Natural Resources Internship Program

Final Report for Study (701814C150)

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ABSTRACT

The Kuskokwim River is the second largest river in Alaska, draining an area approximately 130,000 km^2 and supports an annual average subsistence and commercial harvest of nearly one million salmon (*Oncorhynchus spp.*). The goal of salmon management in the Kuskokwim River is to provide for long-term sustainable fisheries. Historically, Kuskokwim River community members have felt removed from the fisheries management process. This lack of local involvement translated into local community mistrust of both state and federal management agencies. More recently, management actions and monitoring projects are receiving stronger support from Kuskokwim River communities and residents. It has taken specific actions such as the KNA Natural Resources Internship Program and other efforts to build positive working relationships and to foster respectful communication. The Natural Resources Internship Program was incorporated in 1998 by the Kuskokwim Native Association to the George River and Tatlawiksuk River weir projects, and in 2001 to the Kalskag fish wheel project. A total of 128 internships for students ages 14-17 have been provided since program inception. Annually 85% of students have completed their assignments and received the stipend provided by the program. The success of this program has resulted in increased student involvement, student awareness, community support, and local employment opportunities.

INTRODUCTION

The Kuskokwim River is the second largest river in Alaska, draining an area approximately 130,000 km^2 (Brown 1983). Each year mature Pacific salmon (*Oncorhynchus spp.*) return to the river and its tributaries to spawn, supporting an annual average subsistence and commercial harvest of nearly one million salmon (Whitmore et al. 2005). The subsistence salmon fishery in the Kuskokwim Area is one of the largest in the state, and remains a fundamental component of the local culture and economy (ADF&G 2004; Coffing 1991, *unpublished* a, b; Coffing et al. 2000; Whitmore et al. 2005). The commercial salmon fishery, though modest in value compared to other areas of Alaska, has been an important component of the market economy of lower Kuskokwim River communities (Buklis 1999; Whitmore et al. 2005). Sport fishermen have begun to travel to the Kuskokwim drainage in the past several years for the Chinook salmon (*O. tshawytscha*) fishing. Although this increase in sport fishing has been viewed as substantial by local community members; the catch, effort, and harvest for Chinook salmon in the Kuskokwim River area from sport fishing is relatively low compared to other areas of the state (Stuby 2005). Between 1993 and 2002, the average sport harvest of Chinook salmon within the entire Kuskokwim River drainage as a proportion of the total utilization of this species was only 0.8% and between 1998 and 2002 only 0.6% (Lafferty 2004).

The goal of salmon management in the Kuskokwim River is to provide for long-term sustainable fisheries. Legally the state must also give priority for subsistence use before commercial harvests may be considered. Scheduled openings by time and area for commercial fisheries, subsistence windows openings and closures, and test fisheries are some of the tools implemented over the years to manage Kuskokwim River salmon fisheries. In addition, successful management of long-term sustainable salmon fisheries requires an array of escapement monitoring projects that reliably measure the adequacy of annual escapement to key spawning systems and track temporal and spatial patterns in abundance (Hildebrand et al. *in prep*). The need for long-term escapement monitoring projects was supported in September 2000, when the Alaska Board of Fisheries (BOF) classified both Kuskokwim River Chinook and chum salmon as “stocks of yield concerns” (5 AAC 39.222, 2001) (Burkey et al. 2000a, b).

Historically, management actions and monitoring projects have received little support and sometimes even opposition from Kuskokwim River communities and residents due to fear of unwanted regulations and concerns for the sustainability of fisheries resources. Kuskokwim River communities and residents have historically felt removed from the fisheries management decision making process. The lack of local involvement in fisheries management and monitoring projects translated into mistrust of both state and federal management agencies and the data they gathered. More recently; however, management actions and monitoring projects are receiving stronger support from Kuskokwim River communities and residents. It has taken specific actions such as increased local hire and community involvement in monitoring projects and local advisory groups such as the Kuskokwim River Salmon Management Working Group and Federal Regional Advisory Councils to build positive working relationships and to foster

respectful communication (Whitmore and Martz 2005). It is widely accepted that community involvement in fisheries management is essential (Nielsen 1999; Hartley 2006) and the more involved that communities are the more respect they will have toward the management process (Meffe et al. 2002). The Kuskokwim area has proven to be no different than other areas. The recent improvement in the fisheries management process has been due, in part, to the Kuskokwim Native Association (KNA) Fisheries Department personnel representation at advisory group meetings, participation in cooperative monitoring projects, and sponsorship of internship programs (both college and high school).

Specifically, increased community support has been generated by the KNA Natural Resources Internship Program. The purpose of this program is to increase local involvement in fisheries monitoring and management processes by fostering relationships between agencies and local communities through engaging youth and thus communities in fisheries monitoring projects.

There are five objectives to this program:

1. Facilitate regional youth in developing an understanding of subsistence fisheries issues by working closely with fisheries technicians and biologists.
2. Teach each intern basic salmon management and conservation concepts.
3. Diversify the employment opportunities of area residents, and develop a skilled pool of future technicians to work in the growing field of fisheries management.
4. Encourage participants to pursue higher education and full-time careers in natural resource management.
5. Foster community involvement, acceptance, and ownership of research and monitoring projects.

METHODS

Study Area

George River and Tatlawiksuk River Weirs

The George River and Tatlawiksuk River weirs are salmon escapement monitoring projects located 7 rkm upstream of the mouth of the George River, and 3 rkm upstream of the mouth of the Tatlawiksuk River, respectively. The projects began in 1996 and 1998 and are cooperatively run by the Alaska Department of Fish and Game (ADF&G), Commercial Fisheries Division and KNA. The Natural Resources Internship Program was incorporated into these projects in 1998. Related projects supported by these weirs include projects funded by the Office of Subsistence Management (OSM) Fisheries Resource Monitoring Program (FRMP) and the Arctic Yukon Kuskokwim Sustainable Salmon Initiative (AYK SSI): *Inriver Abundance of Chinook Salmon in the Kuskokwim River (FRMP 02-015), Kuskokwim River Salmon Mark-Recapture Project (FRMP 04-308), Chinook Salmon Run Reconstruction (AYK SSI #612), and Kuskokwim River Sockeye Salmon Investigations (AYK SSI #618).*

Kalskag Fish Wheels

The Kalskag fish wheels are an ongoing mark-recapture project whose location has shifted over the years and has ranged from just downstream of Kalskag to about 10 miles downstream of Aniak. The current location is about 4 miles upstream of Kalskag on the mainstem Kuskokwim River. The project began in 2001 and is cooperatively run by ADF&G, Commercial Fisheries Division and KNA. The Natural Resources Internship Program has been incorporated into this project since its inception. Related projects supported by the Kalskag fish wheels include: *Inriver Abundance of Chinook Salmon in the Kuskokwim River (FRMP 02-015), Kuskokwim River Salmon Mark-Recapture Project (FMRP 04-308), Chinook Run Reconstruction (AYK SSI #612), and Kuskokwim River Sockeye Salmon Investigations (AYK SSI #618).*

Curriculum Development

The bulk of the written curriculum was developed using the following books: the *Streamkeeper's Field Guide* by Tom Murdoch and Martha Cheo, *Alaska's Wild Salmon* by the Alaska Department of Fish and Game, *Alaska's Fish: A Guide to Selected Species* by Robert H. Armstrong, and *Field Identification of Coastal Juvenile Salmonids* by W.R. Pollard, G.F. Hartman, C. Groot, and Phil Edgell. Additional resources were provided by: Project WILD: *Aquatic Education Activity Guide, Adopting a Stream: A Northwest Handbook* by Steve Yates, and Project WET: *K-12 Curriculum and Activity Guide*.

In 2005, the KNA Fishery Partners Biologist; David Orabutt, along with the Partners Education College Intern; Dana Diehl, developed the current intern curriculum. This curriculum was developed to adhere to Alaskan state standards for math and science so that interns would receive high school credit for their participation in the program.

In 2006, the KNA Fishery Partners Biologist; Heather Hildebrand, along with the Partners Education College Intern; Rainy Diehl, improved the curriculum (Appendix 1) and also developed a "returning intern" curriculum (Appendix 2). The second curriculum was developed to provide returning interns with more in-depth fisheries science concepts and experiences. This curriculum also adheres to Alaskan state standards for math and science and interns received high school credit for their participation in the program.

Recruitment and Selection

All internship announcements for a given field season were sent to KNA member villages' schools (Kuspuk and Iditarod school districts) at the beginning of March. Applicants had to prepare a one page essay describing their desire to participate in the program, as well as receive their parents' permission. Applications were reviewed by the Fishery Partners Biologist (Partners Biologist) and the Fisheries Partners Education College Intern (Education Intern), and 14-19 students ages 14-17 were chosen and contacted by June 1st of each year. All written materials were sent to the students prior to their scheduled travel dates.

Intern Travel and Schedule

All intern travel was provided by Robert Vanderpool of Vanderpool's Flying Service out of Red Devil, Alaska or Hagelands Aviation. Interns were transported each week from June 15-August 10th from their village to either the George River weir, Tatlawiksuk River weir, or Kalskag fish wheel camps. Re-supplies and crew shift changes were done at this same time to minimize project expenses.

Intern Responsibilities

Interns had three main program responsibilities while at their respective camp. The first responsibility was to their written curriculum, which consisted of daily reading and writing assignments. These assignments were completed before the end of their stay at the camps and turned in to the Education Intern. The second responsibility was to the fisheries monitoring component of their curriculum, which at the weir camps consisted of assisting crew members with Age, Sex, and Length (ASL) data collection, genetics sample collection, daily fish passage counting, weir cleaning and maintenance, environmental variable data collection, and related project duties. The fisheries monitoring component of their curriculum at the Kalskag fish wheel camp consisted of radio tagging Chinook and sockeye salmon, T-tagging Chinook, sockeye, chum, and coho salmon, and collecting salmon ASL data. Interns were each provided a disposable camera and photo-documented their fisheries monitoring work. Cameras were turned in to the Education Intern and photos were later developed and returned to the interns. The Education Intern or another member of the crew filled out an intern evaluation form to assess the interns' abilities and willingness to assist with project responsibilities. The third responsibility for interns was to participate in several science projects: snorkeling, habitat assessment, water quality measurements, macroinvertebrate identification, and human environmental impact assessments. These activities were evaluated by the Education Intern or another member of the crew. Intern work and evaluations were reviewed by the Education Intern and if complete the interns received a $250 stipend and their work was sent to their teachers so that they could receive high school credit.

Returning interns focused more heavily on the science project and fisheries monitoring components of the curriculum. Science projects were more involved and required short reports. These assignments were completed before the end of their stay at the camps and turned in to the Education Intern along with a one page final report on the biology of a salmon species. The fisheries monitoring component of their curriculum was also more involved and high school interns worked in more technician like roles often completing task independently (e.g. solo counting shifts). Interns were each provided a disposable camera and photo-documented their fisheries monitoring work. Cameras were turned in to the Education Intern and photos were later developed and returned to the interns. The Education Intern or another member of the crew filled out an intern evaluation form to assess the intern's abilities and willingness to assist with project responsibilities. Intern work and evaluations were reviewed by the Education Intern and if complete, the interns received a $250 stipend and their work was sent to their teachers so that they could receive high school credit.

All interns were encouraged to take the pictures they took while in camp back to their communities and show them to family and other community members. These interns have also been asked during school visits; by KNA Fisheries Department personnel, to elaborate on their specific program experiences for other class members.

RESULTS

This program has provided middle Kuskokwim River youth an understanding of subsistence fisheries issues. A total of 128 high school internships have been provided since program inception in 1998 and 10 high school students returned to participate in a second season of advanced training.

This program has successfully taught participating students basic salmon management and conservation concepts; as evidenced by about 85% of interns being able to complete their curriculum assignments annually. Returning students have exhibited the ability to handle more complex concepts, work as a more integral part of the crew, and conduct science projects such as: water and soil quality parameters, Vitamin C in foods, and stomach content analysis of juvenile Salmonids. When we visited classrooms, it was evident that these programs passed on increased knowledge of past interns to fellow students and teachers who were knowledgeable about fisheries monitoring activities. This, represents long-term retention and knowledge sharing. Some teachers have also used the internship curriculum to teach lessons during the school year.

This program has also diversified the employment opportunities of area residents and developed a skilled pool of future technicians to work in the growing field of fisheries management. Nine interns have gone on to be hired as either ADF&G or KNA technicians. An example would be 2000 intern, Michael Middlemist who worked as the KNA George River Weir Crew Leader in 2004 and the KNA Tatlawiksuk River Weir Fisheries Technician in 2002, 2003, and 2005.

This program has encouraged interns to pursue higher education and full-time careers in natural resource management. Several high school interns have enrolled in college and come back to participate in the Partners College Intern program with KNA: Michelle Robinette (2003), Dana Diehl (2005), and Rainy Diehl (2006). More recently, the High School Intern II position was offered to those students who had previously participated in the program and were interested in becoming a part-time crew member in order to gain experience for a future career in fisheries science but who weren't enrolled in college yet. In 2006, Charles John from Aniak was selected for one of these positions. Charles worked on the Aniak River Beach Seining project as a member of the crew for the *Chinook Salmon Run Reconstruction (AYK SSI #612)* project. He worked part-time for 7 weeks and assisted with tag recovery, tag deployment, and beach seining during that time. Amanda Goods from Takotna was the other intern chosen for this position in 2006. She had not participated in the Natural Resources Internship Program in the past because Takotna is not a KNA member village, and therefore had never received the announcements. However, she qualified for this position based on her previous experience working as a high school intern at the Takotna River weir which was similar to the KNA Natural Resources Internship Program. Amanda worked at the Kalskag fish wheel project as a member of the crew and assisted with deploying radio tags. She radio tagged sockeye salmon as part of the *Kuskokwim River Sockeye Salmon Investigations*

(AYK SSI #618) project. In addition, she collected ASL data, environmental data, gill netted salmon, and performed daily camp chores.

This program fosters community involvement, acceptance, and ownership of research and monitoring projects at both the village and regional levels. At the village level, students provided community outreach by returning home and discussing their experiences with family and community members. Community acceptance of the ongoing research in this area has been provided by this program, as evidenced by KNA Fisheries Department personnel receiving phone calls from parents thanking KNA for this opportunity for their children and encouraging KNA to do more local monitoring projects. Increased ownership of the ongoing research and monitoring projects in this area has also been provided by this program, as evidenced by direct communication with traditional council representatives and their interest in expanding KNA's involvement and increasing opportunities for local residents.

At the regional level, community outreach has been provided by KNA Fisheries Department personnel at Federal RAC , State Advisory Committee, and Kuskokwim River Salmon Management Working Group meetings. Results of KNA's internship program and cooperative fisheries projects have been presented to RAC members, and ideas and interest for future developments discussed. Regional community acceptance of the ongoing research in this area has been provided by this program as evidenced by direct communication with RAC members and their willingness to draft a letter of support to the Office of Subsistence Management (OSM) for the continuation of both the KNA Partners Biologist position and Fisheries Internship Program.

Finally, an objective that was not included in the Investigation Plan for this program, but that has always been a goal of KNA, was for the interns to contribute to the monitoring projects as well as obtaining experiences from them. This goal was reached annually by this program; in that, all interns contributed to gathering required data for these projects, in the form of ASL, daily escapement, and environmental variables. Some interns even were able to fully function as a crew member and do independent counting shifts and other weir responsibilities.

DISCUSSION

The KNA Natural Resources Internship Program was successful every year since it's inception in reaching its objectives. A critical component to its success was the development of the Partners for Fisheries Monitoring Program and the inclusion of the Partners Biologist and Education Intern in curriculum development and project logistics. The Partners Biologist has provided a strong framework on which to develop this program. However, the responsibilities of the Partners Biologist over the years have increased and made it difficult to spend significant time on any single project. This coupled with the continued need for additional internship opportunities in this region justified the creation of the Partners Education College Intern position. The framework developed by the Partners Biologist provided the Education Intern with a strong foundation on which to continue to build and improve the Natural Resources Internship Program.

The Education Intern position is available to any Rural Alaskan college and preferably one with an interest in secondary education or natural resources. The

responsibilities of this intern were mainly to the Natural Resources Internship Program and include: curriculum development, intern selection, materials preparation and distribution, intern rotation scheduling, and logistical support. Additional field responsibilities were to FRMP projects and include: collecting ASL data, genetic samples, environmental data, and daily escapement data, as well as installing and maintaining weirs, doing camp chores, and assisting with related projects. At the completion of the field season, the Education Intern was responsible for reviewing all intern curriculums and writing a summary report of the program. The Education Intern was also responsible for preparing a power point presentation for OSM's Intern Day in Anchorage.

The Education Intern has assisted in the continued improvement to the Natural Resources Internship Program by improving the curriculum and mentoring interns. This can be seen by the increased participation of interns over the years, their ability to receive high school credit, the number of returning students, increases in students' natural resources education levels, and the ability of KNA to offer and fill advanced high school internship positions.

Community support of the Natural Resources Internship Program has been strong over the years and particularly within the last few. This has been a direct result of the interns receiving high school credit, their positive experiences with the program, and the role models provided by the Partners College Interns. Community members have seen this opportunity for their children develop since it's inception as well as students' interests in participating.

This community support does not strictly come from the adults of this region. Younger siblings of past interns as well as classmates have become increasingly interested in participating in the program, both from the positive experiences described by past interns as well as the program's proximity to their homes. Most summer programs for Alaskan students involve extended travel and are located far from their home village. This program offered students the chance to participate with ongoing fisheries projects in their own "backyard" and feel more connected with the projects than if they had traveled to an unknown system or area. Interns felt more comfortable with this program given the opportunity to work with their friends. Other summer programs offer work in an unknown area and the opportunity to make new friends. However, too much change at once can be overwhelming for some students; the ability to see a familiar face can make all the difference in the level of enjoyment experienced by an intern.

The increased community support over the duration of this program is also a direct result of the increased community ownership of the ongoing fisheries monitoring projects. This sense of ownership is a result of parents seeing the success of a project that their children had a direct hand in assisting. The community outreach provided by the interns after returning home coupled with KNA Fisheries Department village visits to summarize project results and accomplishments, lets parents know that the internship program; and essentially their children, are a vital component to the success of the fisheries projects.

The Natural Resources Internship Program has not only been successful, it has contributed to the ongoing success of the various FRMP projects. Outreach efforts of the Partners Biologist and the Fisheries Director have proven to be successful in establishing trust and community support for not only the internship program but all FRMP projects.

Village and school visits were opportunities for students and parents to learn of past accomplishments of interns and the projects, to ask questions and express ideas about future directions for the projects and internships, and to learn about upcoming opportunities for both themselves and their children.

Finally, an ongoing program goal of KNA, OSM, the U.S. Fish and Wildlife Service (USFWS), and ADF&G has been to foster cooperative research and management efforts within the Kuskokwim region. The Natural Resources Internship Program allowed KNA to accomplish this goal by providing a connection to local community members in a way that was more intimate than any local hiring position could have been. This program provided an opportunity for local children to become involved with research that will affect their future way of life in regards to subsistence. The experiences they have gained and the pride that they have felt in contributing to the sustainability of one of their cultures' most important resources has been seen and heard by their parents. These students have felt more connected to their resource by being able to better understand management issues and practices that affect it. The parents have felt more connected because it is now their children that are assisting with the sustainability of their resources. In the past, community members have felt as though their voices were not being heard by state and federal agencies and that local interests were not being taken into consideration when it came to fisheries management decisions. The Natural Resources Internship Program has provided community members; and more importantly their children, with the voice that was so desperately needed.

Future participation in the management of sustainable salmon fisheries can now be a reality for many local youths in the Kuskokwim region. Past participation in the KNA's internship opportunities has given students an increased skill set for future career choices. Since its inception, the Natural Resources Internship Program has been training tomorrow's fisheries technicians, biologists, community leaders, and RAC and Kuskokwim Salmon Management Working Group representatives by providing knowledge and experiences that directly relate to their everyday lives and giving them a sense of pride from their contributions to the ongoing fisheries monitoring projects within their region.

The future success of fisheries monitoring projects within the Kuskokwim region can only be achieved through the continuation of this internship program as well as the Fisheries Partners Program. These programs have proven to be valuable assets to the community and to the projects in this area, and for them to end now would be extremely detrimental to the progress made by KNA and our cooperators.

CONCLUSIONS

- Student interest has increased over the course of this program.
- Community support has increased and is very strong as evidenced by Western Interior RAC, Yukon-Kuskokwim Delta RAC, Kuskokwim River Salmon Management Working Group, Traditional Councils, Kuspuk School District, and individual community members support.
- Year round and classroom involvement are needed by the students in order to increase their exposure to ecological concepts and basic biology. Currently, KNA has submitted a proposal to OSM to extend the high school internship program as

well as add a classroom component during the fall semester. A decision is expected in May of 2007.

- The Natural Resources Internship Program and the Fisheries Partners Program have benefited one another over the years and should continue to be connected for the future success of both in this region.
- The Partners Education College Intern has benefited the Natural Resources Internship Program over the years and should continue to participate in curriculum and project development in the future.

RECOMMENDATIONS

- The Natural Resources High School Internship Program should not only continue but should also be continually developed in this region. It is important for the continued success of the ongoing fisheries monitoring projects, for continued capacity building, and for providing future fisheries technicians and biologists.
- There is a strong need for a fall and winter classroom component to this program. Continued exposure to biological concepts helps increase understanding of them. The Fishery Partners Biologist and Fisheries Director submitted a proposal to OSM which included this classroom component after conducting a pilot study in 2006-2007 in area village classrooms. Macroinvertebrate identification, the River Continuum Concept, salmon biology, and careers in fisheries science topics were presented in lessons to students at several member villages during routine school visits and were overwhelmingly supported by teachers, school district administrators, and the students themselves.
- In the future, additional advanced curriculums will be necessary to continue to engage returning students to the program.
- There is a strong need to get and keep teachers involved in this program and in assisting to develop future internship opportunities for students.
- More advanced opportunities for high school students are needed for those students who have already participated in the program and are looking for more involvement with the projects. KNA has responded to this by providing a more advanced crew position for students but needs to expand these opportunities.
- It would be beneficial in the future to include travel money in the internship budget to provide parents the opportunity to visit the projects while their children were there in order to see for themselves their children's contributions to these projects. Involving parents in future decision making and project planning for this program would be beneficial in order to increase community ownership of this program and to assess any additional needs of the community.

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APPENDIX 1

Week 1 Curriculum

Week 1: Ecology

-Day 1: Arrive at camp
- Review daily activities
-Pre-season questionnaire
-Read handout on "Weirs" and fill out worksheet
-Read Ch. 3-Wild Salmon
-(Additional resources Ch. 1-Streamkeepers)
- Begin work and camp chores as directed by tech. or mentor
-Fill out "**Day 1 Worksheet."**

-Day 2: Fish and bug lifecycles
-Read Ch. 1&2-Wild Salmon
-(Additional resources Ch. 6-Streamkeepers)
-Complete "**Identify Species Worksheet**"
- Fill out **worksheet on aquatic insects**
-Continue work and camp chores as directed by tech. or mentor
-Fill out "**Day 2 worksheet**"

- Day 3: Fish anatomy
- Continue work and camp chores as directed by tech. or mentor
If you have been involved in any ASL sampling start differentiating between physical characteristics of fish species (Example: How does a sockeye differ from a chum?) and look at some scales through the microscope and attempt some age predictions. If there were any washed up or drift salmon throughout the day/week use one of those fish to dissect. Identify parts and complete "**anatomy of fish**" worksheet.
-Read Ch. 3&4-Wild Salmon
- Fill out "**Day 3** worksheet"
- Watch "Alaska's Harvest" video and answer questions.

-Day 4: Water quality
- Continue work and camp chores as directed by tech. or mentor
Go out with a Tech. and help take water characteristics: observe color, clarity, temperature, current and flow, pH and acidity, presence of pollutants. Complete **worksheet on water**

characteristics (must use water observations handout in back of binder to compare) and complete **"Healthy Habitat Activity**"
. Play the board-game "The Great Salmon Life Cycle Race" page 8 out of your Salmon Homecoming Activity book with the other intern, or anyone interested.
Read Ch. 4-Wild Salmon
-Fill out "**Day 4 worksheet**"
-(Additional resources: Ch. 7-Streamkeepers)

-Day 5: Ecosystem and salmon
-Read Ch.5-Wild Salmon
-Scientific method worksheet
-(Additional resources: Ch. 8-Streamkeepers)
- Fill out "**Day 5 worksheet**"

-Day 6: Snorkeling in the river
-Continue work and camp chores as directed by tech. or mentor
Have the crew help you out with using the dry-suits and snorkeling equipment
- See what you can see in the river
-Complete **"Where Have all the Salmon Gone"** worksheet
- **Must** complete this worksheet along with the graphs!
-(Additional resources: Ch.9-Streamkeepers)
-Read Ch.6-Wild Salmon
-Start writing your essay on what you've learned from this experience

-Day 7: Last Day at camp
- Continue work and camp chores as directed by tech. or mentor
Complete all your work and neatly organize it by day into your binder
-Finish writing your essay on what you have learned from this experience

-Day 8: Travel home
- Compile all your work and neatly organize it by day into your binder
-Finish writing your essay on what you've learned from this experience
***All work must be completed in order to receive the $250 stipend.**

Pre-Season Questionnaire

Matching

A. Watershed
B. Alevins
C. Tributary
D. Niche
E. Ecology
F. Weir
G. Adipose fin
H. Dorsal fin
I. Pectoral fin
J. Operculum
K. Chinook
L. Coho
M. Chum
N. Sockeye
O. Fry

_____ A fleshy lobed fin located between the dorsal and tail fins.

_____ Smaller feeder streams or rivers which empty into a larger mainstem river.

_____ An area surrounding and draining water into a stream, river, lake, or wetland.

_____ The life stage at which the young fish still have a yolk sac attached to them.

_____ The life stage at which the young fish leave the gravel bed and begin swimming around.

_____ Otherwise known as King salmon

_____ The gill covering of the fish

_____ The fin used mainly for steering

_____ The fin located on the top of the fish
_____ Otherwise known as Dog salmon.

_____ A portion of the environment that an animal uses to live.

_____The study of the interrelationships between living species.

_____Otherwise known as Silver salmon.

_____Otherwise known as Red salmon.

_____A method to enable biologists to count fish.

True or False

1). Human impacts on the environment can be small; for example, a can of oil or bag of trash._____

2). Adult salmon sometimes eat juvenile salmon. _____

3). Five of the seven species of Pacific salmon spawn in the Kuskokwim. _____

4). Anadromous means the fish spawn in freshwater and migrate to saltwater to feed and grow. _____

5). Salmon eggs are laid in aquatic vegetation. _____

DAY 1 WORKSHEET

1. Fish Counts
(Note: must sit down with tech. or crew leader at end of each day to determine these statistics.)

Daily - Total number of fish counted within a one day period.

Cumulative - Number of fish counted from the start of the 2005 season up until today.

Species	**Daily**	**Cumulative**
Chum Salmon		
Chinook Salmon		
Sockeye Salmon		
Coho Salmon		
Pink Salmon		

2. Weather Observations:
   a. Was it clear, overcast, rainy etc.?_____

   b. Water Temperature_____

Questions from Reading: Chapter 3

1. Define what a watershed is, and list as many watersheds in your area you know of.

2. Explain how human impact on specific watersheds in your area may have damaged any salmon habitat. How often if at all does this occur?

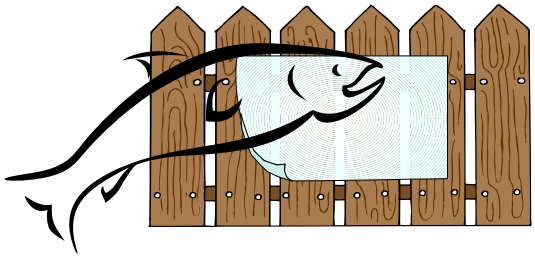
3. Briefly explain what you can do to reduce damage to salmon habitat and natural resources as a whole?

4. What can you do to reduce damage to the watershed, and salmon habitat at camp (George or Tatlawiksuk)?

5. How does your usage of trash, gas/fuel storage, and outhouses have an impact on your camp environment? Describe some methods you might use to lessen this impact on the environment. What can you do today to clean up that environment?

6. Why do you think it is so important to maintain a healthy environment and salmon habitat?

Weir Worksheet Questions:



(must read Weir Handout in back of binder)

1. Explain what a fish weir is?

2. Explain what the weir looks like, what it is made out of, and where on the river it is placed:

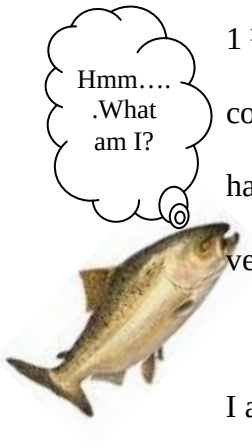
3. Explain how the weir works.

4. Do weirs hurt or kill the fish?

5. What is escapement? Why is this important to you, and your family?

6. What is the primary goal of the fish weir? Describe why this is important.

Identify this species worksheet!



At adulthood I am a salmon that normally weighs between 8 & 12 pounds. I spend about 1 ½ years at sea before returning to fresh water to spawn. I normally have a bright silver complexion with small black spots on my back and upper lobe of my caudal fin. I like to hangout in the headwaters of streams, but when I feel like spawning I force my way into very small tributaries. Who am I?_____

I am very abundant during the mid June, and early July months all along the Kuskokwim River. I spend 1 to 2 years in fresh water, and 3 to 5 at sea. I start spawning between the ages of 4 and 7. I have black spots on my back and dorsal fin, and a very black gum line. One of my ancestors weighed a whopping 126 Lbs.! If I were Royalty you would be my servant! Plus I think I make the best fish strips! Who am I? _____

I think I am probably the most abundant (and at times irritating) species of salmon found on the Kuskokwim River. When I reach fresh water I turn a greenish purple color. Our little ones (fry) stay in fresh water for just a short time before migrating to sea. I normally seek spring fed or upwelling areas to spawn in. Who am I? _____

I am a fish of smaller presence; I only weigh about 4 to 8 pounds at adulthood. We stay in the ocean for 1 to 4 years then spawn in rivers, streams, and in lakes with spring-fed upwellings. I don't have any black spots like my relatives do but I can develop a humped back, and elongated hooked jaw. Who am I? _____

Aquatic Insects

1. Describe what you found:

2. Where you found it:

3. How you determined what it was (did you use the Dichotomous key?)

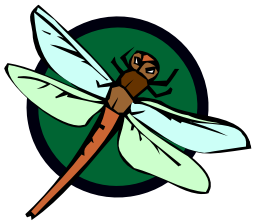
4. Look at pages **126 & 127 of your "Streamkeeper's Field Guide"** text, and identify which feeding group your insect is categorized in. Describe why it is considered one of the following:

Shredders _____

Collectors _____

Scrapers _____

Predators_____



DAY 2 WORKSHEET

1. Fish Counts

Species	Daily	Cumulative
Chum Salmon		
Chinook Salmon		
Sockeye Salmon		
Coho Salmon		
Pink Salmon		

2. Weather Observations:
   a. Was it clear, overcast, rainy etc.?_____

   b. Water Temperature_____

<u>Questions from Reading (Chapters 1 & 2)- (</u>use back of sheet or additional paper)

1. What are natural resources, and why are they important to your community?

2. Briefly list and describe each stage of the life cycle of a salmon:

3. Briefly describe why a salmon carcass is important to future generations of salmon and the entire environment in general.

4. Treasure Hunt!
   * Go outside and use your kick nets, small seines, and yourself to gather any insects, water bugs, larva, or plants you can find throughout camp.
   * Use the microscope to identify what types of insects or aquatic insects you've found.
   * Compare your findings with the **Bug Dichotomy provided on pages 148-161 in your text "Streamkeeper's Field Guide"**
   * Journal or draw out the three most abundant species you identified, and list your favorite creature or creatures

DAY 3 WORKSHEET

1. Fish Counts

Species	**Daily**	**Cumulative**
Chum Salmon		
Chinook Salmon		
Sockeye Salmon		
Coho Salmon		
Pink Salmon		

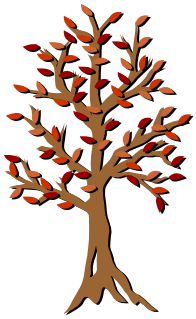
2. Weather Observations:
   a. Was it clear, overcast, rainy etc.?_____

   b. Water Temperature _____

3. Complete the "**anatomy of a fish**" worksheet

<u>Video "Alaska's Harvest"</u>

*After watching the video list the important points, how it relates to you and your community, and what you learned from the video (may use back of this sheet).



Healthy Habitat Activity

*** Now look around camp and find anything you might be able to help out with:**

- Is there any trash scattered around camp?
- How is your gas and fuel stored? (close to the river, directly on the ground, etc.?)
- Is the riverbank eroding or does it have potential to erode?

- At the bottom of this sheet write down what you did to maintain a healthy camping environment. Then give suggestions for what can make it an even healthier environment.
- After completing this activity try to bring it back to your own community. Ask yourself and others the same questions. Create a trash pick-up day, clean the beach day, or anything similar you might be able to help out with. Make it a fun, and educating experience for everyone!!

Water Characteristics Worksheet

Record your observations here: (for questions below look at water observations handout in back)

1. Water Temperature_____

2. Air Temperature _____

3. pH (if applicable)_____

4. Water appearance (describe what it looked like: scummy, brown, foamy, muddy etc)

5. What factors do you think contribute to water appearance?

6. From the handout provided explain what temperature is required for fish to survive.

7. What range of temperature may create disease for the fish?

8. Describe why each recording is important to both the survival of yourself, and the fish.

9. Now utilize your artistic talents to create a drawing of what the river, weir, and skies above looked like today!
Attach the drawing to this handout.

DAY 4 WORKSHEET

1. Fish Counts

Species	Daily	Cumulative
Chum Salmon		
Chinook Salmon		
Sockeye Salmon		
Coho Salmon		
Pink Salmon		

2. Weather Observations:
   a. Was it clear, overcast, rainy etc.?_____

   b. Water Temperature _____

Questions from Readings: Chapter 4

1. Define at least 2 of the state laws which protect salmon spawning and rearing habitats:

2. Which law allows private individuals, as well as state, federal, and local governments the right to reserve water in rivers and lakes?

3. What does Alaska's **Forest and Resources Practices Act** require?

4. Name at least 2 Invasive Species, and how they can be a threat to our watersheds.

5. Explain some of the risks involved with fish farming.

DAY 5 WORKSHEET

1. Fish Counts

Species	Daily	Cumulative
Chum Salmon		
Chinook Salmon		
Sockeye Salmon		
Coho Salmon		
Pink Salmon		

2. Weather Observations:
   a. Was it clear, overcast, rainy etc.?_____

   b. Water Temperature _____

Questions from Reading: Chapter 5

1. Define subsistence harvests.

2. Why is subsistence fishing important to you personally, and your community?

3. How has commercial fishing contributed to the decline in salmon populations?

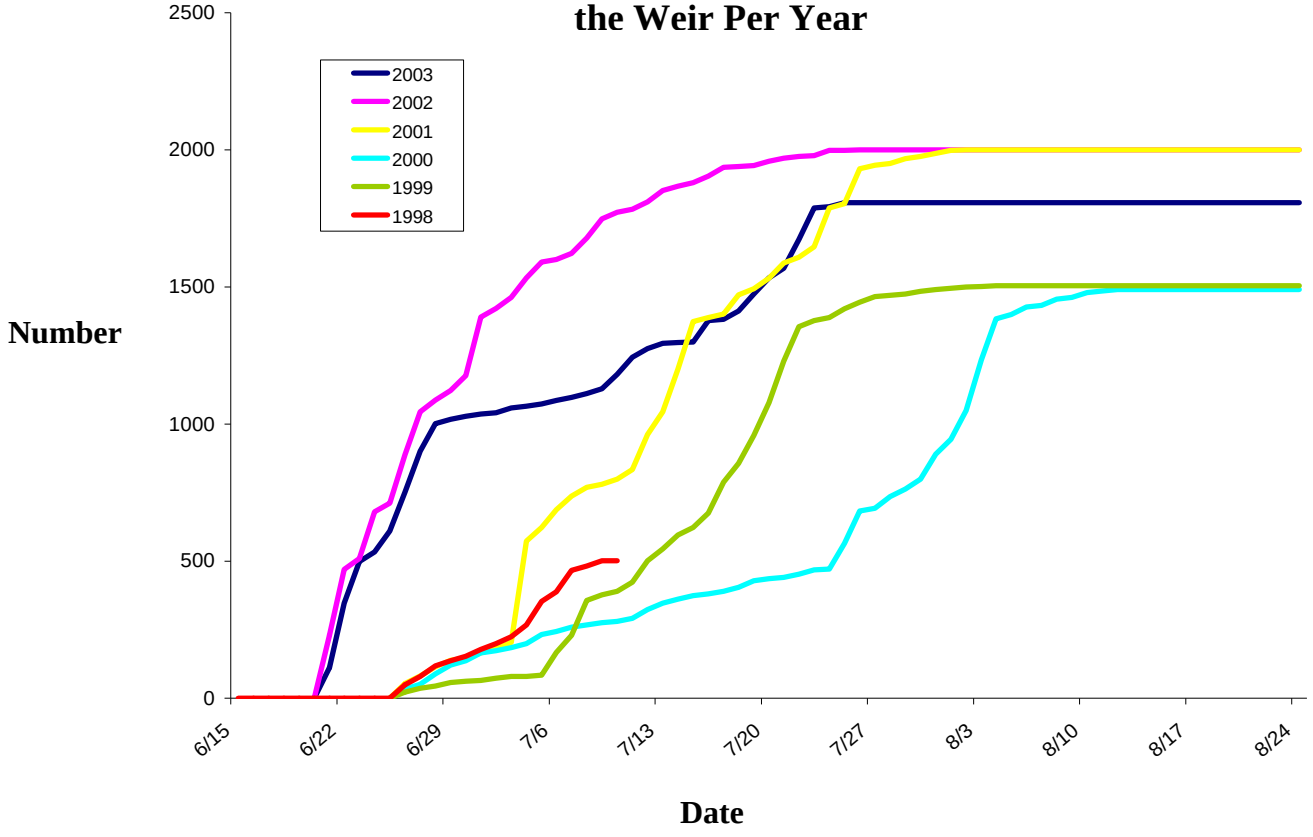
4. Why is the "limited entry program" important to maintaining salmon populations?

5. Explain some examples of salmon stewardship programs, and develop ideas for programs that might be valuable to your area.

Graphing

Graphs are not as hard to understand as you might think. They are simply pictures of the data. Although there are many different kinds of graphs, we will be focusing on line and bar graphs. We normally make graphs for other people, in an attempt to simplify information we want them to understand. For that reason, we have a title-which should be descriptive but to the point, use labels to identify the data presented on each of the axes, have at least two axes (an x and y axis), and provide a key or a legend to explain anything else the reader might need to know.

Figure 1: Number of Chinook Salmon That Passed the Weir Per Year

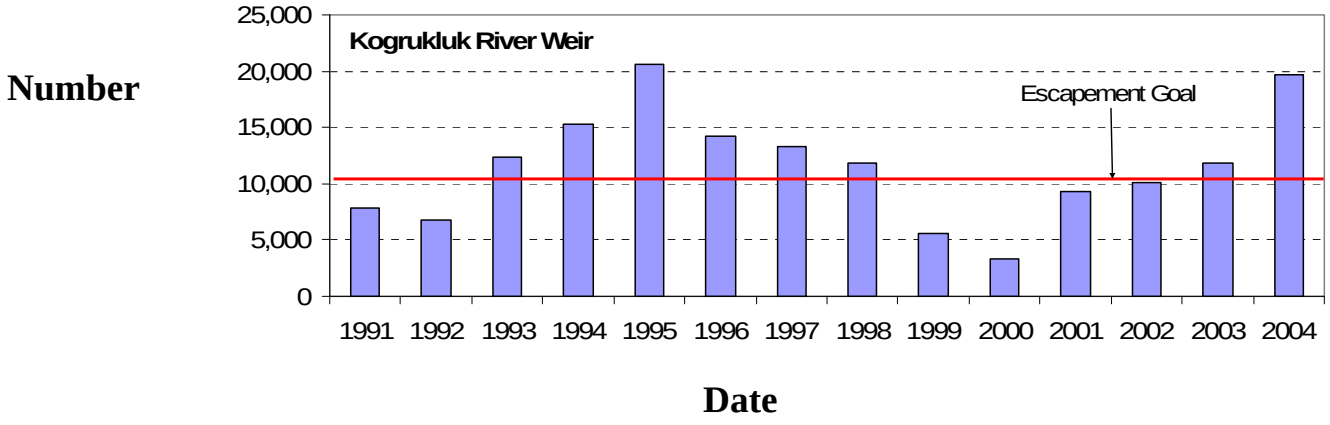


The sample graph above is a good example of what a graph should look like. The title tells you what the graph is showing, each axis is labeled and the legend shows you what each of the lines represents.

Line graphs are typically used to show changes in things over a certain time period. From this graph you can not only see what the number of fish was per year, you can also compare years to one another, see what happened on a monthly basis (run timing), and from this information begin to see a pattern for the future.

Bar graphs are similar to line graphs in the fact that they have all the same components: title, axis, and sometimes a legend. However, bar graphs are typically used to show differences between things or compare things. For instance, the graph below is comparing the number of Chinook between the different years in addition to showing the escapement goal (or minimum number of fish that they would like to see).

Figure 2: Number of Chinook Salmon that passed the Kogrukluk River Weir between 1991 and 2004



These examples are intended to help introduce you to graphing and displaying your information so that others can understand it. If you need more information about graphs and how to interpret and construct them, please consult your Streamkeeper's Guide (Ch. 9).

Where have all the salmon gone?

* Use all the information gathered from your end of day worksheets to input that data into these charts. Use the species of salmon which was most prevalent throughout the week and enter **just** their data into the fish chart. For example: If the majority of salmon passing through the weir each day was chums, input only daily chum counts. Next use the graph paper provided to plot out your points (remember to label each axis).

Days	**Number of (species) _____ Counted**
1	
2	
3	
4	
5	
6	
Total	

Days	**Water Temperature**
1	
2	
3	
4	
5	
6	

1. Look at your fish graph and tell me if there are any patterns you can define throughout the week.

2. If so why do you think these patterns occur and what might contribute to them?

3. Look at your water temperature graph and explain what it looks like (was the water temp. consistent, fluctuating etc.)

4. Compare your water temperature graph, and your fish graph: Are there certain temperatures fish might choose to travel in? Can you make any other connections between the two graphs, or do you see any obvious relationships?

DAY 6 WORKSHEET

1. Fish Counts

Species	Daily	Cumulative
Chum Salmon		
Chinook Salmon		
Sockeye Salmon		
Coho Salmon		
Pink Salmon		

2. Weather Observations:
   a. Was it clear, overcast, rainy etc.?_____

   b. Water Temperature _____

3. In your journal write a short essay about what you have learned from this experience. Briefly explain how all the information you have gathered relates to your surroundings, specifically your community. Briefly describe some of the main ideas you have learned, and why they may be valuable to your future. To conclude tell us your overall feelings: For example- Was it an exciting learning experience? Did you get bored with camping out? What was your favorite activity? Etc…

Questions from Reading: Chapter 6

1. What are the 3 main themes to Alaska's salmon management?

2. List the 5 guiding principles that organize *Alaska's Sustainable Salmon Fisheries Policy.*

3. Why is this policy important?

Post-Season Questionnaire

Matching

A. Riparian zone
B. Alevins
C. Estuary
D. Tributary
E. Niche
F. Ecology
G. Caudal fin
H. Lateral line
I. Pelvic fin
J. Swim bladder
K. Chinook
L. Coho
M. Chum
N. Sockeye
O. Smolt

_____ The tail fin.

_____ Areas where fresh and salt water mix at the mouths of streams and rivers.

_____ The area surrounding a stream that directly affects the stream.

_____ The life stage at which the young fish still have a yolk sac attached to them.

_____ The life stage at which the juveniles migrate to the sea.

_____ Adults have irregular black spots on the dorsal surface and both lobes of the tail.

_____ The organ used to control a fish's position in the water.

_____ Sometimes can be used to detect things in the substrate and can be used for stopping.

_____ The sensory organ with which a fish detects movement.

_____ At time of spawning it has vertical bars of green and purple.

_____ Smaller feeder streams or rivers which empty into a larger mainstem river.

_____ A portion of the environment that an animal uses to live.

_____Only spend about a year an a half of their life in the ocean.

_____Breeding males develop a humped back and there is a lack of black spots along the dorsal surface.

_____ The study of the interrelationships between living species.

True or False

1). Humans cannot create or destroy mercury._____

2). Macroinvertebrates are animals that do not have backbones, but are visible to the naked eye. _____

3). Precipitation occurs when the sun's energy turns liquid water into water vapor. _____

4). A hypothesis doesn't have to be testable. _____

5). A weir is removable. _____

APPENDIX 2

Week Two Daily Schedule

Follow the daily schedule and check off each item as you go along☺
If you have any extra time during your stay, you may read Life in a River to enhance your knowledge of watersheds.

Day 1
__Arrive at camp
__Begin work or camp chores as directed by Technician or Mentor
__Read River of Life or Life in a River and answer questions in worksheet
__Make an entry in your daily journal about what you learned and any questions you may have

Day 2
__Participate in work or camp chores as directed by Technician or Mentor
__Read Day 2 Worksheet
__Answer all questions **prior** to Water Quality testing
__Test Water Quality with Technician or Mentor (take your Rite in the Rain book to record data)
__Fill out table at the end of the Day 2 Worksheet
__Make an entry in your daily journal about what you learned and any questions you may have
__Read Day 3 below: Set a minnow trap so that you will have plenty of juveniles to identify in the morning!

Day 3
__Do work or camp chores as directed by Technician or Mentor
__Read Field Identification of Coastal Juvenile Salmonids pgs 4-9, 20-27, & 30.
__Travel to a quiet stream and catch some juveniles!
__Answer questions in the worksheet about the juvenile salmon that you caught
__Make an entry in your daily journal about what you learned and any questions you may have

Day 4
__Participate in work or camp chores as directed by Technician or Mentor
__Read Day 4 Worksheet
__Color the **Wetland Soil Color Chart** with corresponding crayons. Crayons will be available at camp and it is very important to use the correct colors.
__Take soil sample containers, the Wetland Soils Color Chart, the Soil Sample Data Chart, a shovel, a clipboard, a pencil, and your Rite in the Rain book for a hike to search for Wetlands! Don't forget the bug dope!!!
__Complete the **Soil Sample Data Chart**
__Make an entry in your daily journal about what you learned and any questions you may have

Day 5:
__Participate in work or camp chores as directed by Technician or Mentor
__Read Day 5 Worksheet and answer the questions
__Hike around camp and search for wild foods that you would like to test for Vitamin C. You must be able to squeeze ½ a cup of juice in order to test for Vitamin C
__Take the Tanaina Plantlore and Wild Edible and Poisonous Plants of Alaska books with you to determine which plants contain Vitamin C
__Make an entry in your daily journal about what you learned and any questions you may have

Day 6:
__Participate in work or camp chores as directed by Technician or Mentor
__Make an entry in your daily journal about what you learned and any questions you may have
__Read Day 6 Worksheet and answer the corresponding questions

Day 7:
__Participate in work or camp chores as directed by Technician or Mentor
__Complete the questionnaire in your binder. This should be review from the last two internships that you have participated in.
__Make an entry in your daily journal about what you learned and any questions you may have
__Give the Student Evaluation and envelope to a technician or mentor to complete and return to KNA.

Day 8 - Return Home
__ Begin writing one page report on the salmon of your choice.
__Compile all your work and neatly organize it by day into your binder.
__Travel Home!

- **All work must be completed and sent in to receive the $250 stipend.**
- **Questions should be addressed to Rainy at (907) 675-4384**
- **Materials should be sent to:**

  Kuskokwim Native Association
  Rainy Diehl
  PO Box 127
  Aniak, AK 99557

DAY 1 WORKSHEET

Welcome to Camp! Your assignment today is to read through pages of River of Life and Life in a River (available at camp) and answer the following questions. River of Life should be review for you while Life in a River will provide new information. Look over this entire worksheet before you read the books.

River of Life: Read all pages of the book and answer the questions as you go along.

- What do salmon fry eat?
- What does the Harlequin duck eat?
- What does the rainbow trout try to eat?
- What does the kingfisher eat?
- How do eagles catch salmon?
- How do brown bears and otters catch salmon?
- Name one bird and one animal that eats the salmon carcass.

Life in a River:

Open the book to pages 69 & 70 (this is the glossary).

- Look at the definition for **anadromous fish** and describe it below:

- Name one anadromous fish:

- Look at the definition for **primary consumers** and describe it below:

- Look at the definition for **primary producers** and describe it below:

- Look at the definition for **secondary consumers** and describe it below:

Now read pages 20, 29, & 36.

- Name three primary consumers.

- Name a primary producer.

- Name a secondary consumer. What does this secondary consumer eat?

DAY 3 WORKSHEET

Juvenile salmonids are those that have recently hatched from their egg and will soon travel down the river out to the ocean where they will feed for several years.

Read pages 4-9, 20-27, and pg 30 in Field Identification of Coastal Juvenile Salmonids in the morning. Thoroughly study the differentiating characteristics of juvenile salmon and place your focus primarily on salmon. Notice that parr marks are very useful in distinguishing between juveniles. Parr marks are the distinct dark bar shaped marks on either side of the juvenile salmon.

Once all the assigned reading is complete, you will travel to a quiet spot on the river and must bring along the Field Identification Guide, your Rite in the Rain book, the viewing bag, and a cast net or dip net. Once a juvenile salmonid is caught, students must immediately fill the viewing bag with water and place the juvenile salmonid in the viewing bag. Juvenile salmonids cannot withstand air for long periods, so it is imperative that they are placed in the viewing bag quickly. Use the Field Identification Guide to determine what type of fish you just caught. In your Rite in the Rain book, describe the juvenile salmonid that you caught and the distinguishing characteristics that helped you to determine the species.

- Did you catch a juvenile salmon or juvenile trout?

- If salmon, what species of salmon? Give the common name and scientific name.

- How did you identify this species?

- Describe the parr marks on the juvenile.

- Describe the distribution that this species of salmon is commonly found in (use your Field Guide).

DAY 4 WORKSHEET

Soil Science: Wetlands

Today we will change our focus from watersheds to the land. This is not, however, the kind of land that initially crosses your mind. The land we will study today is soaked with water. Soils that are saturated with water or that are covered to a shallow depth with water are called **wetlands**.

- Can you think of anything around you that sounds like a wetland?

Wetlands remain wet long enough during the growing season that the upper soil layers become deprived of oxygen. Over time, the lack of oxygen produces chemical reactions that change the color, texture, and organic content of the soil.

The soil of wetlands is divided into two major layers: organic and mineral. The top layer is organic, meaning that it is made up of anything that lives or once lived. This layer comes from decomposed plants and animals. The organic layer looks like black muck or dark brown or black peat. The second major layer is the mineral layer and is found deeper than the organic layer. Sand, silt, and clay typically make up this layer and it is neutral gray to greenish or bluish gray in color.

- Now can you think of anything around you that sounds like a wetland?

Analyzing the characteristics of the soil is just one factor that allows scientists to determine whether or not the land is considered a wetland. It is essential to categorize the land as a wetland to in order to protect it, as there is an international agreement to protect wetlands. Over 1/3 of the threatened and endangered species in the US live in wetlands, and over 1/2 of those species spend time in wetlands. Destruction of those species' habitat could ultimately lead to destruction of their entire population.

- Can you think of any wetlands nearby that are federally protected?

The Yukon Delta National Wildlife Refuge is a 19 million acre refuge in Southwestern Alaska. It is riddled with wetlands in which millions of waterfowl call home each summer. The waterfowl, including ducks and geese, return every year to feed, nest, and rear their offspring. Destruction of those wetlands would result in loss of home and habitat to millions of migratory birds.

- Can you think of any migratory birds that are endangered and protected (that is, birds that you cannot hunt)?

Today's Activity!

Your project today is to go for a hike in search of a wetland. You will take samples of both wet and dry soil and compare those samples to the Wetland Soil Chart that you must color prior to leaving camp. You will bring the Soil Sample Data Chart with you and fill it out as you take samples. Take a clipboard and pencil with you to write on and a shovel to dig a hole.

Once you find a wetland (or wet soil), dig a two foot hole (if permafrost allows). Take a golf ball size sample approximately every four inches and compare the color of the sample to the Wetland Soils Color Chart. Determine if the soil that you dug up was wet or dry.

- Was your soil wet or dry?
- What color was it?
- Based on the color of the soil, were your samples organic, mineral, or both?
- Can you think of any birds or animals that rely on the wetland from which you took soil?

DAY 5 WORKSHEET

Today we will talk about everyone's favorite subject.....FOOD!!!

We will discuss two types of contaminants that can be found in food that we eat and then we will discuss vitamin C in foods. Afterwards, we will take a hike to find local foods that contain Vitamin C and run tests to determine which plant has the greatest amount of Vitamin C.

Contaminants in Food: PCBs

PCBs are a group of chemicals known as polychlorinated biphenyls. They are manmade chemicals and do not occur naturally in nature. PCBs are used in many different types of products including hydraulic fluid, carbonless copy paper, vacuum pumps, and compressors. Their primary use was as a fluid in transformers and capacitors, which are electrical equipment.

In the 1970s it was determined that PCBs have major health risks associated with them. They can cause cancer in animals and humans, liver disease, reproductive disorders, skin ailments, and neurological disorders.

Unfortunately, PCBs are resistant to degradation or decomposition and will persist in the environment for several years. They also bioaccumulate in the foodchain. This means that if a shrimp eats a PCB in the bottom of the ocean, a fish eats the shrimp, and a person subsequently eats that fish, the person will get the PCB. The Environmental Protection Agency banned the ability to manufacture PCBs in 1978 due to the bioaccumulation and harmful effects.

Sadly, disposal of PCBs into waterways has caused pollution of many waterways including rivers and oceans. One particular population that has been greatly affected are the Siberian Eskimos on St. Lawrence Island. The two villages on that island are Gambell and Savoonga. This is because the ocean surrounding the island has a high concentration of PCBs from an old military site and the population relies heavily on a marine diet. Communities on St. Lawrence Island must monitor the fish and marine mammals that they eat so that they do not accumulate too many PCBs in their body.

On a brighter note, a recent study determined that the concentration of PCBs in Chinook and Chum Salmon in the Yukon and Kuskokwim Rivers are at levels safe for human consumption.

- What is a PCB?
- Is it made in the environment or by man?
- What effects do PCBs have on humans?
- In Alaska, who have been affected by PCBs?

Contaminants in Food: Mercury

Mercury is an element (Hg) that is naturally occurring and is a liquid in pure form. It is found in the air, water, and the soil. It is also found in coal. Power plants that burn coal cause a large source of mercury to be emitted into the air. Because mercury is heavier than air, it will eventually fall to the ground or water. Once mercury is in the water, it can be changed to methylmercury. Methylmercury builds up in fish and shellfish and can be very toxic. Like PCBs, methylmercury will build up in organisms that eat the fish, such as humans.

Exposure to mercury at high levels can harm the brain, kidneys, lungs, heart, and the immune system in humans. Perhaps the most devastating effects that mercury has are on children and babies who are still growing. The mercury can cause damage to their nervous system causing the child to have trouble walking, talking, learning, and thinking. The child may not grow like other children either and be smaller in stature.

A recent study determined that levels of mercury in salmon in the Yukon and Kuskokwim drainages are safe for human consumption. Levels of mercury in pike in the Yukon River drainages have been found to be dangerously high and it is recommended that children only eat two servings of pike per year.

- What is mercury?
- Is it made in the environment or by man?
- What effects do high levels of mercury have on humans?
- Where in Alaska are mercury levels too high for human consumption? And in what fish?

Vitamin C

Vitamin C helps our body to stay healthy. Not only does Vitamin C help our body repair tissues, it aids in healing and may prevent certain types of infections. Humans cannot produce Vitamin C naturally, so we need to eat foods or vitamins that are rich in Vitamin C. That is why our moms tell us to take Vitamin C or drink orange juice when we are sick.

Today's Activity!

Today we will perform an experiment to determine which wild foods contain Vitamin C and which wild food contains the most Vitamin C. Your job is to walk around camp and find as many plants and animals that you think contain Vitamin C. Examples include leafy greens, rose hips, fireweed, salmonberries, blueberries, and raspberries. You will need at least ½ a cup of the juice from the wild foods. Once you obtain large enough samples of wild foods, bring them back to camp and we will test them for how much Vitamin C they have.

Take the Tanaina Plantlore and Wild Edible and Poisonous Plants of Alaska books with you to determine which wild foods contain Vitamin C.

Once you have finished, answer the following questions:

- Why is Vitamin C good for the human body?
- Name four wild foods in your area that contain Vitamin C.
- Which wild food contained the most Vitamin C?

DAY 6 WORKSHEET

Mining and Fisheries

Mining has recently become a hot topic throughout the Kuskokwim Drainage. Today we will discuss three effects that mining can have on the fisheries in our watershed: acid rock drainage, cyanide, and mercury. We will also discuss fuel oil spills as salmon can suffer from large scale spills. Keep in mind that this is just a short list of the harmful effects of mining. It is also useful for you to know that the harmful effects on the environment can be minimized if all of the proper steps are taken to safely operate a mine.

Acid Rock Drainage

Acid mine drainage refers to the leakage of acidic water from old metal mines or old coal mines. This is also known as **acid rock water** or **acid rock drainage**. Remember that anything with a pH below 7.0 is considered acidic and aquatic life in freshwater cannot survive if the pH is less than 5.0.

Acid rock drainage occurs naturally in the environment. However, once mining or heavy construction begins, the natural processes of the earth become disrupted. The large scale disruptions cause more water to come in contact with the mineral pyrite, which will cause more acidic water to be produced. This will then cause more acid than normal to be released.

Subsurface mining, or mining that occurs below the surface of the land, normally occurs below the water table so water has to constantly be pumped out of the mine to prevent it from flooding. When the mine is abandoned, water immediately enters the mine and it can come into contact with pyrite. Chemical reactions will occur and cause high levels of acidic discharge.

Acid rock drainage is typically accompanied by high levels of heavy metals. As you learned yesterday, high levels of mercury are toxic to humans and animals. Low levels of other heavy metals, such as arsenic and lead, are also toxic to humans and animals.

- Can you think of any mines nearby that can potentially cause acid rock drainage?

Donlin Creek Mine is a proposed gold mine near Crooked Creek that will be an open pit mine if developed. The pit will be 2 miles long, ¾ of a mile wide, and 1000 feet deep and will be running for twenty years. There is potential for acid rock drainage with such a large disruption of the earth's natural processes. If the acid drains into streams and rivers, it can cause the pH to fall so low that aquatic life such as salmon and aquatic insects cannot survive.

Cyanide

Acid rock drainage is not the only harmful effect of mining on fisheries. **Cyanide** is a chemical that is used in mining to separate gold from the rocks. It is extremely toxic to humans, fish, and plants and will deprive the organisms of oxygen, thereby killing them immediately.

Mercury

We discussed mercury and its harmful effects yesterday. If autoclaving is used to mine, mercury can be released into the air. Since mercury is heavier than air, it will fall to the ground and waterways. Remember that it bioaccumulates in the food chain and has serious implications if it bioaccumulates in humans.

- Name four effects that mercury has on humans (hint: look in your Day 5 worksheet)

Transportation

Fuel is what we use to make our four wheelers, boats, and snowmachines run. It is not typically a harmful agent that results from mining, but Donlin Creek is a unique situation. It has been proposed to use bulk transportation of fuel via barge at a rate of one barge up and one barge down per day all summer. The large scale barge traffic will have repercussions in and of itself, while a large scale fuel spill would undoubtedly have even more severe implications.

Barges typically travel up the same channel in rivers. When several barges travel up the same channel of a river, the contour of the riverbed will change. This will alter the habitat of many aquatic organisms, including salmon. Redds, or the nests that salmon lay their eggs in, will be disturbed or even covered entirely. Plant life can be destroyed. Exhaust from the barges will be released and this pollution can change the water quality of the river. If a fuel spill occurs, water quality will significantly change. Oxygen will be deprived of the area that has been affected and aquatic organisms will suffocate. The coats of aquatic organisms will be covered, making it harder or impossible for them to move. Remember the mucous lining (slime) that salmon have to make them glide through the water with ease? This slime would be covered and they can no longer move with ease.

Clearly, pollution to rivers will have severe implications. Know that these accidents are avoidable when proper measures are taken to ensure that the environment remains unharmed.

- Name four harmful agents that can result from mining in your area.
- Name one mine near your area that can potentially harm the watershed in which you are a part of.

- Name one effect of cyanide on living organisms
- Name two effects of fuel spills on living organisms

DAY 7 WORKSHEET

Test your knowledge!
Questionnaire☺

The first section is review from last year. We do not expect you to remember everything but we do expect you to use resources such as books or technicians to determine the correct answers.

Matching:

A. Watershed
B. Alevins
C. Tributary
D. Weir
E. Adipose Fin
F. Dorsal Fin
G. Caudal Fin
H. Operculum
I. Chinook
J. Coho
K. Chum
L. Sockeye
M. Fry

____A fleshy lobe fin located between the dorsal and caudal fin
____Smaller feeder streams or rivers which empty into a larger mainstream river
____An area surrounding and draining water into a stream, river, lake, or wetland
____The life stage at which the young fish still have a yolk sac attached to them
____The life stage at which the young fish leave the gravel bed and begin swimming
____Otherwise known as King Salmon
____The gill covering of the fish
____The fin used mainly for steering
____The fin located on the top of the fish
____Otherwise known as Dog Salmon
____Otherwise known as Silver Salmon
____Otherwise known as Red Salmon
____A method to enable biologists to count fish

True/False

____Human Impacts on the environment can be small; for example, a can of oil or a bag of trash
____Adult Salmon sometimes eat aquatic insects
____Five of the seven species of Pacific Salmon spawn in the Kuskokwim or tributaries of the Kuskokwim
____Salmon eggs are laid in gravel nests called redds

This section tests you knowledge from your experience during the past week.

Matching:

A. Mineral Layer
B. Dissolved Oxygen
C. Wetlands
D. Nitrate
E. pH
F. Chlorofluorocarbons
G. Organic Layer
H. Mercury
I. Vitamin C

____This manmade chemical is known to cause cancer in animals and humans, liver disease, reproductive disorder, skin ailments, and neurological disorders.
____This type of land is saturated with water and/or covered to a shallow depth with water.
____This layer of soil looks like black muck or black or brown peat and comes from organisms that have once lived.
____This layer of soil is made of sand, silt, or clay and is usually neutral gray to bluish gray in color.
____This element is released when coal is burned and can harm the brain, kidneys, heart, lungs, and immune system in humans.
____This vitamin helps our body repair tissues, heal our body, and strengthen our immune system.
____This measurement of water quality determines how many molecules of oxygen are in the water.
____This measurement of water quality determines the relative acidity of the water.
____This element is needed by all living plants and animals to build protein.

True/False

____PCBs cause cancer in humans and animals
____Acid rock drainage can cause the pH to rise above 7.0
____Cyanide can deplete oxygen stores in living organisms and suffocate them
____Mercury can be released from mines if they use a method called autoclaving

DAY 8 WORKSHEET

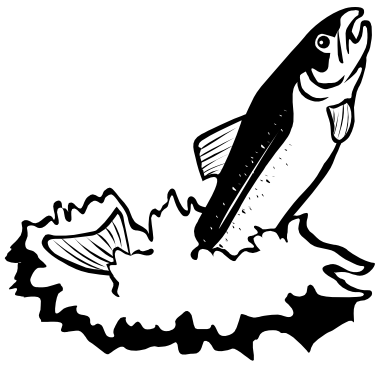
Take Home Assignment

Prior to the internship, the student is to inform the Internship Coordinator about their salmon of choice so that the appropriate reading materials can be provided.

Upon completion of the internship, the student must submit a one page report on one of the five species of salmon. Choices include Chinook (king), Sockeye (red), Coho (silver), Chum (dog), and Pink (humpy). Reports must include the average lifespan, size, and typical appearance of the salmon. Students must discuss the salmon life cycle and common residencies of the salmon that was chosen. In addition, the student is to discuss why they chose the specific salmon and the importance of that salmon in their culture.

It is highly recommended to reference Alaska's Fish: A Guide to Selected Species and Field Identification of Coastal Juvenile Salmonids. These two books contain the information that is required of the report.

Reports must have no more than three spelling errors and must be grammatically correct. Typed or written submissions are acceptable. It is advised that the student ask an adult peer to proof-read the report prior to submission.



APPENDIX 3

Project Sites

Image 1. The George River weir

Image 2. The Tatlawiksuk River weir

Image 3. The Kalskag fish wheel camp

Intern Experiences

Image 4. Reading and writing assignments

Image 5. Data collection at the fish wheels

Image 6. Data collection at the weirs

Image 7. Data analysis

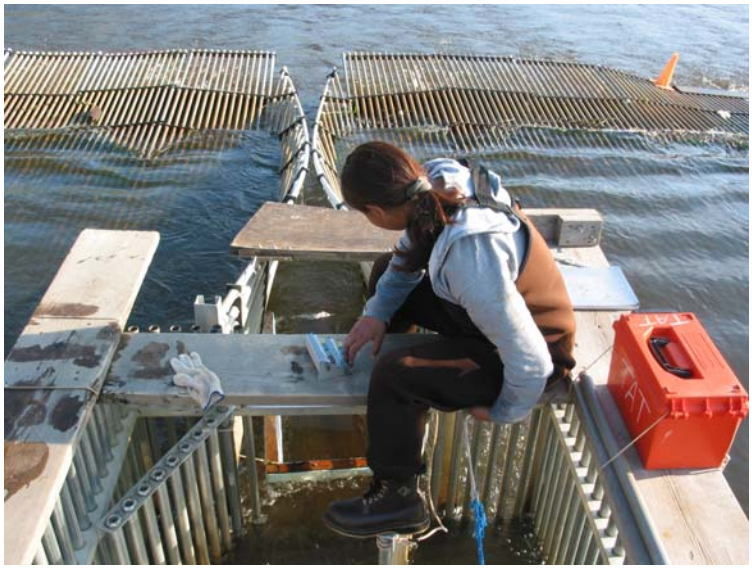


Image 8. Daily fish passage

Image 9. Radio tag deployment

Image 10. Radio tracking station setup and download

Image 11. Fish anatomy

Image 12. Fish dissection

Image 13. Juvenile salmon sampling with a beach seine

Image 14. Juvenile salmon identification

Image 15. Snorkeling and substrate composition