. | | | | | | |
| Rainbow ad. | | | | | | |
| Trout juv. | | | 4 | | 8 | 5 |
| Chinook juv. | | | | | | |
| others | | | | | | |
| total | 0 | 0 | 6 | 0 | 12 | 7 |

total fish in the whole area: 25

Date: 6 August 2005 Time: 0:00
Obs 2

temp Big Cr.: 19
temp Cliff Cr.: 14
temp diff: -5

| | Sector 1 | Sector 2 | Sector 3 | Sector 4 | Sector 5 | Sector 6 |
|---------------|----------|----------|----------|-----------|----------|----------|
| Cutthroat ad. | | | | | 2 | |
| Whitefish ad. | | | | | 1 | |
| Pikemin. ad. | | | | | | |
| Bulltrout ad. | | | | | | |
| Rainbow ad. | | | | | | |
| Trout juv. | | | | 12 | | |
| Chinook juv. | | | | | | |
| others | | | | | | |
| total | 0 | 0 | 0 | 12 | 3 | 0 |

total fish in the whole area: 15

Notes: only the sectors 4 and 5 have been snorkelled at this time

Date: 7 August 2005 Time: 6:00
Obs 3

temp Big Cr.: 15
temp Cliff Cr.: 13
temp diff: -2

| | Sector 1 | Sector 2 | Sector 3 | Sector 4 | Sector 5 | Sector 6 |
|---------------|----------|----------|----------|-----------|----------|----------|
| Cutthroat ad. | | | | 2 | 4 | |
| Whitefish ad. | | | | | | |
| Pikemin. ad. | | | | | | |
| Bulltrout ad. | | | | | | |
| Rainbow ad. | | | | | | |
| Trout juv. | | | | 8 | 4 | |
| Chinook juv. | | | | | | |
| others | | | | | | |
| total | 0 | 0 | 0 | 10 | 8 | 0 |

total fish in the whole area: 18

Notes: only the sectors 4 and 5 have been snorkelled at this time

Date: 11 August 2005 Time: 22:00
 Obs 7

temp Big Cr.: 17
 temp Cliff Cr.: 14
 temp diff: -3

| | Sector 1 | Sector 2 | Sector 3 | Sector 4 | Sector 5 | Sector 6 |
|---------------|----------|----------|----------|----------|----------|----------|
| Cutthroat ad. | | | | 3 | 3 | |
| Whitefish ad. | | | | | | |
| Pikemin. ad. | | | | | | |
| Bulltrout ad. | | | | | | |
| Rainbow ad. | | | | | | |
| Trout juv. | | | | | | |
| Chinook juv. | | | | | | |
| others | | | | | | |
| total | 0 | 0 | 0 | 3 | 3 | 0 |

total fish in the whole area: 6

Note: Only sector 4 and 5 have been snorkelled. All the six fish observed were actively feeding and were max 1.5 meters away of the shore.

Date: 15 August 2005 Time: 14:00
 Obs 8

temp Big Cr.: 19
 temp Cliff Cr.: 13
 temp diff: -6

| | Sector 1 | Sector 2 | Sector 3 | Sector 4 | Sector 5 | Sector 6 |
|---------------|-----------|----------|----------|----------|-----------|----------|
| Cutthroat ad. | 5 | 2 | 2 | 2 | 6 | 2 |
| Whitefish ad. | 11 | | 2 | 1 | 5 | |
| Pikemin. ad. | 1 | | | | | |
| Bulltrout ad. | | | | | | |
| Rainbow ad. | | | | | | |
| Trout juv. | 3 | | 2 | 1 | 5 | |
| Chinook juv. | | | | | | |
| others | 1 | | | | 1 | |
| total | 21 | 2 | 6 | 4 | 17 | 2 |

total fish in the whole area: 52

Note 1: the 2 "other" fish were Chinook Salmon (probably Jack-Salmon)

Date: 15 August 2005 Time: 22:00
 Obs 9

temp Big Cr.: 16
 temp Cliff Cr.: 13
 temp diff: -3

| | Sector 1 | Sector 2 | Sector 3 | Sector 4 | Sector 5 | Sector 6 |
|---------------|----------|----------|----------|----------|----------|----------|
| Cutthroat ad. | | | | | 3 | |
| Whitefish ad. | | | | | | |
| Pikemin. ad. | | | | | | |
| Bulltrout ad. | | | | | | |
| Rainbow ad. | | | | | | |
| Trout juv. | | | | | 2 | |
| Chinook juv. | | | | | | |
| others | | | | | | |
| total | 0 | 0 | 0 | 0 | 5 | 0 |

total fish in the whole area: 5

Note 1: these data are not sure
 Note 2: only sector 5 has been snorkelled

Date: 20 August 2005 Time: 11:30
 Obs 13

temp Big Cr.: 14
 temp Cliff Cr.: 13
 temp diff : -1

| | Sector 1 | Sector 2 | Sector 3 | Sector 4 | Sector 5 | Sector 6 |
|---------------|-----------|----------|----------|----------|----------|----------|
| Cutthroat ad. | 3 | | | 1 | 4 | |
| Whitefish ad. | 14 | | | | | |
| Pikemin. ad. | | | | 1 | | |
| Bulltrout ad. | | | | | | |
| Rainbow ad. | | | | | | |
| Trout juv. | 3 | | | | 2 | |
| Chinook juv. | | | | | | |
| others | | | | | 1 | |
| total | 20 | 0 | 0 | 2 | 7 | 0 |

total fish in the whole area: 29

Note 1: these results are not 100% sure

Note 2: the trout were right at the confluence, but a Jack-Salmon (other) was disturbing them

Date: 4 September Time: 10:00
 Obs 14

temp Big Cr.: 10
 temp Cliff Cr.: 8
 temp diff : -2

| | Sector 1 | Sector 2 | Sector 3 | Sector 4 | Sector 5 | Sector 6 |
|---------------|----------|----------|----------|----------|----------|----------|
| Cutthroat ad. | | | | 0 | 2 | |
| Whitefish ad. | | | | | | |
| Pikemin. ad. | | | | 0 | | |
| Bulltrout ad. | | | | | | |
| Rainbow ad. | | | | 0 | | |
| Trout juv. | | | | | | |
| Chinook juv. | | | | 0 | | |
| others | | | | | | |
| total | 0 | 0 | 0 | 0 | 2 | 0 |

total fish in the whole area: 2

Note 1: only sector 4 and 5 have been snorkelled

Note 2: the two trout were swimming direction Cliff Creek

Date: 4 September Time: 18:00
 Obs 15

temp Big Cr.: 16
 temp Cliff Cr.: 12
 temp diff : -4

| | Sector 1 | Sector 2 | Sector 3 | Sector 4 | Sector 5 | Sector 6 |
|---------------|----------|----------|----------|----------|----------|----------|
| Cutthroat ad. | | | | | | |
| Whitefish ad. | | | | | | |
| Pikemin. ad. | | | | | | |
| Bulltrout ad. | | | | | | |
| Rainbow ad. | | | | | | |
| Trout juv. | | | | | | |
| Chinook juv. | | | | | | |
| others | | | | | | |
| total | 0 | 0 | 0 | 0 | 0 | 0 |

total fish in the whole area: 0

Date: 28 Sempther Time: 16:00
 Obs 19

temp Big Cr.: 12.5
 temp Cliff Cr.: 12
 temp diff: -0.5

| | Sector 1 | Sector 2 | Sector 3 | Sector 4 | Sector 5 | Sector 6 |
|---------------|-----------|----------|----------|----------|----------|----------|
| Cutthroat ad. | 2 | | | | 1 | |
| Whitefish ad. | 15 | | | | | |
| Pikemin. ad. | | | | | | |
| Bulltrout ad. | | | | | | |
| Rainbow ad. | | | | | | |
| Trout juv. | | | | | | |
| Chinook juv. | | | | | | |
| others | | | | | | |
| total | 17 | 0 | 0 | 0 | 1 | 0 |

total fish in the whole area: 18

Note 1: The trout in sector 5 was at the confluence but swam away by my arrival

Date: 28 Sempther Time: 22:00
 Obs 20

temp Big Cr.: 10
 temp Cliff Cr.: 10
 temp diff: 0

| | Sector 1 | Sector 2 | Sector 3 | Sector 4 | Sector 5 | Sector 6 |
|---------------|----------|----------|----------|----------|----------|----------|
| Cutthroat ad. | | | | | 1 | |
| Whitefish ad. | | | | | 1 | |
| Pikemin. ad. | | | | | | |
| Bulltrout ad. | | | | | | |
| Rainbow ad. | | | | | | |
| Trout juv. | | | | | 1 | |
| Chinook juv. | | | | | | |
| others | | | | | | |
| total | 0 | 0 | 0 | 0 | 3 | 0 |

total fish in the whole area: 3

Note 1: The adult trout in sector 5 was at the confluence

Note 2: The juvenile trout and the Whitefish were not at the confluence

Date: 30 Sempther Time: 22:00
 Obs 21

temp Big Cr.: 12
 temp Cliff Cr.: 12
 temp diff: 0

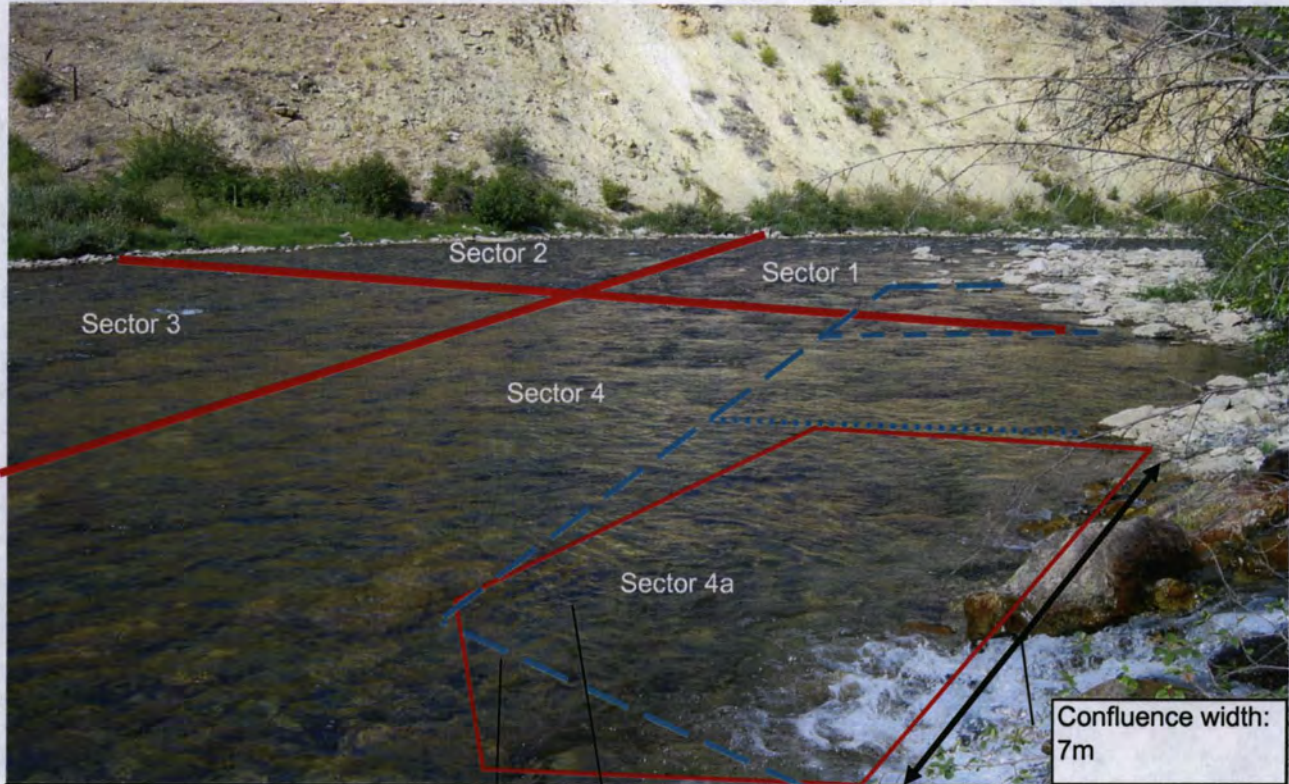
| | Sector 1 | Sector 2 | Sector 3 | Sector 4 | Sector 5 | Sector 6 |
|---------------|----------|----------|----------|----------|----------|----------|
| Cutthroat ad. | | | | | | |
| Whitefish ad. | | | | | | |
| Pikemin. ad. | | | | | | |
| Bulltrout ad. | | | | | | |
| Rainbow ad. | | | | | | |
| Trout juv. | | | | | 3 | |
| Chinook juv. | | | | | | |
| others | | | | | | |
| total | 0 | 0 | 0 | 0 | 3 | 0 |

total fish in the whole area: 3

Note 1: Only sectors 4 and 5 have been snorkelled

Note 2: Only one of the trout was at the confluence

Pioneer Creek: all the observed sectors



Temperature difference line
 (inside this boundary Pioneer Creek affects the temperature of Big Creek)
 - - - - - begin to 16th August
 - - - - - 16th to end August
 end August and September

Sector 4a:
 the proximity of the confluence
Bottom:
 80% cobble,
 20% gravel
Safety: high

| | Length (m) | Depth (m) | Area (m ²) | % of total |
|------------------|---------------|------------------|---------------------------|-------------|
| Sector 1 | 20 | 0.3 | 300 | 28.57 |
| Sector 2 | 20 | 0.3 | 300 | 28.57 |
| Sector 3 | 15 | 0.4 | 225 | 21.43 |
| Sector 4 | 15 | 0.4 | 225 | 21.43 |
| Total | 35 | 0.35 | 1050 | 100 |
| Sector 4a | 8 | 0.4 (max) | 18 | 1.71 |

Note: although sector 4 is more exposed and shallower as the other sectors, it still allow the fish to escape in case of an attack (see difference with Cougar Creek's sectors 1-2-3)

Characteristics of the observed area:


Mean main-stem's width: 30 m
Bottom of the whole area: 80% Cobble
 20% Gravel

Waterflow (from Pioneer Creek): 12.12 Liter/second

Insects drift (insects / hour)

Insects during all day - Summer: 2454 total nr insects
 Insects during all day - Fall: 1573 total nr insects
 Summer - Day: 58
 Summer - Night: 132
 Fall - Day: 34
 Fall - Night: 128

Result of the snorkelling

 sectors with temperature change dued to Pioneer Cr.

Date: 15 August 2005 Time: 14:00
 Obs 1

temp Big Cr.: 19
 temp Pioneer 13
 temp diff : -6

| | Sector 1 | Sector 2 | Sector 3 | Sector 4 |
|---------------|----------|----------|----------|----------|
| Cutthroat ad. | | | | 4 |
| Whitefish ad. | 1 | | | |
| Pikemin. ad. | | | | |
| Bulltrout ad. | | | | |
| Rainbow ad. | | | | |
| Trout juv. | | | | |
| Chinook juv. | | | | |
| others | | | | |
| total | 1 | 0 | 0 | 4 |

total fishes in the whole area: 5

Note 1: all the four trouts were right at the confluence in sector 4a

Note 2: another Cutthroat trout is probably to add in sector 4a (but not 100% sure)

Date: 15 August 2005 Time: 22:00
 Obs 2

temp Big Cr.: 16
 temp Pioneer 12
 temp diff : -4

| | Sector 1 | Sector 2 | Sector 3 | Sector 4 |
|---------------|----------|----------|----------|----------|
| Cutthroat ad. | | | | 2 |
| Whitefish ad. | | | | |
| Pikemin. ad. | | | | |
| Bulltrout ad. | | | | |
| Rainbow ad. | | | | |
| Trout juv. | | | | |
| Chinook juv. | | | | |
| others | | | | |
| total | 0 | 0 | 0 | 2 |

total fishes in the whole area: 2
 Notes: only the sectors 4 has been snorkelled at this time

Date: 16 August 2005 Time: 6:00
 Obs 3

temp Big Cr.: 13.5
 temp Pioneer 10
 temp diff : -3.5

| | Sector 1 | Sector 2 | Sector 3 | Sector 4 |
|---------------|----------|----------|----------|----------|
| Cutthroat ad. | | | | 3 |
| Whitefish ad. | | | | |
| Pikemin. ad. | | | | |
| Bulltrout ad. | | | | |
| Rainbow ad. | | | | |
| Trout juv. | | | | 4 |
| Chinook juv. | | | | |
| others | | | | |
| total | 0 | 0 | 0 | 7 |

total fishes in the whole area: 7
 Note 1: only the sectors 4 has been snorkelled at this time
 Note 2: one of the three Cutthroat was **active feeding** in sector 4a, the other two went away as soon as I got there

Date: 18 August 2005 Time: 18:00
 Obs 4

temp Big Cr.: 20
 temp Pioneer 13
 temp diff : -7

| | Sector 1 | Sector 2 | Sector 3 | Sector 4 |
|---------------|----------|----------|----------|----------|
| Cutthroat ad. | | | | 4 |
| Whitefish ad. | | | | |
| Pikemin. ad. | | | | |
| Bulltrout ad. | | | | |
| Rainbow ad. | | | | |
| Trout juv. | | | | |
| Chinook juv. | | | | |
| others | | | | |
| total | 0 | 0 | 0 | 4 |

total fishes in the whole area: 4
 Note: all the 4 trouts were in sector 4a

Date: 4 September Time: 18:00
Obs 8

temp Big Cr.: 16
temp Pioneer 12
temp diff : -4

| | Sector 1 | Sector 2 | Sector 3 | Sector 4 |
|---------------|----------|----------|----------|----------|
| Cutthroat ad. | | | | |
| Whitefish ad. | | | | |
| Pikemin. ad. | | | | |
| Bulltrout ad. | | | | |
| Rainbow ad. | | | | |
| Trout juv. | | | | |
| Chinook juv. | | | | |
| others | | | | |
| total | 0 | 0 | 0 | 0 |

total fishes in the whole area: 0

Date: 27 September Time: 10:00
Obs 9

temp Big Cr.: 8.5
temp Pioneer 8.5
temp diff : 0

| | Sector 1 | Sector 2 | Sector 3 | Sector 4 |
|---------------|----------|----------|----------|----------|
| Cutthroat ad. | | | | |
| Whitefish ad. | | | | |
| Pikemin. ad. | | | | |
| Bulltrout ad. | | | | |
| Rainbow ad. | | | | |
| Trout juv. | | | | |
| Chinook juv. | | | | |
| others | | | | |
| total | 0 | 0 | 0 | 0 |

total fishes in the whole area: 0

Note: all the sectors were empty

Date: 27 September Time: 16:00
Obs 10

temp Big Cr.: 9
temp Pioneer 9
temp diff : 0

| | Sector 1 | Sector 2 | Sector 3 | Sector 4 |
|---------------|----------|----------|----------|----------|
| Cutthroat ad. | | | | |
| Whitefish ad. | | | | 2 |
| Pikemin. ad. | | | | |
| Bulltrout ad. | | | | |
| Rainbow ad. | | | | |
| Trout juv. | | | | |
| Chinook juv. | | | | |
| others | | | | |
| total | 0 | 0 | 0 | 2 |

total fishes in the whole area: 2

Note 1: only sectors 1 and 4 have been snorkelled

Note 2: the two Whitefish were not by the confluence

Date: 30 September Time: 22:00
Obs 14

temp Big Cr.: 12
temp Pioneer 10
temp diff : -2

| | Sector 1 | Sector 2 | Sector 3 | Sector 4 |
|---------------|----------|----------|----------|----------|
| Cutthroat ad. | | | | 3 |
| Whitefish ad. | | | | 1 |
| Pikemin. ad. | | | | |
| Bulltrout ad. | | | | |
| Rainbow ad. | | | | |
| Trout juv. | | | | 3 |
| Chinook juv. | | | | |
| others | | | | |
| total | 0 | 0 | 0 | 7 |

total fishes in the whole area: 7

Note 1: only sector 4 has been snorkelled

Note 2: the three adult trout were feeding right by the confluence

Date: 6 October Time: 13:00
Obs 15

temp Big Cr.: 7
temp Pioneer 6
temp diff : -1

| | Sector 1 | Sector 2 | Sector 3 | Sector 4 |
|---------------|----------|----------|----------|----------|
| Cutthroat ad. | | | | |
| Whitefish ad. | | | | |
| Pikemin. ad. | | | | |
| Bulltrout ad. | | | | |
| Rainbow ad. | | | | |
| Trout juv. | | | | |
| Chinook juv. | | | | |
| others | | | | |
| total | 0 | 0 | 0 | 0 |

total fishes in the whole area: 0

Note 1: sector 4 has been snorkelled and was empty

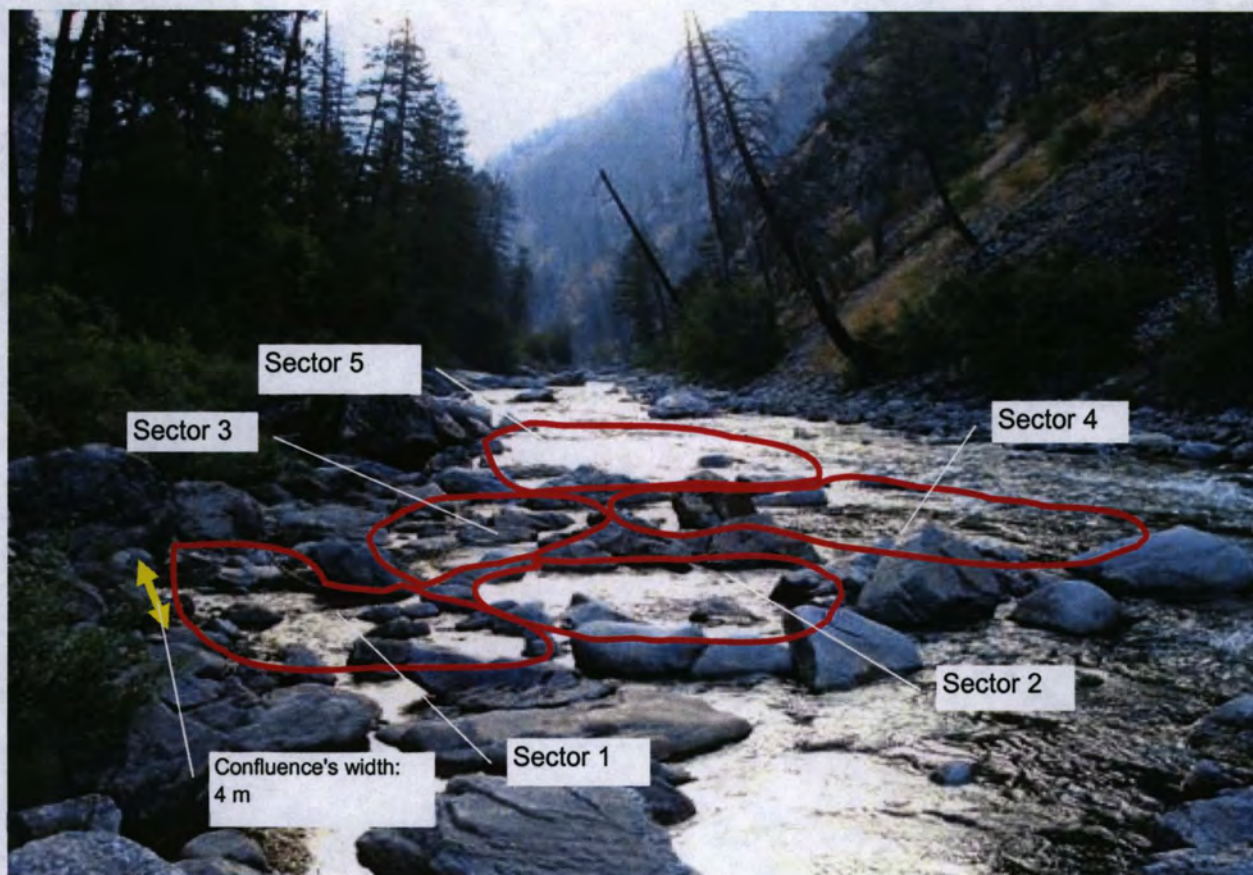
Date: 20 October Time: 17:00
Obs 16

temp Big Cr.: 7.5
temp Pioneer 7
temp diff : -0.5

| | Sector 1 | Sector 2 | Sector 3 | Sector 4 |
|---------------|----------|----------|----------|----------|
| Cutthroat ad. | | | | |
| Whitefish ad. | 5 | | | |
| Pikemin. ad. | | | | |
| Bulltrout ad. | | | | |
| Rainbow ad. | | | | |
| Trout juv. | | | | |
| Chinook juv. | | | | |
| others | 1 | | | |
| total | 6 | 0 | 0 | 0 |

total fishes in the whole area: 6

Cougar Creek: all the observed sectors

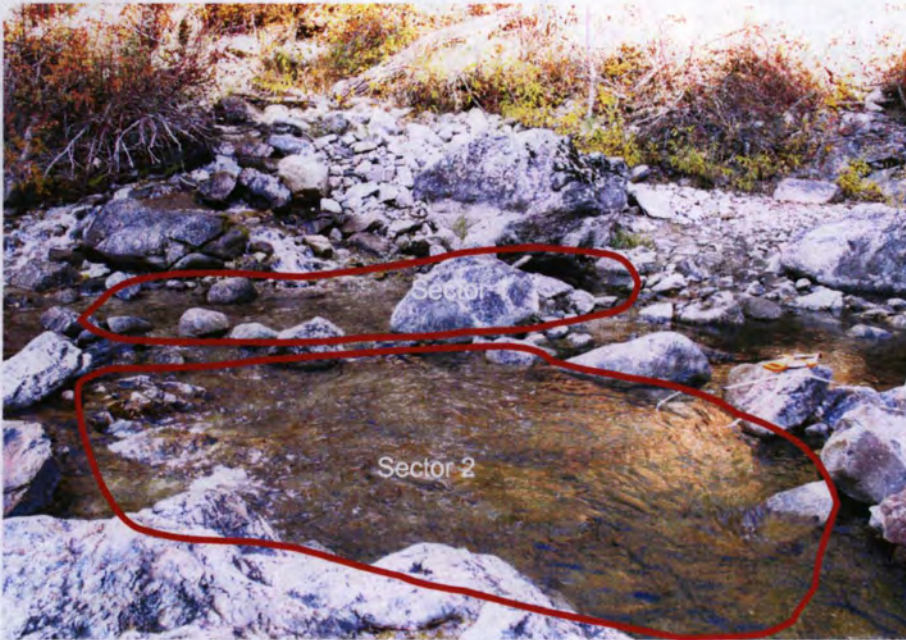


| | Length | Depth | Area | % of total |
|--------------|-------------|------------|-------------------|------------|
| | (m) | (m) | (m ²) | |
| Sector 1 | 3 | 0.25 | 6 | 3.29 |
| Sector 2 | 2.9 | 0.3 | 8.12 | 4.46 |
| Sector 3 | 2.5 | 0.3 | 4.5 | 2.47 |
| Sector 4 | 9.4 | 1.2 | 37.6 | 20.63 |
| Sector 5 | 18 | 1.6 | 126 | 69.15 |
| Total | 23.5 | --- | 182.22 | 100 |

Temperature impact:

sectors 1, 2, 3 presented always at least 1°C temperature difference in respect to Big Creek, sector 4 presented also a difference but only up to 1°C

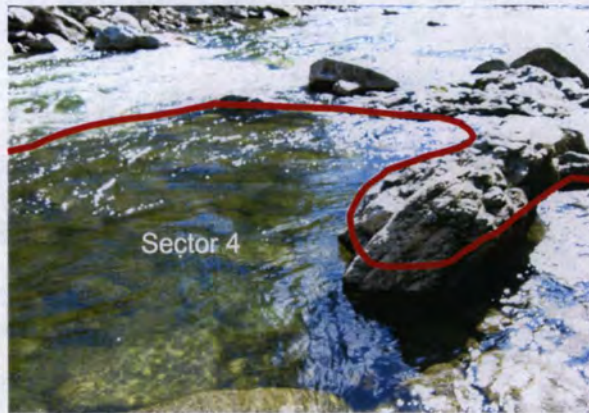
Cougar Creek: sector 1 and 2



Sector 3



Sector 4 (the upper part)



Most of the water in sector 4 comes from Cougar Cr. Most of the water in sector 4 comes from Cougar Cr. wich allows a major food input and a cooler temperature. Sectors 1-2-3 are in the other hand very bad for fishes since the water is very shallow, they are very exposed, and they don't allow a fast escape for the fish in case of attack. The water there is also much slower than in sector 4

Sector 5 (the lower part)



Characteristics of the observed area:

Mean main-stem's width: 18m
Bottom of the whole area: 50% Cobble
 30% Boulders
 20% Gravel
Bottom of sectors 1, 2, 3: 40% Gravel / Sand
 30% Cobble
 30% Boulders

Waterflow (from Cougar Creek): 10.46 Liter/second

Insects drift (insects / hour)

Insects during all day - Summer: 2470 total nr insects
 Insects during all day - Fall: 683 total nr insects
 Summer - Day: 53
 Summer - Night: 178
 Fall - Day: 19
 Fall - Night: 47

Result of the snorkeling

Observation during the "Onion Project"

Temp Big Creek 64°F = 18°C
 Temp Cougar Creek 56°F = 13.5 °C

1 adult Bulltrout in sector 5
 1 adult Bulltrout in sector 3
 1 adult Bulltrout in sector 4
 8 yoy trout in sector 1 and 2

sectors with temperature change dued to Cougar Cr.

Date: 8 August 2005 Time: 18:00
 Obs 1

temp Big Cr.: 20.5
 temp Cougar 16
 temp diff : -4.5

| | Sector 1 | Sector 2 | Sector 3 | Sector 4 | Sector 5 |
|---------------|----------|----------|----------|----------|----------|
| Cutthroat ad. | 2 | | 1 | 1 | |
| Whitefish ad. | | | | | 2 |
| Pikemin. ad. | | | | | |
| Bulltrout ad. | | | | | |
| Rainbow ad. | | | | | |
| Trout juv. | 2 | | | | 5 |
| Chinook juv. | | | | | |
| others | | | | | |
| total | 4 | 0 | 1 | 1 | 7 |

total fishes in the whole area: 13

Date: 25 August 2005 Time: 13:00
Obs 5

temp Big Cr.: 14
temp Cougar 11
temp diff : -3

| | Sector 1 | Sector 2 | Sector 3 | Sector 4 | Sector 5 |
|---------------|----------|----------|----------|----------|-----------|
| Cutthroat ad. | | | | 4 | 1 |
| Whitefish ad. | | | | 2 | 7 |
| Pikemin. ad. | | | | | |
| Bulltrout ad. | | | | | |
| Rainbow ad. | | | | | |
| Trout juv. | | 1 | | 1 | 2 |
| Chinook juv. | | | | | |
| others | | | | | |
| total | 0 | 1 | 0 | 7 | 10 |

total fishes in the whole area: 18

Date: 25 August 2005 Time: 19:30
Obs 6

temp Big Cr.: 18
temp Cougar 12
temp diff : -6

| | Sector 1 | Sector 2 | Sector 3 | Sector 4 | Sector 5 |
|---------------|----------|----------|----------|-----------|-----------|
| Cutthroat ad. | | | | 4 | 3 |
| Whitefish ad. | | | | | 8 |
| Pikemin. ad. | | | | | |
| Bulltrout ad. | | | | | |
| Rainbow ad. | | | | | |
| Trout juv. | | 2 | | 6 | 2 |
| Chinook juv. | | | | | |
| others | | | | | |
| total | 0 | 2 | 0 | 10 | 13 |

total fishes in the whole area: 25

Date: 26 August 2005 Time: 7:40
Obs 7

temp Big Cr.: 12
temp Cougar 10
temp diff : -2

| | Sector 1 | Sector 2 | Sector 3 | Sector 4 | Sector 5 |
|---------------|----------|----------|----------|----------|----------|
| Cutthroat ad. | | | | 1 | |
| Whitefish ad. | | | | | |
| Pikemin. ad. | | | | | |
| Bulltrout ad. | | | | | |
| Rainbow ad. | | | | | |
| Trout juv. | | 2 | | | |
| Chinook juv. | | | | | |
| others | | | | | |
| total | 0 | 2 | 0 | 1 | 0 |

total fishes in the whole area: 3

Note 1: very bad water visibility. Less than 0.8m

Note 2: sector 5 could not be snorkelled because of the bad water visibility (safety)

Note 3: sector 1 and 3 very empty (controlled with flash-light from outside)

Date: 24 October Time: 12:30
Obs 11

temp Big Cr.: 5.5
temp Cougar 7
temp diff : 1.5

| | Sector 1 | Sector 2 | Sector 3 | Sector 4 | Sector 5 |
|---------------|----------|----------|----------|----------|----------|
| Cutthroat ad. | | | | | |
| Whitefish ad. | | | | | |
| Pikemin. ad. | | | | | |
| Bulltrout ad. | | | | | |
| Rainbow ad. | | | | | |
| Trout juv. | | | | | |
| Chinook juv. | | | | | |
| others | | | | | |
| total | 0 | 0 | 0 | 0 | 0 |

total fishes in the whole area: 0
Note 1: no fish were observed

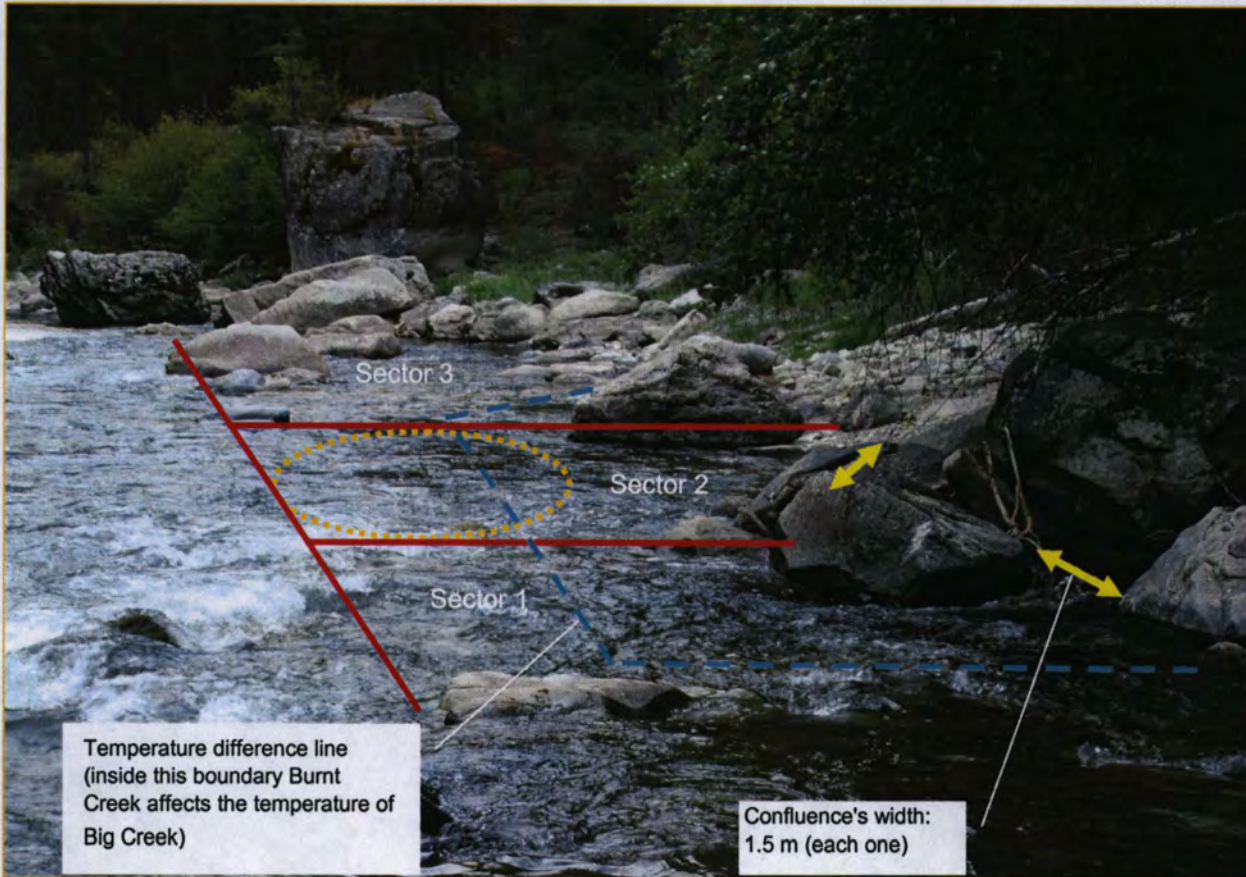
Date: 24 October Time: 21:30
Obs 12

temp Big Cr.: 7
temp Cougar 10.5
temp diff : 3.5

| | Sector 1 | Sector 2 | Sector 3 | Sector 4 | Sector 5 |
|---------------|----------|----------|----------|-----------|----------|
| Cutthroat ad. | | 1 | | 10 | |
| Whitefish ad. | | | | 1 | |
| Pikemin. ad. | | | | | |
| Bulltrout ad. | | | | | |
| Rainbow ad. | | | | | |
| Trout juv. | | | | 7 | |
| Chinook juv. | | | | | |
| others | | | | | |
| total | 0 | 1 | 0 | 18 | 0 |

total fishes in the whole area: 19
Note 1: sector 5 has not been snorkelled

Burnt Creek: all the observed sectors

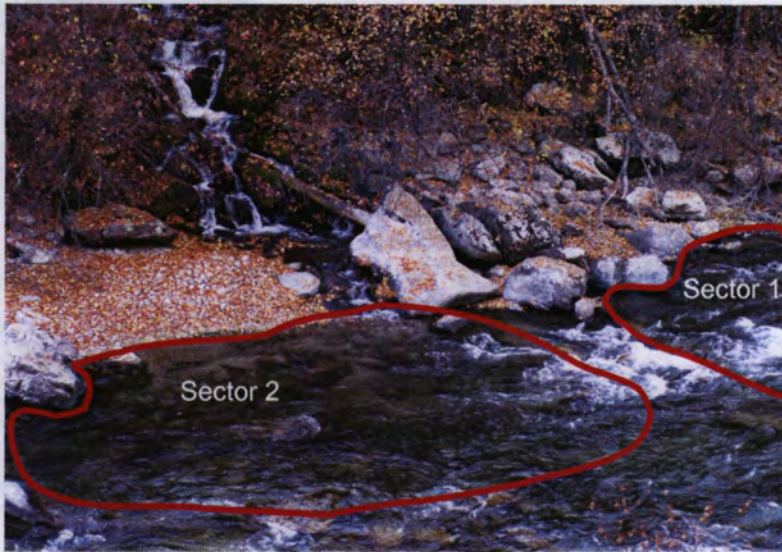


| | Length (m) | Depth (m) | Area (m ²) | % of total |
|--------------|---------------|--------------|---------------------------|---------------|
| Sector 1 | 5 | 0.9 | 25 | 20.66 |
| Sector 2 | 6 | 1.1 | 36 | 29.75 |
| Sector 3 | 10 | 1.2 | 60 | 49.59 |
| Total | 21 | 1.07 | 121 | 100.00 |

Note 1: This confluence is not very similar to the one of Pioneer and Cougar, since is divided in two. This affect the temperature effect on Big Creek, wich is smaller than in the other two streams.

Note 2: All the sector present more or less the same shape. This allows me to take every habitat preferences of the fishes away of my experiment.

Burnt Creek: the confluence area



Mean main-stem's width: 18m
Bottom of the whole area: 40% Cobble
 40% Boulders
 20% Gravel
Bottom of sectors 1, 2: 60% Cobble
 20% Boulders
 20% Gravel
Waterflow (from Burnt Creek): 14.04 Liter/second

Results of the snorkeling

Date: 2 September 2005 Time: 10:30

| | Sector 1 | Sector 2 | Sector 3 |
|---------------|----------|----------|----------|
| Cutthroat ad. | | | 2 |
| Whitefish ad. | | | |
| Pikemin. ad. | | | |
| Bulltrout ad. | | | |
| Rainbow ad. | | | |
| Trout juv. | | 1 | |
| Chinook juv. | | | |
| others | | | |
| total | 0 | 1 | 2 |

total fishes in the whole area: 3

■ sectors with temperature change dued to Burnt Cr.

temp Big Cr.: 11
 temp Burnt Cr: 8
 temp diff : -3

Date: 2 September 2005 Time: 17:00

temp Big Cr.: 14
temp Burnt Cr: 9
temp diff: -5

| | Sector 1 | Sector 2 | Sector 3 |
|---------------|----------|----------|----------|
| Cutthroat ad. | 1 | 5 | 3 |
| Whitefish ad. | | | |
| Pikemin. ad. | | | |
| Bulltrout ad. | | | |
| Rainbow ad. | | | |
| Trout juv. | | 2 | 4 |
| Chinook juv. | | | |
| others | | | |
| total | 1 | 7 | 7 |

total fishes in the whole area: 15

Note: The trout in sector 2 at 17:00 were not right at the confluence, but more in the middle. I can not say if this was due to my presence (I was snorkelling more on the side than in the middle) or if that is the normal situation (they were in the yellow sector).

Date: 24 October Time: 16:00

temp Big Cr.: 6
temp Burnt Cr: 7
temp diff: 1

| | Sector 1 | Sector 2 | Sector 3 |
|---------------|----------|----------|----------|
| Cutthroat ad. | | | 1 |
| Whitefish ad. | | | |
| Pikemin. ad. | | | |
| Bulltrout ad. | | | |
| Rainbow ad. | | | |
| Trout juv. | | | |
| Chinook juv. | | | |
| others | | | |
| total | 0 | 0 | 1 |

total fishes in the whole area: 1

Date: 24 October Time: 19:30

temp Big Cr.: 7
temp Burnt Cr: 8
temp diff: 1

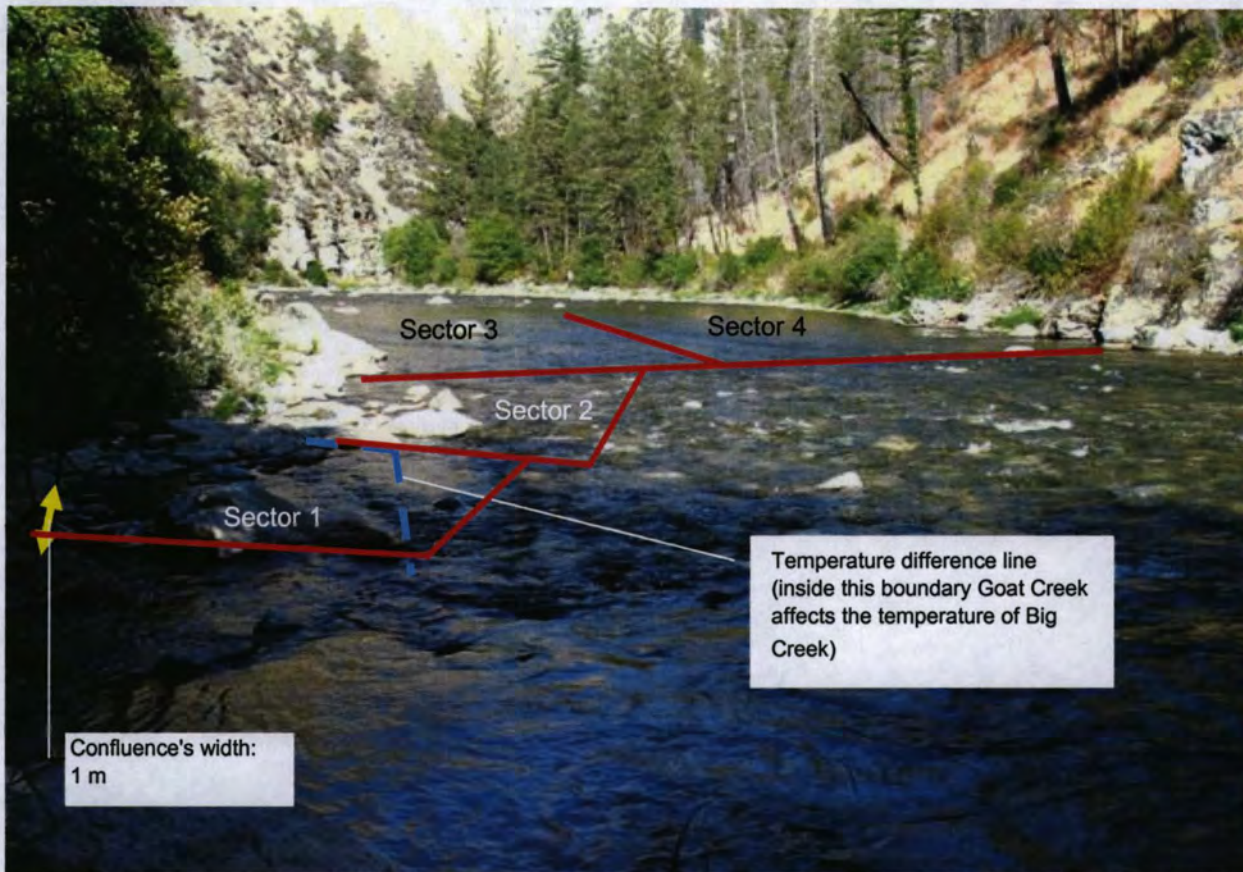
| | Sector 1 | Sector 2 | Sector 3 |
|---------------|----------|----------|----------|
| Cutthroat ad. | 1 | 2 | 4 |
| Whitefish ad. | | | |
| Pikemin. ad. | | | |
| Bulltrout ad. | | | |
| Rainbow ad. | | | |
| Trout juv. | | 2 | 5 |
| Chinook juv. | | | |
| others | | | |
| total | 1 | 4 | 9 |

total fishes in the whole area: 14

Note 1: the trout in sector 1 was swimming in direction of Burnt Creek

Note 2: the two trout in sector 2 were not right at the confluence

Goat Creek: all the observed sectors



| | Length (m) | Depth (m) | Area (m ²) | % of total |
|--------------|------------|------------|------------------------|------------|
| Sector 1 | 3 | 0.3 | 9 | 1.24 |
| Sector 2 | 16 | 0.3 | 64 | 8.85 |
| Sector 3 | 26 | 1.7 | 325 | 44.95 |
| Sector 4 | 26 | 1.6 | 325 | 44.95 |
| Total | 45 | --- | 723 | 100 |

Characteristics of the observed area:

Mean main-stem's width: 25m
Bottom of the whole area: 70% Cobble
 20% Gravel
 10% Boulders
Waterflow (from Goat Creek): 1.92 Liter/second

Note 1: sector 1 is very bad for fish since it is shallow, and does not allow a rapid escape of the fish in case of an attack

Note 2: sector 2 could be seen as a feeding riffle, but until now I wasn't able to test it

Note 3: Goat Creek have an effect on temperature for only 2 meters downstream and only 1.5 meters inside Big Creek, so there is almost no temperature attraction.

Goat Creek: The confluence area



Results of the snorkeling

Observation during the "Onion Project"

Temp Big Creek 64°F =18

Temp Goat Creek 59°F =15

Time: 15:00

Date: 29.07.05

10 Adult Cutthroat Trout in the whole area

4 Adult Cutthroat Trout were in sector 1

8 yoy trout were also in sector one behind the 4 CTa

Date: 25 August 2005 Time: 14:00

| | Sector 1 | Sector 2 | Sector 3 | Sector 4 |
|---------------|----------|----------|-----------|----------|
| Cutthroat ad. | | | 6 | |
| Whitefish ad. | | | 4 | |
| Pikemin. ad. | | | | |
| Bulltrout ad. | | | | |
| Rainbow ad. | | | | |
| Trout juv. | | | 1 | |
| Chinook juv. | | | | |
| others | 1 | | | |
| total | 1 | 0 | 11 | 0 |

sectors with temperature change dued to Goat Cr.

temp Big Cr.: 16

temp Goat Cr 11

temp diff : -5

total fishes in the whole area: 12

Note: sector 4 not snorkelled

Date: 25 August 2005 Time: 18:00

temp Big Cr.: 18
temp Goat Cr 12
temp diff : -6

| | Sector 1 | Sector 2 | Sector 3 | Sector 4 |
|---------------|----------|----------|-----------|----------|
| Cutthroat ad. | | | 6 | 2 |
| Whitefish ad. | | | 5 | 3 |
| Pikemin. ad. | | | | |
| Bulltrout ad. | | | | |
| Rainbow ad. | | | | |
| Trout juv. | | | 3 | |
| Chinook juv. | | | | |
| others | | | | |
| total | 0 | 0 | 14 | 5 |

total fishes in the whole area: 19

Date: 26 August 2005 Time: 8:00

temp Big Cr.: 12
temp Goat Cr 11
temp diff : -1

| | Sector 1 | Sector 2 | Sector 3 | Sector 4 |
|---------------|----------|----------|----------|----------|
| Cutthroat ad. | | | | |
| Whitefish ad. | | | | |
| Pikemin. ad. | | | | |
| Bulltrout ad. | | | | |
| Rainbow ad. | | | | |
| Trout juv. | | | | |
| Chinook juv. | | | | |
| others | | | 7 | 4 |
| total | 0 | 0 | 7 | 4 |

total fishes in the whole area: 11

Note: as for Cougar Cr, during this immersion there was very bad water visibility (less than 0.8 m) It was very difficult to recognise the fish, that's why they appear all under "others"

Note 2: sector 1 and 2 were anyway empty (checked out with flash light)

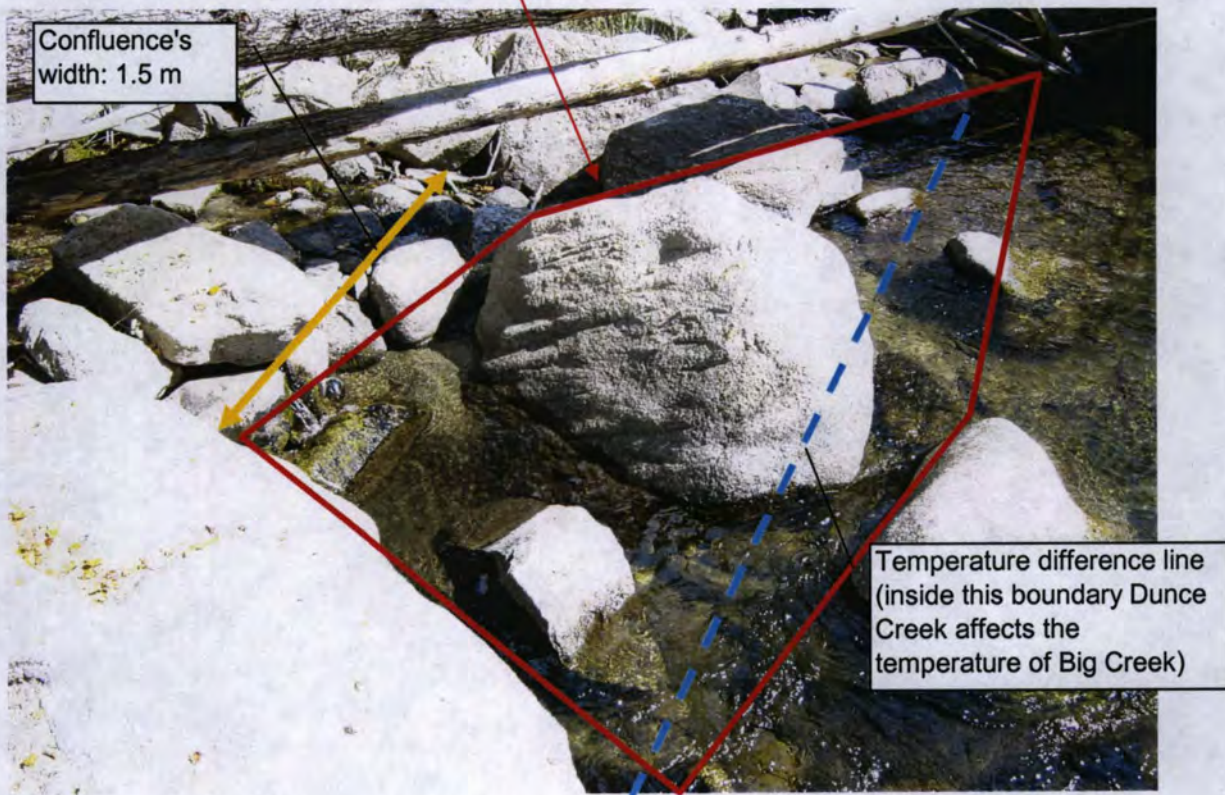
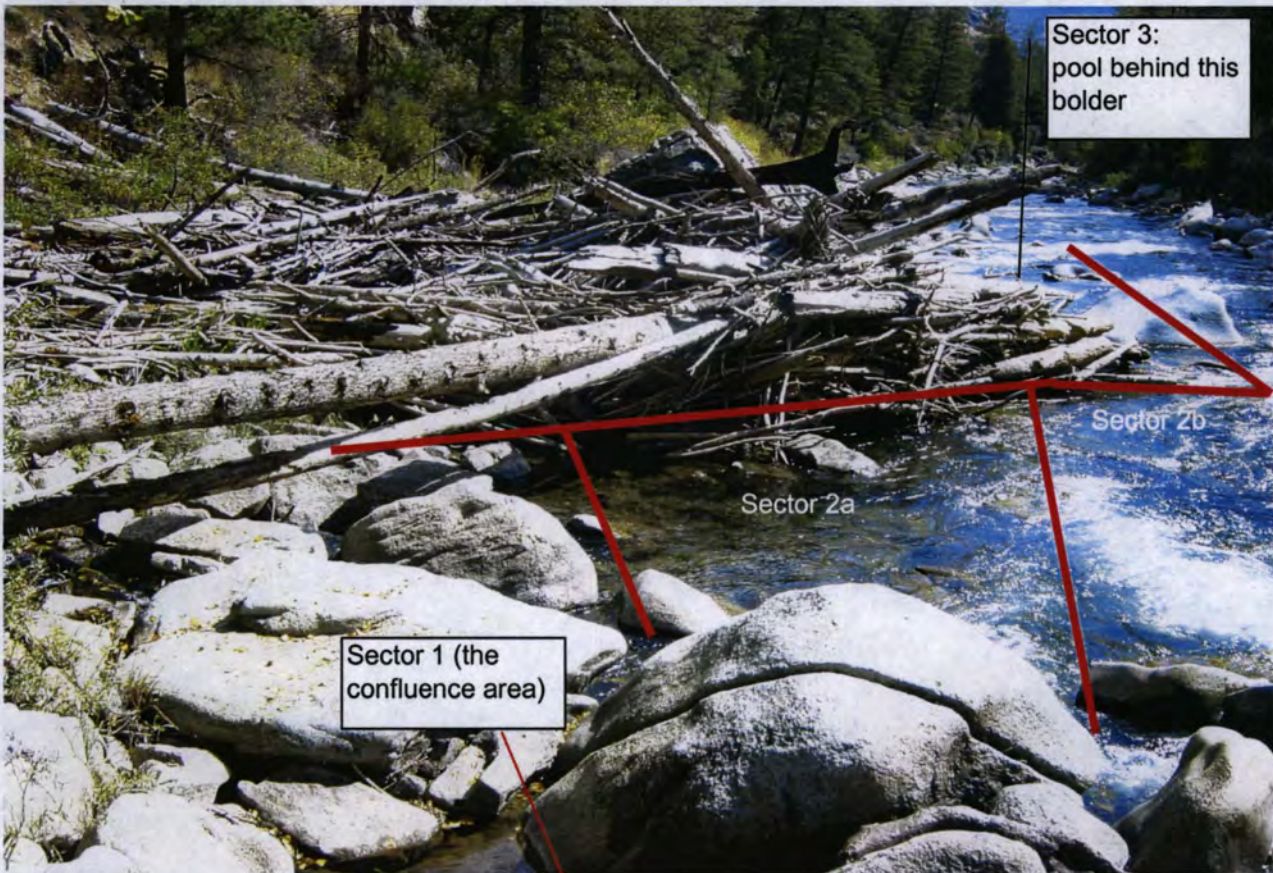
Date: 24 October Time: 13:40

temp Big Cr.: 6
temp Goat Cr 9
temp diff : 3

| | Sector 1 | Sector 2 | Sector 3 | Sector 4 |
|---------------|----------|----------|----------|----------|
| Cutthroat ad. | | | | 1 |
| Whitefish ad. | | | 2 | 6 |
| Pikemin. ad. | | | | |
| Bulltrout ad. | | | | |
| Rainbow ad. | | | | |
| Trout juv. | | | | |
| Chinook juv. | | | | |
| others | | | | 1 |
| total | 0 | 0 | 2 | 8 |

total fishes in the whole area: 10

Dunce Creek: all the observed sectors, and a zoom on sector 1




| | Length (m) | Depth (m) | Area (m2) | % of total |
|--------------|---------------|--------------|--------------|------------|
| Sector 1 | 2.5 | 0.3 | 2.5 | 1.47 |
| Sector 2a | 4 | 1.4 | 16 | 9.38 |
| Sector 2b | 8 | 2 | 32 | 18.77 |
| Sector 3 | 12 | 2 | 120 | 70.38 |
| Total | 20 | --- | 170.5 | 100 |

Characteristics of the observed area:

Mean main-stem's width: 20m
Bottom of the whole area: 60% Boulders
20% Cobble
20% Gravel
Waterflow (from Pioneer Creek): 3.19 Liter/second

Note 1: As for Goat Creek, Dunce Cr has very little temperature effect on Big Cr. There is anyway a very big difference in the shape of the confluence. Dunce Creek enters in a very beautiful pool. For my study, I consider only sector 1 as temperature-attractive, and look at the fishes position in sector 2a-2b and at their swim-direction.

Results of the snorkeling

 sectors with temperature change due to Dunce Cr.

Date: 2 September 2005 Time: 10:00

temp Big Cr.: 11
temp Dunce C: 10
temp diff: -1

| | Sector 1 | Sector 2a | Sector 2b | Sector 3 |
|---------------|----------|-----------|-----------|----------|
| Cutthroat ad. | | | 2 | 1 |
| Whitefish ad. | | | 2 | 4 |
| Pikemin. ad. | | | | |
| Bulltrout ad. | | | | |
| Rainbow ad. | | | | |
| Trout juv. | | | | 1 |
| Chinook juv. | | | | |
| others | | | | |
| total | 0 | 0 | 4 | 6 |

total fishes in the whole area: 10

Date: 2 September 2005 Time: 18:00

temp Big Cr.: 14
temp Dunce C: 12
temp diff: -2

| | Sector 1 | Sector 2a | Sector 2b | Sector 3 |
|---------------|----------|-----------|-----------|----------|
| Cutthroat ad. | | | 3 | 1 |
| Whitefish ad. | | | | 4 |
| Pikemin. ad. | | | | |
| Bulltrout ad. | | | | |
| Rainbow ad. | | | | |
| Trout juv. | 1 | | | 1 |
| Chinook juv. | | | | |
| others | | | | |
| total | 1 | 0 | 3 | 6 |

total fishes in the whole area: 10

Note: the fish in sector 2 did not seem to specially attracted by Dunce Creek.

I think that the pool is attractive for the fish for ist shape, and not because of Dunce Creek.

Date: 24 October Time: 15:00

temp Big Cr.: 6
temp Dunce C: 11
temp diff: 5

| | Sector 1 | Sector 2a | Sector 2b | Sector 3 |
|---------------|----------|-----------|-----------|----------|
| Cutthroat ad. | | | | 1 |
| Whitefish ad. | | | | |
| Pikemin. ad. | | | | |
| Bulltrout ad. | | | | |
| Rainbow ad. | | | | |
| Trout juv. | | | | |
| Chinook juv. | | | | |
| others | | | | |
| total | 0 | 0 | 0 | 1 |

total fishes in the whole area: 1

Date: 24 October Time: 20:00

temp Big Cr.: 7
temp Dunce C: 11
temp diff: 4

| | Sector 1 | Sector 2a | Sector 2b | Sector 3 |
|---------------|----------|-----------|-----------|-----------|
| Cutthroat ad. | | | | 7 |
| Whitefish ad. | | | | |
| Pikemin. ad. | | | | |
| Bulltrout ad. | | | | |
| Rainbow ad. | | | | |
| Trout juv. | 2 | 1 | | 14 |
| Chinook juv. | | | | |
| others | | | | |
| total | 2 | 1 | 0 | 21 |

total fishes in the whole area: 24

Note 1: sector 2b has not been snorkelled

Note 2: the juvenile in sector 1 was not right at the confluence

Selection for confluence habitats in relationship with temperatue difference, day-time and production for all the streams

| Stream: | | Date | Time | Saison | selection for confluence habitat | Day / Night | Tempera-ture Big Creek | tempera-ture difference | productivity | Spatial effect | | | | |
|----------|--------|------|-----------|--------|--|-------------|---------------------------|----------------------------|--------------|----------------|--------|---|--------|----|
| CLIFF: | Obs 1 | 1 | 8/6/2005 | 18:00 | Summer | yes | 1 | sunset | 21 | -5 | high | 3 | big | 3 |
| CLIFF: | Obs 2 | 1 | 8/6/2005 | 0:00 | Summer | yes | 1 | night | 19 | -5 | max | 4 | big | 3 |
| CLIFF: | Obs 3 | 1 | 8/7/2005 | 6:00 | Summer | yes | 1 | sunrise | 15 | -2 | max | 4 | big | 3 |
| CLIFF: | Obs 4 | 1 | 8/7/2005 | 12:00 | Summer | yes | 1 | day | 20 | -5 | high | 3 | big | 3 |
| CLIFF: | Obs 5 | 1 | 8/10/2005 | 18:00 | Summer | yes | 1 | sunset | 21 | -5 | high | 3 | big | 3 |
| CLIFF: | Obs 6 | 1 | 8/10/2005 | 22:00 | Summer | yes | 1 | night | 17 | -3 | max | 4 | big | 3 |
| CLIFF: | Obs 7 | 1 | 8/11/2005 | 22:00 | Summer | yes | 1 | night | 17 | -3 | max | 4 | big | 3 |
| CLIFF: | Obs 8 | 1 | 8/15/2005 | 14:00 | Summer | yes | 1 | day | 19 | -6 | high | 3 | big | 3 |
| CLIFF: | Obs 9 | 1 | 8/15/2005 | 22:00 | Summer | yes | 1 | night | 16 | -3 | max | 4 | big | 3 |
| CLIFF: | Obs 10 | 1 | 8/16/2005 | 6:00 | Summer | yes | 1 | sunrise | 13.5 | -1.5 | max | 4 | normal | 2 |
| CLIFF: | Obs 11 | 1 | 8/16/2005 | 18:00 | Summer | yes | 1 | sunset | 18 | -3 | high | 3 | normal | 2 |
| CLIFF: | Obs 12 | 1 | 8/18/2005 | 18:00 | Summer | yes | 1 | sunset | 19 | -6 | high | 3 | normal | 2 |
| CLIFF: | Obs 13 | 1 | 8/20/2005 | 11:30 | Summer | yes | 1 | day | 14 | -1 | high | 3 | normal | 2 |
| CLIFF: | Obs 14 | 1 | 9/4/2005 | 10:00 | Summer | yes | 1 | day | 10 | -2 | high | 3 | normal | 2 |
| CLIFF: | Obs 15 | 1 | 9/4/2005 | 18:00 | Summer | yes | 1 | sunset | 16 | -4 | high | 3 | normal | 2 |
| PIONEER: | Obs 1 | 1 | 8/15/2005 | 14:00 | Summer | yes | 1 | Day | 19 | -6 | medium | 2 | big | 3 |
| PIONEER: | Obs 2 | 1 | 8/15/2005 | 22:00 | Summer | yes | 1 | night | 16 | -4 | high | 3 | big | 3 |
| PIONEER: | Obs 3 | 1 | 8/16/2005 | 6:00 | Summer | yes | 1 | sunrise | 13.5 | -3.5 | high | 3 | big | 3 |
| PIONEER: | Obs 4 | 1 | 8/18/2005 | 18:00 | Summer | yes | 1 | sunset | 20 | -7 | medium | 2 | big | 3 |
| PIONEER: | Obs 5 | 1 | 8/19/2005 | 22:00 | Summer | yes | 1 | night | 18 | -6 | high | 3 | big | 3 |
| PIONEER: | Obs 6 | 1 | 8/20/2005 | 11:30 | Summer | no | 0 | day | 14 | -3 | medium | 2 | normal | 2 |
| PIONEER: | Obs 7 | 1 | 9/4/2005 | 10:00 | Summer | no | 0 | day | 10 | -3 | medium | 2 | normal | 2 |
| PIONEER: | Obs 8 | 1 | 9/4/2005 | 18:00 | Summer | no | 0 | sunset | 16 | -4 | medium | 2 | normal | 2 |
| COUGAR: | Onion | 1 | 7/29/2005 | 16:30 | Summer | yes | 1 | day | 18 | -6.5 | medium | 2 | big | 3 |
| COUGAR: | Obs 1 | 1 | 8/8/2005 | 18:00 | Summer | yes | 1 | sunset | 20.5 | -4.5 | medium | 2 | big | 3 |
| COUGAR: | Obs 2 | 1 | 8/8/2005 | 0:00 | Summer | yes | 1 | night | 18 | -3 | high | 3 | big | 3 |
| COUGAR: | Obs 3 | 1 | 8/9/2005 | 6:00 | Summer | yes | 1 | sunrise | 16.5 | -2.5 | high | 3 | big | 33 |
| COUGAR: | Obs 4 | 1 | 8/9/2005 | 12:00 | Summer | yes | 1 | day | 19 | -4 | medium | 2 | big | 3 |
| COUGAR: | Obs 5 | 1 | 8/25/2005 | 13:00 | Summer | no | 0 | day | 14 | -3 | medium | 2 | normal | 2 |
| COUGAR: | Obs 6 | 1 | 8/25/2005 | 19:30 | Summer | no | 0 | night | 18 | -6 | medium | 2 | normal | 2 |
| COUGAR: | Obs 7 | 1 | 8/26/2005 | 7:40 | Summer | no | 0 | sunrise | 12 | -2 | medium | 2 | normal | 2 |
| GOAT: | Onion | 1 | 7/29/2005 | 14:00 | Summer | yes | 1 | day | 18 | -3 | low | 1 | little | 1 |

Yes + sunrise = 4 (80% of the sunrise observations showed selection for confluence habitat)
Yes+sunrise+summer = 4 (only in the summer sunrise selection was observed)
Yes+sunrise+fall = 0

Yes + sunset = 7 (53.84% of the sunset observations showed selection for confluence habitat)
Yes+sunset+summer = 7 (only in the summer sunrise selection was observed)
Yes+sunset+fall = 0

Legend: **Temperature difference**
always given in negative numbers if tributaries are cooler than Big Creek

Productivity classes (see file "Water's volume and insects per day")

max = 4 (means more than 200 insects per hour)
high = 3 (means between 90 and 200 insects per hour)
medium = 2 (means between 50 and 90 insects per hour)
low = 1 (means between 10 and 50 insects per hour)
min = 0 (meansbetween 0 and 9 insects per hour)

Day / Night

Day (+1) = from 07:00am to 20:00
Night (-1) = from 21:00 to 06:00 am

selection for confluence habitat

yes means that there were fish in the confluence sector
no means that there weren't fish, or that the ones that were there
were not right by the confluence

Spatial effect (means the spatial extension of the temperature effect of the stream in Big Creek)

big = 3 more than one meter inside the river and more 5 metres downstream
normal = 2 at least on meter inside the river and between 2 and 5 meters downstream
little = 1 at least on meter inside the river and between 1 and 2 metres downstream
none = 0 less than 1 meter inside the river and less than 1 meter downstream

Use versus availability

Cliff Creek

SUMMER

| day-time | Tot observed CTad | tot CTad in sector 5 | % | tot CTad in sector 5a | % | use vs availability |
|----------|-------------------------|-------------------------|--------|--------------------------|--------|------------------------|
| Sunset | 8 | 4 | 50.00 | | | 5.14 |
| Night | 2 | 2 | 100.00 | | | 2.35 |
| Sunrise | 6 | 4 | 66.67 | | | 1.57 |
| Day | 15 | 6 | 40.00 | | | 4.12 |
| Sunset | 10 | | | 7 | 70.00 | 56.00 |
| Night | 4 | | | 4 | 100.00 | 7.78 |
| Night | 6 | 3 | 50.00 | | | 1.18 |
| Day | 19 | 6 | 31.58 | | | 3.25 |
| Night | 3 | | | 3 | 100.00 | 7.78 |
| Sunrise | 3 | | | 3 | 100.00 | 7.78 |
| Sunset | 7 | | | 4 | 57.14 | 45.71 |
| Sunset | 12 | | | 4 | 33.33 | 26.67 |
| Day | 8 | | | 4 | 50.00 | 40.00 |
| Day | 2 | | | 2 | 100.00 | 18.31 |
| Sunset | 0 | | | 0 | 0.00 | 0.00 |

mean (observation with fish): **16.26**

mean only day: **16.42**

mean only night: **4.77**

FALL

| day-time | Tot observed CTad | tot CTad in sector 5 | % | tot CTad in sector 5a | % | use vs availability |
|----------|-------------------------|-------------------------|--------|--------------------------|--------|------------------------|
| Day | 5 | 0 | 0.00 | | | 0.00 |
| Day | 1 | 1 | 100.00 | | | 2.35 |
| Night | 0 | 0 | 0.00 | | | 0.00 |
| Day | 3 | | | 1 | 33.33 | 26.67 |
| Night | 1 | | | 1 | 100.00 | 18.31 |
| Night | 0 | | | 0 | | 0.00 |
| Day | 0 | | | 0 | | 0.00 |
| Day | 0 | | | 0 | | 0.00 |
| Night | 10 | 2 | 20.00 | | | 1.04 |

mean (observation with fish): **9.68**

mean only day: **9.67**

mean only night: **9.68**

Cougar Creek

SUMMER

| day-time | Tot observed CTad | tot CTad in sectors 1-2-3 | % | use vs availability |
|----------|-------------------------|---------------------------------|----|------------------------|
| Sunset | 4 | 3 | 75 | 7.34 |
| Night | 6 | 3 | 50 | 4.89 |
| Sunrise | 4 | 1 | 25 | 2.45 |
| Day | 5 | 3 | 60 | 5.87 |
| Day | 5 | 0 | 0 | 0.00 |
| Sunset | 7 | 0 | 0 | 0.00 |
| Sunrise | 1 | 0 | 0 | 0.00 |

mean: 2.94
mean only day: 2.94
mean only night: 4.89

FALL

| day-time | Tot observed CTad | tot CTad in sectors 1-2-3 | % | use vs availability |
|----------|-------------------------|---------------------------------|----------|------------------------|
| Day | 0 | 0 | 0 | 0.00 |
| Day | 0 | 0 | 0 | 0.00 |
| Night | 14 | 1 | 7.142857 | 0.70 |
| Day | 0 | 0 | 0 | 0.00 |
| Night | 11 | 1 | 9.090909 | 0.89 |

mean: 0.79
mean only day: ---
mean only night: 0.79

Dunce Creek

use versus availability for Summer and Fall = 0

Water Volume for Cliff, Pioneer, Cougar, Burnt, Goat and Dunce

Cliff Creek

Water Volume

| | counts /sec | cm/s | width (cm) | depth (cm) | liters /sec | % of total |
|-----------------------------|-------------|-------------|------------|------------|--------------|--------------|
| Sector 1 | 2.50 | 8.27 | 40 | 15 | 4.96 | 43.47 |
| Sector 2 | 1.57 | 5.81 | 80 | 6 | 2.79 | 24.42 |
| Sector 3 | 1.77 | 6.34 | 20 | 9 | 1.14 | 9.99 |
| Sector 4 | 2.10 | 7.22 | 70 | 5 | 2.53 | 22.12 |
| Total liters / sec = | | | | | 11.42 | 100 |

Insect drift / liter water day

August (insects per 30 min)

August

| | | | |
|-------|----|-----------------------------|-----|
| 16:00 | 23 | insects per hour at 16:00 = | 106 |
| 18:00 | 22 | insects per hour at 18:00 = | 101 |
| 20:00 | 27 | insects per hour at 20:00 = | 124 |
| 22:00 | 89 | insects per hour at 22:00 = | 409 |
| 0:00 | 86 | insects per hour at 00:00 = | 396 |
| 2:00 | 47 | insects per hour at 02:00 = | 216 |
| 4:00 | 53 | insects per hour at 04:00 = | 244 |
| 6:00 | 42 | insects per hour at 06:00 = | 193 |
| 8:00 | 21 | insects per hour at 08:00 = | 97 |
| 10:00 | 24 | insects per hour at 10:00 = | 110 |
| 12:00 | 21 | insects per hour at 12:00 = | 97 |
| 14:00 | 19 | insects per hour at 14:00 = | 87 |

| | |
|---|-------------|
| Total insect during the day = | 4362 |
| Total insects during night time = | 2625 |
| Total insects during day time = | 1736 |
| Mean insects per hour = | 182 |
| Mean insects per hour during the night = | 292 |
| Mean insects per hour during the day = | 103 |

September

| | |
|-------------------------------|-----|
| nr insect per hour at 10:00 = | 87 |
| nr insect per hour at 16:00 = | 55 |
| nr insect per hour at 22:00 = | 123 |

| | |
|---|-------------|
| Total insect during the day = | 2123 |
| Total insects during night time = | |
| Total insects during day time = | |
| Mean insects per hour = | 88 |
| Mean insects per hour during the night = | 123 |
| Mean insects per hour during the day = | 71 |

Pioneer Creek

Water Volume

| | counts /sec | cm/s | width (cm) | depth (cm) | liters /sec | % of total |
|-----------------------------|-------------|-------------|------------|------------|--------------|--------------|
| Sector 1 | 2.80 | 9.06 | 60 | 17 | 9.25 | 76.28 |
| Sector 2 | 1.07 | 4.49 | 80 | 8 | 2.87 | 23.72 |
| Total liters / sec = | | | | | 12.12 | 100 |

Insect drift / liter water day

August (insects per 30 min)

August

| | | | |
|-------|----|-----------------------------|-----|
| 14:00 | 19 | insects per hour at 14:00 = | 50 |
| 22:00 | 60 | insects per hour at 22:00 = | 157 |
| 2:00 | 54 | insects per hour at 02:00 = | 142 |
| 6:00 | 37 | insects per hour at 06:00 = | 97 |
| 10:00 | 25 | insects per hour at 10:00 = | 66 |

| | |
|---|-------------|
| Total insect during the day = | 2454 |
| Total insects during night time = | 1589 |
| Total insects during day time = | 865 |
| Mean insects per hour = | 102 |
| Mean insects per hour during the night = | 132 |
| Mean insects per hour during the day = | 58 |

September

| | |
|-------------------------------|-----|
| nr insect per hour at 10:00 = | 45 |
| nr insect per hour at 16:00 = | 24 |
| nr insect per hour at 22:00 = | 128 |

| | |
|---|-------------|
| Total insect during the day = | 1573 |
| Total insects during night time = | |
| Total insects during day time = | |
| Mean insects per hour = | 66 |
| Mean insects per hour during the night = | 128 |
| Mean insects per hour during the day = | 34 |

Cougar Creek

Water Volume

| | counts /sec | cm/s | width (cm) | depth (cm) | liters /sec | % of total |
|-----------------------------|-------------|-------------|------------|------------|--------------|--------------|
| Sector 1 | 3.00 | 9.59 | 40 | 23 | 8.82 | 84.35 |
| Sector 2 | 0.33 | 2.56 | 80 | 8 | 1.64 | 15.65 |
| Total liters / sec = | | | | | 10.46 | 100 |

Insect drift / liter water day

August (insects per 30 min)

August

| | | | |
|-------|-----|-----------------------------|-----|
| 16:00 | 16 | insects per hour at 16:00 = | 38 |
| 18:00 | 17 | insects per hour at 18:00 = | 40 |
| 20:00 | 18 | insects per hour at 20:00 = | 43 |
| 22:00 | 110 | insects per hour at 22:00 = | 261 |
| 0:00 | 77 | insects per hour at 00:00 = | 183 |
| 2:00 | 59 | insects per hour at 02:00 = | 140 |
| 6:00 | 54 | insects per hour at 06:00 = | 128 |
| 8:00 | 35 | insects per hour at 08:00 = | 83 |
| 10:00 | 27 | insects per hour at 10:00 = | 64 |
| 12:00 | 21 | insects per hour at 12:00 = | 50 |

| | |
|---|-------------|
| Total insect during the day = | 2470 |
| Total insects during night time = | 1600 |
| Total insects during day time = | 869 |
| Mean insects per hour = | 103 |
| Mean insects per hour during the night = | 178 |
| Mean insects per hour during the day = | 53 |

September

| | |
|-------------------------------|----|
| nr insect per hour at 10:00 = | 21 |
| nr insect per hour at 16:00 = | 17 |
| nr insect per hour at 22:00 = | 47 |

| | |
|--|------------|
| Total insect during the day = | 683 |
| Total insects during night time = | 47 |
| Total insects during day time = | 19 |
| Mean insects per hour = | 28 |

Burnt Creek

Water Volume

| | counts /sec | cm/s | width (cm) | depth (cm) | liters /sec | % of total |
|-----------------------------|-------------|------|------------|------------|--------------|------------|
| Sector 1 | 2.17 | 7.39 | 85 | 17 | 10.68 | 76.11 |
| Sector 2 | 1.50 | 5.63 | 85 | 7 | 3.35 | 23.89 |
| Total liters / sec = | | | | | 14.04 | 100 |

Dunce Creek

Water Volume

| | counts /sec | cm/s | width (cm) | depth (cm) | liters /sec | % of total |
|-----------------------------|-------------|------|------------|------------|-------------|------------|
| Sector 1 | 1.67 | 6.07 | 75 | 7 | 3.19 | 100.00 |
| Total liters / sec = | | | | | 3.19 | 100 |

Goat Creek

Water Volume

| | counts /sec | cm/s | width (cm) | depth (cm) | liters /sec | % of total |
|-----------------------------|-------------|------|------------|------------|-------------|------------|
| Sector 1 | 0.67 | 3.44 | 70 | 8 | 1.92 | 100.00 |
| Total liters / sec = | | | | | 1.92 | 100 |

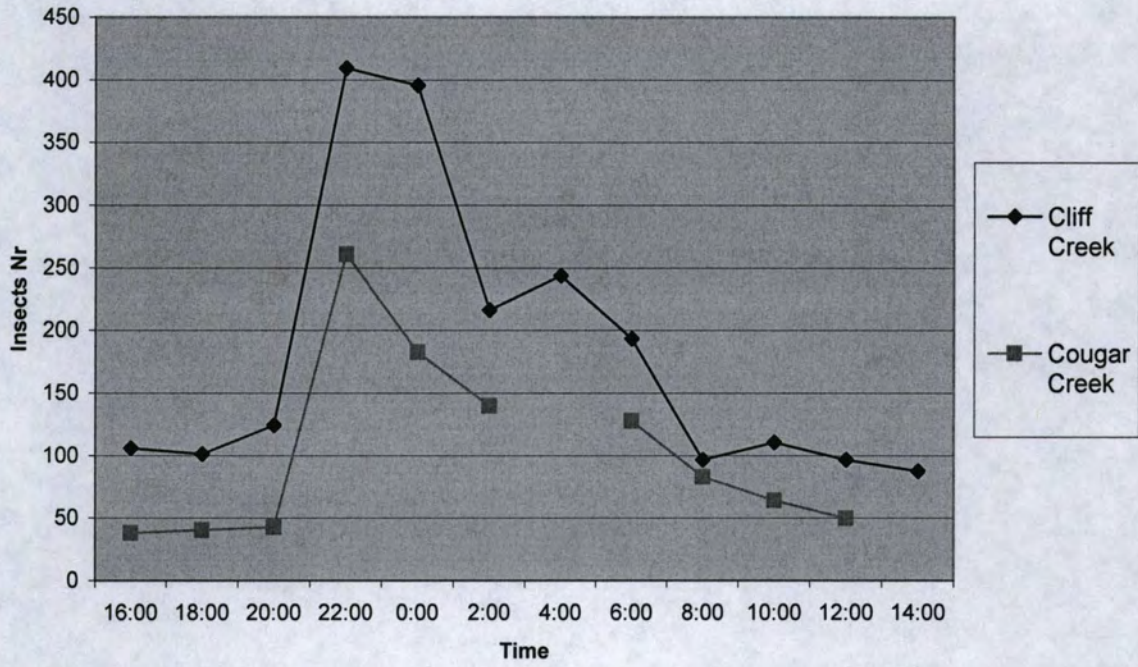
Resuming table for all the streams

productivity (numbers insects per hour)

| Creek | Liter / sec | Summer total | Summer day-time | Summer night-time | Fall total | Fall day | Fall night |
|---------|-------------|--------------|-----------------|-------------------|------------|----------|------------|
| Cliff | 11.42 | 4362 | 103 | 292 | 2123 | 71 | 123 |
| Pioneer | 12.12 | 4350 | 58 | 132 | 1573 | 34 | 128 |
| Cougar | 10.46 | 2470 | 53 | 178 | 683 | 19 | 47 |
| Burnt | 14.04 | --- | --- | --- | --- | --- | --- |
| Dunce | 3.19 | --- | --- | --- | --- | --- | --- |
| Goat | 1.92 | --- | --- | --- | --- | --- | --- |

Legend: high = more than 4000 insects per day
 medium = between 2000 and 2500 insects per day
 low = insects per day < 1500

Insects Drift from Cliff Creek and Cougar Creek



Temperatures of each tributary and of Big Creek during the summer

| | | 6 August to 15 August | 16 August to 4 September |
|----------------------|-------------|-----------------------|--------------------------|
| <i>Big Creek</i> | <i>max</i> | 21.77 | 20.78 |
| | <i>min</i> | 12.71 | 10.40 |
| | <i>mean</i> | 17.31 | 15.35 |
| <i>Cliff Creek</i> | <i>max</i> | 23.24 | 23.24 |
| | <i>min</i> | 9.82 | 8.23 |
| | <i>mean</i> | 13.76 | 12.29 |
| <i>Cougar Creek</i> | <i>max</i> | 15.23 | 14.09 |
| | <i>min</i> | 10.60 | 9.03 |
| | <i>mean</i> | 13.18 | 11.74 |
| <i>Goat Creek</i> | <i>max</i> | 14.09 | 13.32 |
| | <i>min</i> | 9.82 | 7.83 |
| | <i>mean</i> | 12.32 | 10.81 |
| <i>Pioneer Creek</i> | <i>max</i> | 16.76 | 13.70 |
| | <i>min</i> | 7.83 | 6.22 |
| | <i>mean</i> | 10.84 | 9.65 |
| <i>Burnt Creek</i> | <i>max</i> | 12.55 | 10.99 |
| | <i>min</i> | 9.03 | 7.43 |
| | <i>mean</i> | 10.83 | 9.61 |
| <i>Dunce Creek</i> | <i>max</i> | 14.09 | 13.70 |
| | <i>min</i> | 11.77 | 10.60 |
| | <i>mean</i> | 13.15 | 12.36 |

Temperatures differences between each tributary and Big Creek during the summer

| | | 6 August to 15 August | 16 August to 4 September |
|----------------|-------------|-----------------------|--------------------------|
| <i>Cliff</i> | <i>max</i> | 7.5 | 7.59 |
| | <i>min</i> | -4.6 | -6.45 |
| | <i>mean</i> | 3.66 | 3.1 |
| <i>Cougar</i> | <i>max</i> | 7.14 | 7.46 |
| | <i>min</i> | 1.33 | 0.98 |
| | <i>mean</i> | 4.24 | 3.65 |
| <i>Goat</i> | <i>max</i> | 8.07 | 8.14 |
| | <i>min</i> | 2.5 | 2.2 |
| | <i>mean</i> | 5.1 | 4.58 |
| <i>Pioneer</i> | <i>max</i> | 9.01 | 9.4 |
| | <i>min</i> | 1.28 | -0.52 |
| | <i>mean</i> | 6.58 | 5.74 |
| <i>Burnt</i> | <i>max</i> | 9.79 | 10.18 |
| | <i>min</i> | 3.29 | 2.57 |
| | <i>mean</i> | 6.59 | 5.78 |
| <i>Dunce</i> | <i>max</i> | 7.68 | 7.46 |
| | <i>min</i> | 0.55 | -0.28 |
| | <i>mean</i> | 4.28 | 3.03 |