Place Based Science Lessons

By

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Chapter One Introduction

1.1 Background

I am the daughter of Arnold and Emily Brower Sr. from Barrow, Alaska. Both of my parents were predominantly raised in an Inupiaq subsistence lifestyle family. My father was half Inupiaq and half Caucasian. My mother was three quarter Inupiaq and one fourth Caucasian. They both spoke fluent Inupiaq and it was their first language. They also spoke fluent English. During my early childhood years, I recall being raised in a subsistence home and my first language was Inupiaq. The Western influences were present and strongly growing. By the time I was a teenager, most families relied more on the Western lifestyle and economy while continuing to subsist. Today, many if not most, of the community relies on the Western lifestyle. Few Inupiaq families rely completely on subsistence to support their families.

I have chosen to develop place based science lessons for my master's project because I believe that more culturally relevant and engaging material within the sciences could be offered that could positively impact student learning. Research has shown that student awareness and level of concern rise when learning material relate to their environment and to their daily lives. As a teacher, there is nothing more satisfying than when students are engaged and learning about their environmental surroundings.

I felt it was prudent to provide the demographics of my community as it contributes to the contextual nature of my project. The 2000 Barrow demographics were 62% Alaska Native, 24% White, 10% Asian, 1 % Native Hawaiian, and 1 % African American. The shifting demographics could reflect a change of how learning may occur within a community. As a child, the community of Barrow was predominantly Inupiaq and our learning processes heavily relied on the subsistence lifestyle. Today, subsistence activities such as whaling are observed but

seasonally and for short amounts of time, while the same people work for the rest of the year to support their families. As a result of the lessening reliance of the subsistence lifestyle and greater influence of the Western lifestyle, it seems that there may be a change of how learning occurs. This change is observed in my project, as it is infused with culturally relevant knowledge and content coupled with Western science approach. Relevant content provides meaning and purpose for students and results in successful student learning.

1.2 Introduction

Semken and Freeman (2008) state "place-based science teaching focuses on local and regional environments and synthesizes different ways of knowing them, leveraging the senses of place of students and teachers" (p. 1). Place based science education offers relevant hands on inquiry based experiences, content, and instructional guidance that promotes environmental stewardship (Woodhouse and Knapp, n.d.). Promoting science through place-based teaching has been shown to raise students' standardized test scores, increase their critical thinking skills, and promote good teacher practices. (Semken and Freeman, 2008). Dewey (n.d.) claimed that

> a primary responsibility of educators is that they not only be aware of the general principle of the shaping of actual experience by environing conditions, but that they also recognize in the concrete what surroundings are conducive to having experiences that lead to growth. Above all, they should know how to utilize the surroundings, physical and social, that exist so as to extract from them all that they have to contribute to building up experiences that are worthwhile. (Ch 3, para 15)

Place based science provides an avenue to foster traditional ecological knowledge or traditional environmental knowledge (TEK). Traditional environmental knowledge acknowledges the cultural practices of local and indigenous communities (Traditional Ecological

Knowledge, n.d.). Huntington and Mymrin (n.d.) state,

> TEK is a system of understanding one's environment. It is built over generations, as people depend on the land and sea for their food, materials, and culture. TEK is based on observations and experience, evaluated in light of what one has learned from one's elders. People have relied on this detailed knowledge for their survival--they have literally staked their lives on its accuracy and repeatability. (para 1)

Combining place based science education with western science methodologies and building in TEK can be challenging. Each one has its strengths and weaknesses.

As a teacher of the past 9 years in rural Alaska, I've come to understand that place based concepts may add to the foundation of bioregional, bicultural and multicultural education, as they can be considered to be grounded in place. Through my teaching I have come to realize that the most riveting aspects of my teaching were directly related to the local concepts and research occurring in our community. Providing hands on experiential learning activities for students is important to student learning. I was excited to come across the concept of place based education, projects, and theories as my own views and experiences align with it for the most part. Students appear to be more in tune with understanding their world and surroundings including the environment. So much of what I teach relates to the literal environment as I teach biology and the sciences. Place based and culturally relevant education has the potential to increase students' interest in learning, and may result in higher achievement. So, what is place based education? According to Kemp (2006) the place based education approach is grounded in place, community oriented, environmentally sound and provides significant and purposeful learning for students. His investigations of research show that environment is the underlying source for learning. Kemp states that place based education is an educational philosophy that derives its

curriculum from the locale. Starn's (as cited in Kemp, 2006) definition for place-based education,

> Creates learning experiences that: build a group identity and sense of "we" among teachers and learners; help learners become part of a community larger than their own; use communities as learning laboratories; and ensure that the skills, traits and habits that provide access to educational choices are acquired. (p. 136)

Taking into consideration how I view teaching and learning and how my views align with place based philosophies; I came to ponder more specifically what is the importance of place-based education? Woodhouse and Knapp (n.d.) assert that the purpose of place based education is to prepare students to "live and work to sustain the cultural and ecological integrity of the places they inhabit" (p. 3). The experiences and connections offered through place based education would arm students to make knowledgeable decisions that allow them to become active participants in their communities.

The impetus for my project is that place based science lessons could be made available for the North Slope Science course. Naturally, the course title, North Slope Science, acknowledges a place based framework. The course content would lend itself to lesson content grounded in the North Slope. The content will stem from the environment and will avail students with science experiences that they can relate to.

1.3 Rationale and need for the project

Development of sample place based lessons for the North Slope Science course may provide educational significance. It could be suggested that there may be a need to introduce relevant and meaningful content that may increase student engagement and performance into our school systems. Additionally, there seems to exist a need for incorporating local cultural systems

into the educational practices within rural school districts. Place based programs appear to address these needs. It is hoped that development of a place based lessons may be a starting point in identifying and promoting valid place based programs to students in our local region. Perhaps integrating place based activities and projects such as those found in place based programs into the school system could be a benefit to students.

The North Slope Borough School District offers an elective course titled North Slope Science. The course focus is broad and could include learning about the local and traditional aspects of science in the community. The course is offered as a science course for high school students at the Barrow High School. There seemingly exists a vast amount of resources to glean information and material for the course, but that there appears to be lacking a curricular structure for the course. It will be beneficial to have place based science lessons available for the course as well as to have available place based science material for additional science courses that could utilize the lessons.

1.4 Purpose of the Project

The purpose of this project is to develop five sample place based lessons that could be utilized in the North Slope Science course currently offered at the Barrow High School. It could also be used in other science related courses. Development of the sample place based lessons for North Slope Science may provide educators with a useful product that allow for a more effective starting point for the class.

1.5 Limitations of Project

Limitations of this project may exist. The educational content is limited to the sciences and is not necessarily conducive to other educational courses. The project resources are regionally limited. The availability of samples of whale and other culturally related resources

might not be readily available outside the North Slope. The lessons are only suggestions and should not be considered as a full curriculum for science.

1.6 Alaska State Cultural Standards

The Alaska state cultural standards are broad and varied. It allows for interpretation to address culturally related knowledge through various avenues. It does not constrict the methodology of how culturally relevant material should be produced or presented. The lessons produced for this project are considered to be in alignment with the Alaska state cultural standards.

Chapter Two Literature Review

The following section describes place based education, local relevance, multicultural education, western science limitations, place based science education, standards and the 5 E model.

2.1 Place Based Education

As place based and place conscious educational theories are the impetus for this project, it is important to understand the place based framework. Gruenewald (2003) asserts that places speak and interact as an ecological system. He further believes that place conscious education becomes accountable to place and that pedagogy becomes relevant for all. Gruenewald further purports that one's environment shapes experiences of knowledge acquired. (Gruenwald, 2003) Essentially, place based philosophy stems from the knowledge of place. Gruenewald (as cited in Kemp, 2006) states,

> Place based practices and purposes can be connected to experiential learning, contextual learning, problem-based learning, constructivism, outdoor education, indigenous education, environmental and ecological education, bioregional education, democratic education, multicultural education, community based education … as well as other

> approaches that are concerned with context and the value of learning from and nurturing specific places, communities, or regions. (p. 134)

Schroder (2006) states that place conscious education is "thinking about the concept of 'place' in relationship to education leads to exceptionally rich and creative avenues of exploration" (p. 312). Further Gruenewald (as cited in Schroder, 2006) states, "not only is our experience of places mediated by culture, education and personal experience, but places themselves are the products of culture" (p. 313). Hence, places are considered to be linked with cultural knowledge.

The constructivist paradigm naturally coincides with place based theories and projects. Denzin and Lincoln (2000) recognize constructivist's aims to understand and reconstruct; that knowledge develops through informed reconstructions and experience. The paradigm imbedded in place based programs and projects suggest that knowledge is constructed from place.

2.2 Local Relevance

Smith (2002) believes that student learning through connecting to their locale strengthens their academic performance. Place-based education provides a connection with the community and student learning. Students would be engaged in activities that are meaningful and relevant to their community and be challenged academically.

If place based education is to be promoted, it is essential that curriculum must align to community issues. Theobald and Nachitgal (as cited in Kemp, 2006) stated in regards to curriculum stemming from community:

> The curriculum must grow out of real issues important to the students and the people in a particular community. Activities that connect with one's own experience, that requires the use of skills from various disciplines, that are

> carried out in cooperation with others, and that result in a useful product give students the most powerful kinds of learning experiences. (p. 127)

In identifying the critical aspects of place-based education, Kemp (2006) hoped to convey its usefulness towards supporting and promoting locally derived curriculums that provide relevance for student learning.

2.3 Multicultural Education

Place based programs offer support for bicultural and multicultural education. In an expanding multicultural community, it may be important for rural school districts to support the local indigenous culture alongside the dominant Western culture. Keeping this in mind, local school districts seemingly support local and culturally relevant curricula. Akande (1998) states that, "educational change will not occur until new educational system…can root the analysis and practice of education and care-giving of students in the context of their culture" (p. 1). He suggests that the concepts of one culture being introduced onto another should be handled in a balanced way. Improving local curricula and standards of education are constant themes in education and the need for relevant curricula is important to student learning.

Multicultural education provides support towards minority learning. According to Maestri (2006), high school history curricula should be more inclusive of African Americans as their contributions to American history have been underrepresented and continues as so. For example, Maestri found in comparing how well students performed on a history test, on a question regarding George Washington, 90 % of Caucasian students answered correctly versus 79.5 % of black students. Further, regarding Harriet Tubman, 84% of the Caucasian students correctly answered versus 92% of the black students. These findings certainly could offer validation for inclusion of contributions made by other groups of people other than the dominant

Caucasian culture. Perhaps it could be stated that relevancy and association of content improves student performance where it is offered and provided. Maestri (2006) recommended that each state should provide a more balanced history inclusive of all ethnicities to promote cooperation and progress. The promotion of a more inclusive perspective of education is appropriate for acknowledging the historical contributions made by various groups.

Lipka (2002) suggests that instruction relevant to American Indian and Alaska Native culture allows students of these cultures to perform better. The results seem to indicate that the instruction was geared toward younger students in elementary grades. It was not evident that results were associated with students in higher grades such as middle or high school levels. Regarding the degree of success that culturally relevant curriculum may offer, Yazzie (1999) suggested that there is very little basis for success at this time as very little research has been collected. However, Strand (2002) suggests that it may be beneficial for American Indian and Alaska Native students to associate with their cultural activities as this seems to be associated with increase in student success. However, it is significant that students live in a more multicultural worldview as cultures continually merge and are in a constant state of change. It may be that promoting and utilizing relevant curriculum may prove to be a necessary component for the success of Alaska Native and American Indian students.

It is important for indigenous cultures to find a sustainable way to integrate local culture into education. Students become more successful as they learn in their cultural context. Place based education could be a method considered for the promotion of bicultural education as it fosters local cultural knowledge. Students become more successful as they learn in their worldview (Lipka et al. Dec. 2005).

Combining the Western and indigenous cultures could prove to be advantageous for indigenous students. According to Lipka et al. (Dec. 2005) student learning curve is raised when they are taught with culturally relevant curriculum and good teaching practices. In another study Lipka et al (2005) indicates evidence that indigenous cultural curricula increases indigenous student academic performance. It appears that there is a correlation between culturally relevant indigenous content and indigenous student performance. Although at this time the research collected is from younger elementary students, it may be plausible that this may be applied to indigenous students at higher grade levels such as middle and high school.

2.4 Western Science Limitations

Western knowledge systems may offer a limited view of scientific knowledge. Kimmerer (2002) purports that western science is more quantitative, the body of knowledge derived is not necessarily gathered from long term observations, western science knowledge and information is not associated with local environmental and cultural information, western science data is also not connected with cultural values. Sobel (2007) believes that educators within schools spend "too much time focusing on conveying environmental knowledge and way too little time on developing environmental behaviors" (p. 16). In this statement, Sobel captures perhaps an underlying concern within western education.

Development of responsible environmental behaviors begins with teaching students that they can make a difference. In addressing issues of climate change, Sobel follows the Swiss National Science Foundation's recommendations that educational systems instill place based programs, classrooms become caring environments, and schools create a ladder of growing environmental responsibility that is age and level appropriate. Sobel (1997) asserts that environmental values develop as a result of the "combination of landscape and appropriate

modeling" (p. 4). He suggests that it is necessary for students to learn how to care for the environment from adults who demonstrate the act of environmental stewardship (Sobel, 1997).

2.5 Place based science education

Place based science education could be identified in within community and cultural contexts. This contextual combination may provide students with a strong sense of relevance in education. Smith and Williams (as cited in Woodhouse and Knapp, n.d.) support the idea of ecological education by "grounding learning in a sense of place through investigation of surrounding natural and human communities" (p. 2). Smith and Williams (as cited in Woodhouse and Knapp, n.d.) believe that ecological education is a part of the natural world and is a result of ecological interactions and their environment.

Measham (2007) discussed the importance of place in terms of students learning about the environment. He suggests that it is important for students to recognize that they are a part of ecosystem and are connected to their environment. Understanding the interactions with the environment brings awareness of its implications and opens up avenues for students to begin to take action if they choose to do so. Providing a sense of purpose for learning the environment, like stewardship, may be a key for students to make connections to the environment (Measham, 2007).

Another place based study showed place based learning promotes community engagement and ecological integrity. Duffin, Murphy, and Johnson (2008) investigated their research question based on the National Environmental Education Advisory Council's (2005)

main concern: can education programs improve the environment? Quantitative analysis of their findings showed that about half (46%) of the programs studied revealed improved air quality during projects, most programs (89%) took action to improve air quality, and action oriented place-based like programs reported improvements in air quality. They suggested that teacher practices, which demonstrate qualities of place based principles, are more effective at improving air quality. Essentially these findings support that place based science programs contribute to changes in one's community.

2.6 State Standards

The promotion of place based education may come with limitations. The need to meet state standards has been the overarching concern in education today. Gruenewald (2003) recognized that as standard driven education continues to be fostered, place conscious pedagogy is scrutinized for measurable student progress by state and national educational systems. Kannapel (2000) suggests that schools that support place based concepts could be strengthened by the addition of state standards.

Kannapel (2000) cites a research study by Nancy Jennings that where state standards enhanced place based programs. From Jennings' study Kannapel pointed out three elements that warrant consideration: 1. How will schools address both state and local standards and how will they be assessed and accounted for? 2. Who will provide teacher professional development for addressing the time needed to develop place-based lessons integrated with state standards? 3. How can parents and community be involved for creating standards that meet local requirements and state standards? (Kannapel, 2000) These are pertinent questions that should be kept in mind when pursuing place based education in schools. These questions could also become the basis for causal type research.

2.7 Five E Model

There are several types of learning cycle models that suit the place based education philosophy. The 5 E model was on that I chose based on its inquiry and experiential based nature. Constructivist education philosophies such as place based education align well with the 5 E model (5 E Learning Cycle, n.d.). NASA's support of the 5 E model where hands on experience is vital to student learning brings a grounded assurance that this model is sound (5 E Overview, n.d.). The 5 E model was created in the 1980's by Bybee for the Biological Sciences Curriculum Study. This model allows for students to become aware of their reasoning during their activities and is based on Piaget's developmental philosophies. Research has shown that it is vital that the 5 E model be used with fidelity as this increased student learning significantly (Marshall, et al. 2008). The 5 E learning cycle model provides students opportunities to discuss with teachers content at an indepth level which promotes deeper learning of concepts. (Baci, et al. 2006). The 5 E learning cycle model is an effective teaching tool that stimulates, engages, and provides indepth conceptual learning for students.

Chapter 3 Methodology For Designing Curriculum Units

The focus of this project is to design five sample place based lessons for the North Slope Science course offered currently at Barrow High School. The 5E model has been chosen for the lesson structure.

3.1 Target audience, lesson structure, and design approach

High School students who may benefit from the lessons are those who will have selected North Slope Science as an elective science course. This course would contribute credits earned towards high school graduation. During the 2008-2009 school year the North Slope Borough

School District had an attendance rate of 86.2%; k-8 retention rate of 0.5%, graduation rate of 64.2%, and had dropout rates in grades 7-12 of 11.7%. Last year, Barrow High School made Adequate Yearly Progress. (NSBSD School Report, 2008-9).

The lesson elements will include background information, assessments, resources, student worksheets, and hands on inquiry based activities. The lessons will be aligned to the Alaska state standards and grade level expectations where appropriate. They will be designed for secondary students in the high school level grades 9-12th. Thematic lessons would involve the various projects derived from the North Slope and Arctic related themes. The design of the lessons would involve the 5 E learning cycle model.

3.2 Five E model

After investigating various learning cycles, the learning theoretical framework that I have chosen for the lessons is the 5 E model. The 5E model describes five stages associated with learning and is based on a constructivist teaching pedagogy which includes the elements of engagement, exploration, explanation, elaboration and evaluation.

Engagement allows students to become readily involved in an activity that relates to the content being introduced. Students are stimulated to make connections with present and prior knowledge through an engaging activity. Engagements act as hooks for student learning.

Exploration allows students to becoming actively involved. Students investigate concepts through hands on inquiry based activities that allow students to make connections to concepts through experiences. Students are encouraged to explore their way through an activity.

Explanation provides students the opportunity to explain what they have learned. Students are given the opportunity to share what they have learned during the exploration phase. This is also a time for teachers to provide further explanation of concepts.

Elaboration allows students to conduct further research of the concepts they have learned. This is a time for students to deepen the understanding of concepts. Students are encouraged to go beyond the exploration phase during elaboration.

The final stage involves evaluation. The need to evaluate student learning should be measured. Student understanding and comprehension of key concepts are assessed (5 E model n.d.).

3.3 Inspiration

The lessons were inspired by the resources that are available from the North Slope region. The North Slope is a vast and unique place. Its vast landscapes and abundant wildlife have been the inspiration for the cultural traditions and subsistence lifestyle still practiced today by the Iñupiat people.

Chapter 4 Project Lessons

4.1. Approaches to implementing the lessons and assessing student learning

The 5E learning cycle model will be used to implement the lessons. The summative assessment strategies will include student presentations, written reports, and communication of their projects. Students will have the opportunity to search the Internet and available library resources for background research. Elders and community members will be tapped into as local expert resources. Students will create power points and or digital videos as part of their presentations. Videos and could capture interviews of elders. Surveys could tap into the knowledge base of local experts.

4.2. Extensions

Barrow is a natural hot spot for scientific research and the opportunity for students to become connected with scientists and their projects is widely available. One of opportunities

involves the Science Internship sponsored by Ilisagvik College. The Science Internship is a two week collaboration between visiting scientists and local students and mediated by a mentor teacher. It provides students hands on experience with real research. Students earn 2-3 credits for the extensive work that they do. Another opportunity for extension involves participation in the local high school science fair. Students choose projects that are of interest to them. The projects are inquiry based and experiential. The science fair allows students to communicate the results of their projects. Another extension could involve invitation of elders and local experts into the classroom as well as providing time for students to visit local elders and experts in the community. Digital videos can be created to capture interviews and hands on experiences taught by elders and local experts.

4.3 Suggested Formative Assessment Strategies for Place Based Lessons

Formative assessments gauge the process of student learning and recognizes learning needs of students. It is an attempt to assess the development, progression, and mastery during student's engagement in a learning environment. It also involves self reflection and contemplation regarding mastery of knowledge. The place based lessons would seemingly compliment formative assessments that encourage self reflection and self regulation. Self regulated learning may be another form of assessment that would suit place based lessons. It is largely accompanied by students with high internal motivation for learning that allows for deeper learning of concepts. Formative assessments allow students to learn and build from their own experiences (Formative Assessment, n.d.).

4.4 Place Based Science Project Lessons

Vitamin C in Salmonberries

Place Based Lessons
Lesson One

http://i43.photobucket.com/albums/e358/urbanscout/salmonberry8.jpg

Grades:
9-12

Days:
6

Teacher Preparation:
1 hour for lab preparation and to review material.

Alaska State Cultural Standards:
SF1: Students develop an understanding of the interrelationships among individuals, cultures, societies, science and technology
SF2: Students develop an understanding that some individuals, cultures, and societies use other beliefs and methods in addition to scientific methods to describe and understand the world.
SF3: Students develop an understanding of the importance of recording and validating cultural knowledge.

OVERVIEW

Our Inupiaq forefathers ate various berries found on the North Slope for thousands of years. One of the berries that was highly sought after was the salmonberry, aqpik. The salmonberry is known to grow only in certain places across the North Slope. The Inuit of Utkeagvik (Barrow) did not have the salmonberry growing in their location and would trade with other Inupiat from various communities to get salmonberries. Our forefathers did not suffer from scurvy even though they ate foods that were not recognized as vitamin C rich foods. However, they ate berries, which are known to contain vitamin C. This activity is designed to qualitatively determine the amount of vitamin C present in salmonberries from various locations of Alaska.

ALASKA STATE STANDARDS AND GLES

Science
SE3 Students develop an understanding of how scientific discoveries and technological innovations affect and are affected by our lives and cultures.
[10] SE3.1 researching a current problem, identifying possible solutions, and evaluating the impact of each solution. (L)
SA1 Students develop an understanding of the processes of science used to investigate problems, design and conduct repeatable scientific investigations, and defend scientific arguments.
[10] SA1.1 The student demonstrates an understanding of the processes of science by asking questions, predicting, observing, describing, measuring, classifying, making generalizations, analyzing data, developing models, inferring, and communicating.
SF3 Students develop an understanding of the importance of recording and validating cultural knowledge
[10] SF1.1-SF3.1 analyzing the competition for resources by various user groups to describe these interrelationships.
Writing
[10] W4.1.2 The student writes about a topic by writing in paragraphs that included relevant details and evidence that support the main idea of the paragraph and thesis statement, grouping ideas logically within the paragraph, and placing paragraph breaks logically.

NATIONAL STANDARDS

A. Science as Inquiry - Science as inquiry requires students to combine processes and scientific knowledge with scientific reasoning and critical thinking to develop their understanding of science.
H.A.1 Abilities necessary to do scientific inquiry:
a. Identify questions and concepts that guide scientific investigations.
b. Design and conduct scientific investigations.
c. Use technology and mathematics to improve investigations and communications.
d. Formulate and revise scientific explanations and models using logic and evidence.
e. Recognize and analyze alternative explanations and models.
f. Communicate and defend a scientific argument.
U. Unifying Concepts and Processes - Unifying concepts and processes help students think about and integrate a range of basic ideas which builds an understanding of the natural world.
H.U.2 Evidence, models, and explanation.
c. Explanations provide interpretation, meaning, or sense to objects, organisms, or events. Explanations incorporate existing scientific knowledge and new evidence from observations, experiments, or models into internally consistent, logical statements, such as hypotheses, laws, principles, and theories.

Objectives

- Students will describe the importance of vitamin C and what factors affect the biochemistry of vitamin C.
- Students will compare and contrast the amount of vitamin C in salmonberries from various geographic locations in Alaska.
- Students will communicate the project through poster or power point and address aspects of the scientific method.

Materials Needed

10 test tubes, twelve 125 ml beakers, 12 plastic pipettes, vitamin c indicator, mortar and pestle, cheesecloth, distilled water, graduated cylinder, salmonberries from various Alaskan communities, and science journal.

Salmonberry Fact

Rubus chamaemorus, a creeping herbaceous plant, native to the Arctic and subarctic regions of the north temperate zone, and its edible, aggregate fruit resembling structurally the raspberry. The yellow or amber-colored berry grows from a 2.5-centimetre (1-inch) white flower on a creeping root like stem, or rhizome. The stalks grow to a height of 7.6-25 cm (3-10 inches)

http://dictionary.reference.com/browse/salmonberry

Inupiaq Terms

Aqpik

Siignaq

English Vocabulary

Free radicals

Oxidation

Scurvy

http://www.nwplants.com/images/shrubs/rub_spe_photo_jko_salmonberry_small1.jpg

Essential Research Question

Does the salmonberry's vitamin C content vary from different communities around the state of Alaska?

Engagement (day 1-2)

http://yoomilee.files.wordpress.com/2008/06/salmon-berry4.jpg

Process skills: questioning, analyzing data.

- Ask students to discuss how the Inupiat rarely endured scurvy.
- Ask students to discuss what foods the Inupiat ate that might contain vitamin C?
- Have students discuss what they think they know about vitamin C. and have students investigate on the Internet how vitamin C works and is metabolized in the body. Have students investigate what factors can affect vitamin C.
- Ask students what they know of the salmonberry in general and in light of the Inupiat culture.
- Have students investigate the salmonberry. Encourage them to discover the types of vitamins are found in the salmonberry and especially for vitamin C.
- Students will write what they learn in their science journals.

Exploration (day 3-4)

Salmonberries are found as far north as Atqasuk, Alaska.

Process skills: questioning, observing, measuring, collecting data, inferring, predicting, analyzing, hypothesizing, controlling variables, and investigating.

- Students will perform tests on salmonberries from various locations of Alaska to qualitatively determine how much vitamin C is found in them.
- Students will use student worksheet provided.

Explanation (day 5)

Process skills: communicating, making generalizations, analyzing data, and describing.

- Students will discuss the following questions regarding the exploration:
    a. What did the actual outcome of the investigation show? What did the results mean?
    b. What factors could have affected the amount of vitamin C found in various places of the North Slope?

Elaboration (day 6)

Process skills: predicting and inferring.

- Ask students how they think different types of soil may affect vitamin C found in salmonberries? Have them research and explain their answers.
- Ask students if they think different berries might have differing amounts of vitamin C in comparison to one another. Have them investigate and explain.

org/images/stories/plants/salmonberry.jpg

Evaluation

Process skills: comprehension and understanding of concepts.

- Students are informally observed throughout the project.
- Students will produce a digital or poster product to communicate results of project.

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Resources

Nutrition in Science Project: (How to make vitamin C indicator)
http://www.sciencemadesimple.com/nutrition_projects.html

Wikipedia: Vit. C
http://en.wikipedia.org/wiki/Vitamin_C

Decomposition of vitamin C
http://www.chemistry-react.org/go/default/Faq/Faq_12809.html

Definition
http://dictionary.reference.com/browse/salmonberry

Inspiration for Place Based Lessons…

The lessons were inspired by the resources available from the North Slope region. The North Slope is a vast and unique place. Its vast landscapes and abundant wildlife have been the inspiration for the cultural traditions and subsistence lifestyle still practiced today by the Iñupiat people.

Vitamin C in Aanaaliq, Broad Whitefish

http://hww.ca/~Content/363/Images/full_atlanticWhitefish_2.jpg

Place Based Lessons
Lesson Two

Grades:
9-12

Days:
6

Teacher Preparation:
1 hour for lab preparation and to review material.

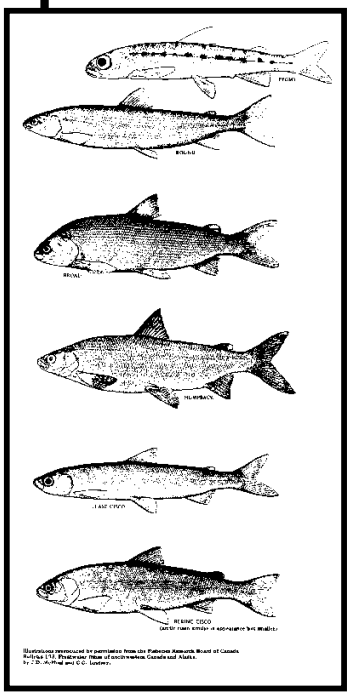
Alaska State Cultural Standards:
SF1: Students develop an understanding of the interrelationships among individuals, cultures, societies, science and technology
SF2: Students develop an understanding that some individuals, cultures, and societies use other beliefs and methods in addition to scientific methods to describe and understand the world.
SF3: Students develop an understanding of the importance of recording and validating cultural knowledge.

OVERVIEW

Our Inupiaq forefathers ate frozen raw foods known as quaq for thousands of years. Quaq was a staple food and was readily available. Quaq is still eaten today. Various animals were eaten in the form of quaq. These included many types of fish both marine and fresh, caribou, and whale. Our forefathers did not suffer from scurvy even though they ate foods that were not recognized as vitamin C rich foods. One of the main foods in the Inupiaq diet was Aanaaliq also known as Broad Whitefish. This activity is designed to qualitatively determine the amount of vitamin C present in raw versus cooked whitefish.

ALASKA STATE STANDARDS AND GLES

Science
SE3 Students develop an understanding of how scientific discoveries and technological innovations affect and are affected by our lives and cultures.
[10] SE3.1 researching a current problem, identifying possible solutions, and evaluating the impact of each solution. (L)
SA1 Students develop an understanding of the processes of science used to investigate problems, design and conduct repeatable scientific investigations, and defend scientific arguments.
[10] SA1.1 The student demonstrates an understanding of the processes of science by asking questions,
predicting, observing, describing, measuring, classifying, making generalizations, analyzing data, developing models, inferring, and communicating.
SF3 Students develop an understanding of the importance of recording and validating cultural knowledge
[10] SF1.1-SF3.1 analyzing the competition for resources by various user groups to describe these interrelationships.
Writing
[10] W4.1.2 The student writes about a topic by writing in paragraphs that included relevant details and evidence that support the main idea of the paragraph and thesis statement, grouping ideas logically within the paragraph, and placing paragraph breaks logically.



NATIONAL STANDARDS

A. Science as Inquiry - Science as inquiry requires students to combine processes and scientific knowledge with scientific reasoning and critical thinking to develop their understanding of science.
H.A.1 Abilities necessary to do scientific inquiry:
a. Identify questions and concepts that guide scientific investigations.
b. Design and conduct scientific investigations.
c. Use technology and mathematics to improve investigations and communications.
d. Formulate and revise scientific explanations and models using logic and evidence.
e. Recognize and analyze alternative explanations and models.
f. Communicate and defend a scientific argument.
U. Unifying Concepts and Processes - Unifying concepts and processes help students think about and integrate a range of basic ideas which builds an understanding of the natural world.
H.U.2 Evidence, models, and explanation.
c. Explanations provide interpretation, meaning, or sense to objects, organisms, or events. Explanations incorporate existing scientific knowledge and new evidence from observations, experiments, or models into internally consistent, logical statements, such as hypotheses, laws, principles, and theories.

Objectives

- Students will describe the importance of vitamin C and what factors affect the biochemistry of vitamin C.
- Students will compare and contrast the amount of vitamin C in cooked versus raw whitefish.
- Students will communicate the project through poster or power point and address aspects of the scientific method.

Inupiaq Terms

Aanaalik

Quaq

Suvak

English Vocabulary

Free radicals

Oxidation

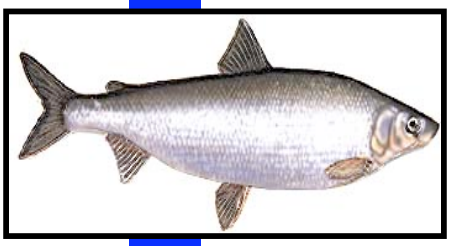
Scurvy

Materials Needed

10 test tubes, ten 150 ml beakers, 10 plastic pipettes, vitamin C indicator, mortar and pestle, cheesecloth, distilled water, graduated cylinder, whitefish, ulu, cutting board, electronic balance, and science journal.

Essential Research Question

Does raw fish contain more vitamin C than cooked fish?



http://www.borealforest.org/fish/white_fish.jpg

Engagement (day 1-2)

Process skills: questioning, analyzing data.

- Ask students to discuss how the Inupiat never endured scurvy.
- Ask students to discuss what foods the Inupiat ate that might contain vitamin C.
- Have students discuss what they think they know about vitamin C. and have students investigate on the Internet how vitamin C works and is metabolized in the body. Have students investigate what factors can affect vitamin C.
- Ask students what they know of the broad whitefish in general and in light of the Inupiat culture.
- Have students investigate the broad whitefish. Encourage them to discover the types of vitamins are found in the fish and especially for vitamin C.
- Students will write what they learn in their science journals.

Exploration (day 3-4)

Process skills: questioning, observing, measuring, collecting data, inferring, predicting, analyzing, hypothesizing, controlling variables, and investigating.

- Students will perform tests on Aanaaliq (raw and cooked) to qualitatively determine how much vitamin C is found in raw and cooked Aanaaliq.
- Students will use student worksheet provided

Explanation (day 5)

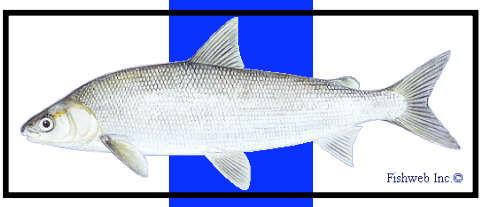
Process skills: communicating, making generalizations, analyzing data, and describing.

- Students will discuss the following questions regarding the exploration:
    a. What did the actual outcome of the investigation show? What did the results mean?
    b. What factor affected the amount of vitamin C? Why?
    c. How does heat affect vitamin C?

Elaboration (day 6)

Process skills: predicting and inferring.

- Ask students how they think different temperatures of cooking may affect vitamin C found in food? Have them research and explain their answers.
- Ask students if they think different organs of the fish may contain more or less vitamin C? Have students research the question and explain their answers.
- Ask students if they think different fish might have differing amounts of vitamin C in comparison to one another. Have them investigate and explain.



http://www.fishweb.com/recreation/fishing/fishfacts/fish/lake_whitefish/lake_whitefish.gif

Evaluation

Process skills: comprehension and understanding of concepts.

- Students are informally observed throughout the project.
- Students will produce a digital or poster product to communicate results of project.

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Resources

Nutrition in Science Project: (How to make vitamin C indicator)
http://www.sciencemadesimple.com/nutrition_projects.html

Nutrition Data (know what you eat) on whitefish (vitamin C found in whitefish)
http://www.nutritiondata.com/facts/ethnic-foods/9976/2

PDF Document: The effect of vitamin C on fish health
Viviane Verlhac and Jacques Gabaudan
Centre for Research in Animal Nutrition, Société Chimique Roche, BP 170, 68305 Saint-Louis Cedex, France
http://74.125.155.132/search?q=cache:kQzHS7flH7QJ:www.dsm.com/en_US/downloads/dnp/51644_VitaminC.pdf+source+of+vit+c+for+fish&cd=1&hl=en&ct=clnk&gl=us&client=firefox-a

Wikipedia: Vit. C
http://en.wikipedia.org/wiki/Vitamin_C

Decomposition of vitamin C
http://www.chemistry-react.org/go/default/Faq/Faq_12809.html

Inspiration for Place Based Lessons…

The lessons were inspired by the resources that are available from the North Slope region. The North Slope is a vast and unique place. Its vast landscapes and abundant wildlife have been the inspiration for the cultural traditions and subsistence lifestyle still practiced today by the Iñupiat people.

Whale Oil Soap

http://graphics8.nytimes.com/images/2007/12/14/science/whale.jpg

Place Based Lessons
Lesson Three

Grades:
9-12

Days:
10

Teacher Preparation:
2 hours for lab preparation and to review material.

Alaska State Cultural Standards:
SF1: Students develop an understanding of the interrelationships among individuals, cultures, societies, science and technology
SF2: Students develop an understanding that some individuals, cultures, and societies use other beliefs and methods in addition to scientific methods to describe and understand the world.
SF3: Students develop an understanding of the importance of recording and validating cultural knowledge.

OVERVIEW

Whaling has been an Inupiaq tradition for thousands of years. The whale was one of the main sources of food available to the Inuit along with other marine animals. During the early colonial whaling years, the whale was not only used for food it was also prized for the products that could be made from whale. One of the products was soap. Though soapmaking is not an Inupiaq tradition, there exists the element of curiosity of soapmaking from animal fat. I do recall my own parents making lye soap in our backyard. This activity involves making soap with whale oil.

ALASKA STATE STANDARDS AND GLES

Science
SE3 Students develop an understanding of how scientific discoveries and technological innovations affect and are affected by our lives and cultures.
[10] SE3.1 researching a current problem, identifying possible solutions, and evaluating the impact of each solution. (L)
SA1 Students develop an understanding of the processes of science used to investigate problems, design and conduct repeatable scientific investigations, and defend scientific arguments.
[10] SA1.1 The student demonstrates an understanding of the processes of science by asking questions,
predicting, observing, describing, measuring, classifying, making generalizations, analyzing data, developing models, inferring, and communicating.
SF3 Students develop an understanding of the importance of recording and validating cultural knowledge
[10] SF1.1-SF3.1 analyzing the competition for resources by various user groups to describe these interrelationships.
Writing
[10] W4.1.2 The student writes about a topic by writing in paragraphs that included relevant details and evidence that support the main idea of the paragraph and thesis statement, grouping ideas logically within the paragraph, and placing paragraph breaks logically.

NATIONAL STANDARDS

A. Science as Inquiry - Science as inquiry requires students to combine processes and scientific knowledge with scientific reasoning and critical thinking to develop their understanding of science.
H.A.1 Abilities necessary to do scientific inquiry:
a. Identify questions and concepts that guide scientific investigations.
b. Design and conduct scientific investigations.
c. Use technology and mathematics to improve investigations and communications.
d. Formulate and revise scientific explanations and models using logic and evidence.
e. Recognize and analyze alternative explanations and models.
f. Communicate and defend a scientific argument.
U. Unifying Concepts and Processes - Unifying concepts and processes help students think about and integrate a range of basic ideas which builds an understanding of the natural world.
H.U.2 Evidence, models, and explanation.
c. Explanations provide interpretation, meaning, or sense to objects, organisms, or events. Explanations incorporate existing scientific knowledge and new evidence from observations, experiments, or models into internally consistent, logical statements, such as hypotheses, laws, principles, and theories.

Bowhead Fact:

"Bowhead whales were hunted by commercial whalers for over four centuries, beginning in the North Atlantic in the 1500s and ending in the North Pacific by the mid-1900s. Bowhead whales are capable of breaking through sea ice at least 8 inches thick; some Eskimo hunters have reported whales surfacing through 2 feet of thick ice."

http://www.alaskatrekker.com/whales.htm

Objectives

- Students will describe the importance of whale blubber in early whaling days. Students will investigate the history of whaling.
- Student will compare and contrast the amount of different amounts of whale oil affect soap hardness.
- Students will communicate the project through poster or power point and address aspects of the scientific method.

Inupiaq Terms

Agvik

Uqsruq

English Vocabulary

Saponification

Micelle

Render

Materials Needed

Steel or glass container, wooden spoon, egg beater, lye, whale oil, water, potato masher, sieve, 5 gallon plastic container, 2 one gallon plastic containers, science journals.

Essential Research Question

How do different amounts of whale oil affect the hardness of soap?

http://img.dailymail.co.uk/i/pix/2007/06_02/BowheadWhaleG_468x266.jpg

Engagement (day 1-4)

Process skills: questioning, analyzing data.

- Ask students to discuss history of the Inupiat hunt whale.
- Ask students to discuss what foods the Inupiat made out of whale.
- Have students discuss what they think they know about whale blubber.
- Have students investigate whale blubber composition.
- Have students discuss what is done with the excess whale blubber.
- Have students investigate the history of soap making.
- Students will write what they learn in their science journals.

Exploration (day 5-8)

Process skills: questioning, observing, measuring, collecting data, inferring, predicting, analyzing, hypothesizing, controlling variables, and investigating.

- Students will make whale oil soap.
- Students will use student worksheet provided.

Explanation (day 9)

Process skills: communicating, making generalizations, analyzing data, and describing.

- Students will discuss the following questions regarding the exploration:
    a. What did the actual outcome of the investigation show? What did the results mean?
    b. Did Inupiat in the early to mid 1900's make soap?
    c. What is a micelle?

Elaboration (day 10)

Process skills: predicting and inferring.

- Ask students how they think different types of soap may be effective on certain types of stains? Have them research and explain their answers.
- Ask students if they think whale oil soap could be made justifiably today. Have them investigate and explain.
- Ask students what other types of animal fat can be made into soap.

http://www.alaskatrekker.com/whales.htm

Evaluation

Process skills: comprehension and understanding of concepts.

- Students will produce a digital video or poster product to communicate results of project.
- Students are informally observed throughout the project.

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Resources

Wikipedia: Blubber
http://en.wikipedia.org/wiki/Blubber

Saponification
http://home.pacific.net.au/~thambilton/Saponification.html

How to make lye soap and other concoctions
http://farmgal.tripod.com/lyesoapconcoctions.html

How to make lye soap with lard
http://www.ehow.com/how_4695940_lye-soap-lard.html

How to make lye soap
http://howtomakelyesoap.weebly.com/

Alaska Eskimo whaling
http://www.highnorth.no/Library/Hunts/Other/al-es-wh.htm

Inspiration for Place Based Lessons…

The lessons were inspired by the resources that are available from the North Slope region. The North Slope is a vast and unique place. Its vast landscapes and abundant wildlife have been the inspiration for the cultural traditions and subsistence lifestyle still practiced today by the Iñupiat people.

Emergence of Arctic Chironomids

http://life.bio.sunysb.edu/marinebio/fc.chironomid.lind.jpg

Place Based Lessons
Lesson Four

Grades:
9-12

Days:
9

Teacher Preparation:
2 hours for lab preparation and to review material.

Alaska State Cultural standards:
SF1: Students develop an understanding of the interrelationships among individuals, cultures, societies, science and technology
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SF3: Students develop an understanding of the importance of recording and validating cultural knowledge.

OVERVIEW

Chironomids are nonbiting midges found all across the North Slope and other regions of the world. Chironomids have hemoglobin in their "blood" and are reddish in color and are known as blood-worms. They are important indicators of freshwater systems. Chironomids are known to survive in all types of water and because they can tolerate low levels of oxygen are indicators of brackish waters. While they are a nuisance for land animals, like caribou, they are an important source of food for migratory birds and fish. The Inupiat rely on migratory birds and fish for subsistence foods even today. So, chironomids play an important role in the arctic ecosystem.

ALASKA STATE STANDARDS AND GLES

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[10] SF1.1-SF3.1 analyzing the competition for resources by various user groups to describe these interrelationships.
Writing
[10] W4.1.2 The student writes about a topic by writing in paragraphs that included relevant details and evidence that support the main idea of the paragraph and thesis statement, grouping ideas logically within the paragraph, and placing paragraph breaks logically.

NATIONAL STANDARDS

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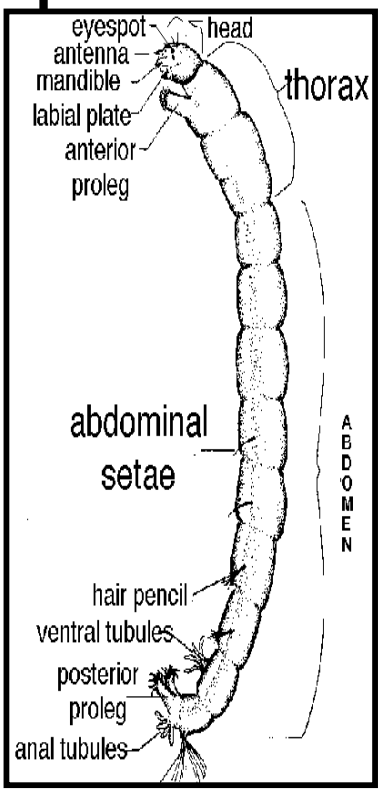

http://life.bio.sunysb.edu/marinebio/fc.chironomid.diagram.jpg

Objectives

- Students will describe the importance of larvae and pupa in the tundra ecology.
- Students will understand how temperature affects the emergence of tundra larvae.
- Students will communicate the project through poster or power point and address all aspects of the scientific method.

Inupiaq Terms

Kiktugiaq
Qupilguq

English Vocabulary

Emergence
Chironomid
Pupa
Ecosystem

Materials Needed

Hip boots, fine mesh net with long handle, 3 five gallon buckets, sieves, small containers with fine mesh net on lids, mesh scooping utensil, vials, rubbing alcohol, 20-30 chironomids, and science journals.

Essential Research Question

How does water temperature affect the timing of emergence of chironomids?

http://www.first-nature.com/insects/diptera/images/chironomus2.jpg

Engagement (day 1-2)

Process skills: questioning, analyzing data.

- Ask students to discuss what they know of larva, where they are found, what type of insects they are…etc.
- Ask students to discuss what animals may eat larva; what do larvae consume?
- Have students investigate on the Internet types of larva found on the North Slope; have them investigate general characteristics of larvae and their importance to the ecology of the tundra.

Exploration (day 3-7)

Process skills: questioning, observing, measuring, collecting data, inferring, predicting, analyzing, hypothesizing, controlling variables, and investigating.

- Students will experiment how different temperatures affect the timing of emergence of larvae.
- Students will use student worksheet provided.

Explanation (day 8)

Process skills: communicating, making generalizations, analyzing data, and describing.

- Students will discuss the following questions regarding the exploration:
    a. What did the actual outcome of the investigation show? What did the results mean?
    b. What factors could have affected the timing of emergence of larvae?

Elaboration (day 9)

Process skills: predicting and inferring.

- Ask students how they think different pH of water may affect emergence?
- Ask students if they think different nitrogen levels may affect emergence of larvae?
- Have students investigate the two questions via Internet.

bugguide.net/node/view/271874/bgimage

Evaluation

Process skills: comprehension and understanding of concepts.

- Students will produce a digital video or poster product to communicate results.
- Students are informally observed throughout the project.

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Resources

*This project was inspired by Dr. Mac Butler of NDSU. He came up to Barrow in the 1970s to study chironomid larvae. He came back in 2007 to conduct further studies on chironomids. Students had the opportunity to work with Dr. Butler through the Science Internship program offered through Ilisagvik College. The Science Internship program was a collaborative effort between Barrow Arctic Science Consortium and Ilisagvik College and one that I put together.

Arctic Midges
http://www.ndsu.edu/ndsu/news/magazine/vol08_issue01/arctic_midges.shtml

Charles Apperson, Michael Waldvogel and Stephen Bambara, (n.d.) Extension Entomology NC Cooperative Extension Dept of Entomology Biology and control of nonbiting aquatic midges
http://www.ces.ncsu.edu/depts/ent/notes/Urban/midges.htm

Chironomids: Fly Craft Angling
http://www.flycraftangling.com/index.asp?p=125

Inspiration for Place Based Lessons…

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Fermented Eskimo Foods

http://dnr.alaska.gov/coastal/acmp/Enews/7_07/Barrow.html

Place Based Lessons
Lesson Five

Grades:
9-12

Days:
7

Teacher Preparation:
2 hours for lab preparation and to review material.

Alaska State Cultural Standards:
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OVERVIEW

The Inupiat hunt and subsist off of both land and marine animals. On land and rivers they hunt the caribou, many species of fish, and birds. Marine animals that are hunted for food include beluga, bowhead whales, bearded seal, ring seal, walrus, clams, and various fish species. One of the ways that the Inupiat people prepare food is through fermentation. Fermented foods include piguraq (caribou), mikigaq (bowhead whale), aaruq (whitefish) and urraq (bearded seal flipper). Mikigaq is a fermented delicacy served during the whale festival, Nalukataq. The goal of this exercise is to discover what kinds of bacteria grow in properly prepared mikigaq versus non-properly prepared mikigaq.

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Excerpt from Pt. Hope Nalukataq

"The crew's women dug elbow-deep into wooden barrels with mikigaq or fermented whale meat, to pass out more meat. Being the only meat that ferments itself, mikigaq takes 8 to 10 days to ferment and needs to be turned over every 12 hours. It is dark red, has a soft consistency and a sweet taste that makes the palates tingle and fills the stomach with a warm feeling."

http://www.turtletrack.org/Issues03/Co08092003/CO_08092003_PointHopeWhaling-III.htm

Objectives

- Students will investigate and describe the importance of fermented foods in the Inupiaq culture.
- Students will compare and contrast the types of bacteria found in various Inupiaq foods.
- Students will communicate the project through poster or power point and address aspects of the scientific method.

Inupiaq Terms

Mikigaq
Piguraq
Aaruq
Urraq
Puvlaq

English Vocabulary

Fermentation

Anaerobic

Respiration

Botulism

Materials Needed

Mikigaq, cotton swab, 10 Petri dishes with agar (could use various types of agar as a point of interest like blood, potato, nutrient agar), incubator and science journals.

Essential Research Question

What types of bacteria grow in properly prepared fermented Inupiaq foods versus non-properly prepared food?

Engagement (day 1-3)

Process skills: questioning, analyzing data.

- Ask students to discuss what foods the Inupiat fermented.
- Have students investigate fermented foods (aaruq, urraq, mikigaq), how they are prepared, by asking elders.
- Have students investigate the medicinal properties of fermented foods.
- Students will write what they learn in their science journals and record interviews via digital video.

Barrow Nalukataq Excerpt:

"…but even more important is the preparation of huge quantities of mikigaq which will be served to hundreds of people. This takes place a week before the Nalukataq; the timing must be exactly right so that the fermentation process is perfect."

http://www.uark.edu/misc/jcdixon/Historic_Whaling/AEWC/aewc_maggie%20presentation.htm

Exploration (day 4-5)

Process skills: questioning, observing, measuring, collecting data, inferring, predicting, analyzing, hypothesizing, controlling variables, and investigating.

- Students will conduct experiment on what types of bacteria grow in properly prepared mikigaq.
- Students will use student worksheets provided.

Explanation (day 6)

Process skills: communicating, making generalizations, analyzing data, and describing.

- Students will discuss the following questions regarding the exploration:
    a. What did the actual outcome of the investigation show?
    b. What did the results mean?

http://www.nativetech.org/inupiat/pointlayindex.html

Elaboration (day 7)

Process skills: predicting and inferring.

- Ask students if they think non-fermented foods may produce just as much or more gas than fermented foods. Have them research and explain their answers.
- Have students research anaerobic and aerobic bacteria.
- Students can experiment to see which fermented foods produce the most gas over time.
    a. What factors contributed to the release of gas? What kinds of bacteria may have contributed to the release of gas?

Evaluation

Process skills: comprehension and understanding of concepts.

- Students will produce a digital video or poster product to communicate results.
- Students are informally observed throughout the project.

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Resources

Wikipedia: Blubber
http://en.wikipedia.org/wiki/Blubber

What kinds of gases does decaying food give off?
http://www.madsci.org/posts/archives/2005-01/1106120458.Bc.r.html

Fermentation
http://en.wikipedia.org/wiki/Fermentation_%28biochemistry%29

Botulism
http://www2.cdc.gov/phtn/botulism/protection/protection.asp

AEWC
http://www.uark.edu/misc/jcdixon/Historic_Whaling/AEWC/aewc_maggie%20presentation.htm

Inspiration for Place Based Lessons…

The lessons were inspired by the resources that are available from the North Slope region. The North Slope is a vast and unique place. Its vast landscapes and abundant wildlife have been the inspiration for the cultural traditions and subsistence lifestyle still practiced today by the Iñupiat people.

Chapter 5 Summary, Implementation, and Reflections

Place based education is a concept that I readily embrace. It has been exciting to find a theory that somewhat aligns to my philosophy of teaching. Providing relevant hands on and inquiry based projects is vital for students' academic development and growth. When students are engaged in meaningful projects, their awareness rises, their level of concern rises, their critical thinking skills are utilized, and they connect to real life research.

The development of sample lessons was started by creating worksheets to accompany reading content material. As I did this, I found that I was rather disappointed with myself for coming up with worksheets. I was not satisfied with the product I was developing. It is important to have student worksheets to accompany reading materials so that students can have a way to connect to the material and that teachers can have concrete and tangible material to assess student progress. However, I found that I ended up hitting a block in writing and just couldn't foster what I was working on. After giving myself some time to think about what I was experiencing, I came across an interesting thought.

I found that as I have contemplated on what I have learned about place based education, that students should be offered relevant, purposeful, and meaningful projects that are related to their environment, I discovered that perhaps I was approaching this project in a manner that did not support what I seemed to understand about place based education. So, this realization gave me the impetus to pursue actual projects that are place based in nature. Once I began writing place based activities, I found that the excitement surrounding the place based concept rising within me.

Most of the activities that I've come up with follow the science fair model and rely on the scientific method. The science fair model provides an avenue for students to work with

meaningful projects, conduct research, experiment, analyze, and communicate their results. I think this is a good match for promoting place based activities and projects.

I had the opportunity to conduct several of the place based lessons introduced for this project. Students were eager to research, form a hypothesis, conduct experiments to test the hypothesis, analyze data and to communicate their results. The students were quite excited about the lesson regarding vitamin C found in Aanaaliq (Broad whitefish). Once students saw the results of the project, students naturally asked more questions which deepened their understanding of the wealth of healthy native foods.

The science fair model naturally lends itself to the 5 E learning cycle model. Selecting the 5 E learning cycle model was a difficult choice. There are many learning cycle models that could fit with the place based philosophies. The indigenous learning cycle model (Best Practices, n.d.) was considered and was found to be commendable and noteworthy. However because of the changing demographics of my community and seemingly changing ways of knowing, it was significant to acknowledge this change. It appeared important to address the changing learning processes, as my community seemed to be experiencing this shift.

Promoting projects is a good way to integrate and address additional educational content besides science. Projects provide an avenue for students to discover and read through research relevant to their topics, allows for students to address mathematical and manipulative concepts, and address writing conventions. Although the place based lessons have focused on science content, lesson projects could be done in other educational fields. The overarching goal of the place based science lessons is that students experience culturally relevant activities that are meaningful to their learning and provide an avenue for student success. Further expansion could include the creation of more culturally relevant science lessons. Further research could involve

addressing how learning processes change as cultures become integrated and intertwined. In addition, investigating the effectiveness of limitations of Western approaches to teaching and evaluating could be considered for further study.

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Appendix A

Vitamin C in Salmonberries

Place Based Lessons
Lesson One

http://i43.photobucket.com/albums/e358/urbanscout/salmonber

Grades:
9-12

Days:
6

Teacher Preparation:
1 hour for lab preparation and to review material.

Alaska State Cultural Standards:
SF1: Students develop an understanding of the interrelationships among individuals, cultures, societies, science and technology
SF2: Students develop an understanding that some individuals, cultures, and societies use other beliefs and methods in addition to scientific methods to describe and understand the world.
SF3: Students develop an understanding of the importance of recording and validating cultural knowledge.

OVERVIEW

Our Inupiaq forefathers ate various berries found on the North Slope for thousands of years. One of the berries that was highly sought after was the salmonberry, Aqpik. The salmonberry is known to grow only in certain places across the North Slope. The Inuit of Utkeagvik (Barrow) did not have the salmonberry growing in their location and would trade with other Inupiat from various communities to get salmonberries. Our forefathers did not suffer from scurvy even though they ate foods that were not recognized as vitamin C rich foods. However, they ate berries, which are known to contain vitamin C. This activity is designed to qualitatively determine the amount of vitamin C present in salmonberries from various locations of Alaska.

Alaska State Standards and GLEs

Science
SE3 Students develop an understanding of how scientific discoveries and technological innovations affect and are affected by our lives and cultures.
[10] SE3.1 researching a current problem, identifying possible solutions, and evaluating the impact of each solution. (L)
SA1 Students develop an understanding of the processes of science used to investigate problems, design and conduct repeatable scientific investigations, and defend scientific arguments.
[10] SA1.1 The student demonstrates an understanding of the processes of science by asking questions, predicting, observing, describing, measuring, classifying, making generalizations, analyzing data, developing models, inferring, and communicating.
SF3 Students develop an understanding of the importance of recording and validating cultural knowledge
[10] SF1.1-SF3.1 analyzing the competition for resources by various user groups to describe these interrelationships.
Writing
[10] W4.1.2 The student writes about a topic by writing in paragraphs that included relevant details and evidence that support the main idea of the paragraph and thesis statement, grouping ideas logically within the paragraph, and placing paragraph breaks logically.

National Standards

A. Science as Inquiry - Science as inquiry requires students to combine processes and scientific knowledge with scientific reasoning and critical thinking to develop their understanding of science.
H.A.1 Abilities necessary to do scientific inquiry:
a. Identify questions and concepts that guide scientific investigations.
b. Design and conduct scientific investigations.
c. Use technology and mathematics to improve investigations and communications.
d. Formulate and revise scientific explanations and models using logic and evidence.
e. Recognize and analyze alternative explanations and models.
f. Communicate and defend a scientific argument.
U. Unifying Concepts and Processes - Unifying concepts and processes help students think about and integrate a range of basic ideas which builds an understanding of the natural world.
H.U.2 Evidence, models, and explanation.
c. Explanations provide interpretation, meaning, or sense to objects, organisms, or events. Explanations incorporate existing scientific knowledge and new evidence from observations, experiments, or models into internally consistent, logical statements, such as hypotheses, laws, principles, and theories.

Salmonberry Fact

Rubus chamaemorus, a creeping herbaceous plant, native to the Arctic and subarctic regions of the north temperate zone, and its edible, aggregate fruit resembling structurally the raspberry. The yellow or amber-colored berry grows from a 2.5-centimetre (1-inch) white flower on a creeping root like stem, or rhizome. The stalks grow to a height of 7.6-25 cm (3-10 inches)

http://dictionary.reference.com/browse/salmonberry

Objectives

- Students will describe the importance of vitamin C and what factors affect the biochemistry of vitamin C.
- Students will compare and contrast the amount of vitamin C in salmonberries from various geographic locations in Alaska.
- Students will communicate the project through poster or power point and address aspects of the scientific method.

Inupiaq Terms

Aqpik

Siignaq

English Vocabulary

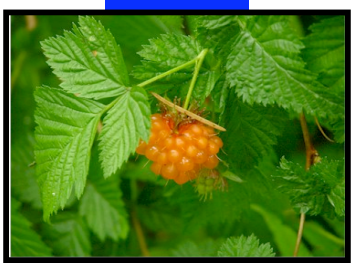
Free radicals

Oxidation

Scurvy

Materials Needed

10 test tubes, twelve 125 ml beakers, 12 plastic pipettes, vitamin C indicator, mortar and pestle, cheesecloth, distilled water, graduated cylinder, salmonberries from various Alaskan communities, and science journal.



http://www.nwplants.com/images/shrubs/rub_spe_photo_jko_salmonberry_small1.jpg

Essential Research Question

Does the salmonberry's vitamin C content vary from different communities around the state of Alaska?

Engagement (day 1-2)

http://yoomilee.files.wordpress.com/2008/06/salmon-

Process skills: questioning, analyzing data.

- Ask students to discuss how the Inupiat rarely endured scurvy.
- Ask students to discuss what foods the Inupiat ate that might contain vitamin C?
- Have students discuss what they think they know about vitamin C. and have students investigate on the Internet how vitamin C works and is metabolized in the body. Have students investigate what factors can affect vitamin C.
- Ask students what they know of the salmonberry in general and in light of the Inupiat culture.
- Have students investigate the salmonberry. Encourage them to discover the types of vitamins are found in the salmonberry and especially for vitamin C.
- Students will write what they learn in their science journals.

Exploration (day 3-4)

Salmonberries are found as far north as Atqasuk, Alaska.

Process skills: questioning, observing, measuring, collecting data, inferring, predicting, analyzing, hypothesizing, controlling variables, and investigating.

- Students will perform tests on salmonberries from various locations of Alaska to qualitatively determine how much vitamin C is found in them.
- Students will use student worksheet provided.

Explanation (day 5)

Process skills: communicating, making generalizations, analyzing data, and describing.

- Students will discuss the following questions regarding the exploration:
    a. What did the actual outcome of the investigation show? What did the results mean?
    b. What factors could have affected the amount of vitamin C found in various places of the North Slope?

Elaboration (day 6)

Process skills: predicting and inferring.

- Ask students how they think different types of soil may affect vitamin C found in salmonberries? Have them research and explain their answers.
- Ask students if they think different berries might have differing amounts of vitamin C in comparison to one another. Have them investigate these concepts and explain.

org/images/stories/plants/salmonberry.jpg

Evaluation

Process skills: comprehension and understanding of concepts.

- Students are informally observed throughout the project.
- Students will produce a digital or poster product to communicate results of project.

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Resources

Nutrition in Science Project: (How to make vitamin C indicator)
http://www.sciencemadesimple.com/nutrition_projects.html

Wikipedia: Vit. C
http://en.wikipedia.org/wiki/Vitamin_C

Decomposition of vitamin C
http://www.chemistry-react.org/go/default/Faq/Faq_12809.html

Definition
http://dictionary.reference.com/browse/salmonberry

Inspiration for Place Based Lessons…

The lessons were inspired by the resources available from the North Slope region. The North Slope is a vast and unique place. Its vast landscapes and abundant wildlife have been the inspiration for the cultural traditions and subsistence lifestyle still practiced today by the Iñupiat people.

Place Based

Lesson 1

Vitamin C in Salmonberries

Project Assessment Rubric

Objective	Developing	Proficient	Expert
Students will describe the importance of vitamin C and what factors affect the biochemistry of vitamin C. Students will investigate the salmonberry.	Students identify 1-2 factors that affect biochemistry of vitamin C. Students will investigate the salmonberry and write a ½ - 1 page introduction. 1-2 resources listed.	Students identify 3-4 factors that affect biochemistry of vitamin C. Students will investigate the salmonberry and write a 3-4 page introduction. 3-4 resources listed.	Students identify 5+ factors that affect biochemistry of vitamin C. Students will investigate the salmonberry and write a 5+ page introduction. 5+ resources listed.
Student will compare and contrast the amount of vitamin C found in different communities around Alaska by completing an experiment.	Student does not become engaged in the project and is a bystander.	Student is engaged in the project, but does not ask questions. Student is keeping up with science journal.	Student is engaged in all aspects of the project and displays curiosity by asking questions and taking the initiative to follow through. Student going above the requirements for the science journal.
Students will communicate the project through poster or power point and address all aspects of the scientific method.	Student has included all the following elements: question, hypothesis, materials and method, results, discussion, conclusion, bibliography (0-1 resources), background research (0.5-1pages)	Student has included all the following elements: question, hypothesis, materials and method, results, discussion, conclusion, bibliography (2-4 resources), elder/local expert resource, and background research 2-3 pg.	Student has included all the following elements: question, hypothesis, materials and method, results, discussion, conclusion, bibliography (5+ resources), elder/local expert knowledge resource, background research (6+ pages), abstract, acknowledgements.

Name: _____ **Per:** _____ **Date:** _____

Qualitative Comparison of Vit. C in Salmonberries from Various Alaskan Communities

Background:

Our Inupiaq forefathers ate various berries found on the North Slope for thousands of years. One of the berries that was highly sought after was the salmonberry, Aqpik. The salmonberry is known to grow only in certain places across the North Slope. The Inuit of Utkeagvik (Barrow) did not have the salmonberry growing in their location and would trade with other Inupiat from various communities to get salmonberries. Our forefathers did not suffer from scurvy even though they ate foods that were not recognized as vitamin C rich foods. However, they ate berries, which are known to contain vitamin C. This activity is designed to qualitatively determine the amount of vitamin C present in salmonberries from various locations of Alaska.

Research question: Which Alaskan community grows salmonberries rich in vitamin C?

Hypothesis:

_____

_____

Materials

10 test tubes, twelve 125 ml beakers, 12 plastic pipettes, vitamin C indicator, mortar and pestle, cheesecloth, distilled water, graduated cylinder, salmonberries from various Alaskan communities, science journals.

Method:

1. Label 10 beakers: 1-3 community (Com) 1, 4-6 community 2, 7-9 community 3.
2. Weigh and collect 1 g of salmonberries from each community.
3. Place salmonberries in cheesecloth and mash in mortar and pestle; add 2 ml of distilled water and mix. Let it sit for 15 minutes.
4. Pour the juice into a 150 ml beaker labeled community 1. Discard the salmonberry pulp with the cheesecloth. Do this for each of the salmonberries collected from various communities and place the salmonberry juice in their respective beakers. Each salmonberry community test should have three samples to analyze.
5. Add 1 ml of vitamin C indicator into test tubes 1-10.
6. Using a plastic pipette add 4 drops of fish liquid to each of the respective test tubes containing vitamin C indicator.
7. Observe and record color changes. The lighter the color the more vitamin C is present. Color key: 6=clear 0=dark black blue.

Salmonberry Results

Results Table

	Com 1	Com 1	Com1	Com 2	Com 2	Com 2	Com 3	Com 3	Com 3	Control water
Wt. in grams										
Amt of ml of salmonberry juice added to test tubes										
1 ml Vitamin C indicator in each test tube	T1	T2	T3	T4	T5	T6	T7	T8	T9	T10 Control
Circle the color change after 4 drops of salmonberry juice added to Vit. C test tubes (6=clear, 1=dark blue)	1 2 3 4 5 6	1 2 3 4 5 6	1 2 3 4 5 6	1 2 3 4 5 6	1 2 3 4 5 6	1 2 3 4 5 6	1 2 3 4 5 6	1 2 3 4 5 6	1 2 3 4 5 6	Dark black blue
Circle the color change after 4 additional drops of salmonberry juice added to Vit. C test tubes (6=clear, 1=dark blue)	1 2 3 4 5 6	1 2 3 4 5 6	1 2 3 4 5 6	1 2 3 4 5 6	1 2 3 4 5 6	1 2 3 4 5 6	1 2 3 4 5 6	1 2 3 4 5 6	1 2 3 4 5 6	Dark black blue
Total Color Change Average										

1. Was your hypothesis supported? Why or why not?

2. After completing the experiment, how else can you think of other ways this project could be done?

3. Create a graph from your data table.

Appendix B

Vitamin C in Aanaaliq, Broad Whitefish

http://hww.ca/~Content/363/Images/full_atlanticWhitefish_2.jpg

Place Based Lessons
Lesson Two

Grades:
9-12

Days:
6

Teacher Preparation:
1 hour for lab preparation and to review material.

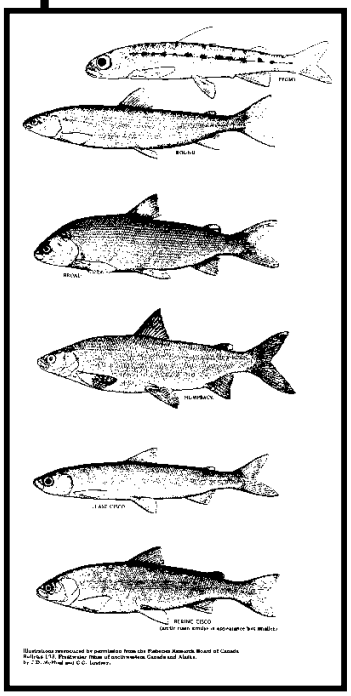
Alaska State Cultural Standards:
SF1: Students develop an understanding of the interrelationships among individuals, cultures, societies, science and technology
SF2: Students develop an understanding that some individuals, cultures, and societies use other beliefs and methods in addition to scientific methods to describe and understand the world.
SF3: Students develop an understanding of the importance of recording and validating cultural knowledge.

OVERVIEW

Our Inupiaq forefathers ate frozen raw foods known as quaq for thousands of years. Quaq was a staple food and was readily available. Quaq is still eaten today. Various animals were eaten in the form of quaq. These included many types of fish both marine and fresh, caribou, and whale. Our forefathers did not suffer from scurvy even though they ate foods that were not recognized as vitamin C rich foods. One of the main foods in the Inupiaq diet was Aanaaliq also known as Broad Whitefish. This activity is designed to qualitatively determine the amount of vitamin C present in raw versus cooked whitefish.

ALASKA STATE STANDARDS AND GLES

Science
SE3 Students develop an understanding of how scientific discoveries and technological innovations affect and are affected by our lives and cultures.
[10] SE3.1 researching a current problem, identifying possible solutions, and evaluating the impact of each solution. (L)
SA1 Students develop an understanding of the processes of science used to investigate problems, design and conduct repeatable scientific investigations, and defend scientific arguments.
[10] SA1.1 The student demonstrates an understanding of the processes of science by asking questions,
predicting, observing, describing, measuring, classifying, making generalizations, analyzing data, developing models, inferring, and communicating.
SF3 Students develop an understanding of the importance of recording and validating cultural knowledge
[10] SF1.1-SF3.1 analyzing the competition for resources by various user groups to describe these interrelationships.
Writing
[10] W4.1.2 The student writes about a topic by writing in paragraphs that included relevant details and evidence that support the main idea of the paragraph and thesis statement, grouping ideas logically within the paragraph, and placing paragraph breaks logically.



NATIONAL STANDARDS

A. Science as Inquiry - Science as inquiry requires students to combine processes and scientific knowledge with scientific reasoning and critical thinking to develop their understanding of science.
H.A.1 Abilities necessary to do scientific inquiry:
a. Identify questions and concepts that guide scientific investigations.
b. Design and conduct scientific investigations.
c. Use technology and mathematics to improve investigations and communications.
d. Formulate and revise scientific explanations and models using logic and evidence.
e. Recognize and analyze alternative explanations and models.
f. Communicate and defend a scientific argument.
U. Unifying Concepts and Processes - Unifying concepts and processes help students think about and integrate a range of basic ideas which builds an understanding of the natural world.
H.U.2 Evidence, models, and explanation.
c. Explanations provide interpretation, meaning, or sense to objects, organisms, or events. Explanations incorporate existing scientific knowledge and new evidence from observations, experiments, or models into internally consistent, logical statements, such as hypotheses, laws, principles, and theories.

Objectives

- Students will describe the importance of vitamin C and what factors affect the biochemistry of vitamin C.
- Students will compare and contrast the amount of vitamin C in cooked versus raw whitefish.
- Students will communicate the project through poster or power point and address aspects of the scientific method.

Inupiaq Terms

Aanaalik

Quaq

Suvak

English Vocabulary

Free radicals

Oxidation

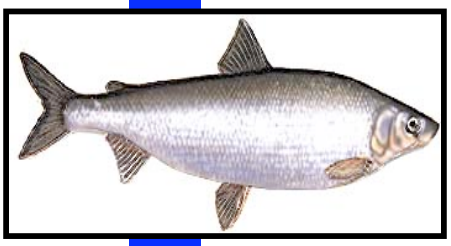
Scurvy

Materials Needed

10 test tubes, ten 150 ml beakers, 10 plastic pipettes, vitamin C indicator, mortar and pestle, cheesecloth, distilled water, graduated cylinder, whitefish, ulu, cutting board, electronic balance, and science journal.

Essential Research Question

Does raw fish contain more vitamin C than cooked fish?



http://www.borealforest.org/fish/white_fish.jpg

Engagement (day 1-2)

Process skills: questioning, analyzing data.

- Ask students to discuss how the Inupiat escaped scurvy.
- Ask students to discuss what foods the Inupiat ate that might contain vitamin C.
- Have students discuss what they think they know about vitamin C. and have students investigate on the Internet how vitamin C works and is metabolized in the body. Have students investigate what factors can affect vitamin C.
- Ask students what they know of the broad whitefish in general and in light of the Inupiat culture.
- Have students investigate the broad whitefish. Encourage them to discover the types of vitamins are found in the fish and especially for vitamin C.
- Students will write what they learn in their science journals.

Exploration (day 3-4)

Process skills: questioning, observing, measuring, collecting data, inferring, predicting, analyzing, hypothesizing, controlling variables, and investigating.

- Students will perform tests on Aanaaliq (raw and cooked) to qualitatively determine how much vitamin C is found in raw and cooked Aanaaliq.
- Students will use student worksheet provided.

Explanation (day 5)

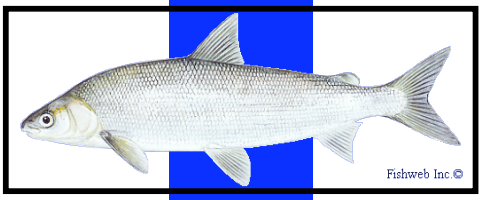
Process skills: communicating, making generalizations, analyzing data, and describing.

- Students will discuss the following questions regarding the exploration:
    a. What did the actual outcome of the investigation show? What did the results mean?
    b. What factor affected the amount of vitamin C? Why?
    c. How does heat affect vitamin C?

Elaboration (day 6)

Process skills: predicting and inferring.

- Ask students how they think different temperatures of cooking may affect vitamin C found in food? Have them research and explain their answers.
- Ask students if they think different organs of the fish may contain more or less vitamin C? Have students research the question and explain their answers.
- Ask students if they think different fish might have differing amounts of vitamin C in comparison to one another. Have them investigate and explain.



http://www.fishweb.com/recreation/fishing/fishfacts/fish/lake_whitefish/lake_whitefish.gif

Evaluation

Process skills: comprehension and understanding of concepts.

- Students are informally observed throughout the project.
- Students will produce a digital or poster product to communicate results of project.

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Resources

Nutrition in Science Project: (How to make vitamin C indicator)
http://www.sciencemadesimple.com/nutrition_projects.html

Nutrition Data (know what you eat) on whitefish (vitamin C found in whitefish)
http://www.nutritiondata.com/facts/ethnic-foods/9976/2

PDF Document: The effect of vitamin C on fish health
Viviane Verlhac and Jacques Gabaudan
Centre for Research in Animal Nutrition, Société Chimique Roche, BP 170, 68305 Saint-Louis Cedex, France
http://74.125.155.132/search?q=cache:kQzHS7flH7QJ:www.dsm.com/en_US/downloads/dnp/51644_VitaminC.pdf+source+of+vit+c+for+fish&cd=1&hl=en&ct=clnk&gl=us&client=firefox-a

Wikipedia: Vit. C
http://en.wikipedia.org/wiki/Vitamin_C

Decomposition of vitamin C
http://www.chemistry-react.org/go/default/Faq/Faq_12809.html

Inspiration for Place Based Lessons…

The lessons were inspired by the resources that are available from the North Slope region. The North Slope is a vast and unique place. Its vast landscapes and abundant wildlife have been the inspiration for the cultural traditions and subsistence lifestyle still practiced today by the Iñupiat people.

Place Based

Lesson 2

Vitamin C in Aanaaliq

Project Assessment Rubric

Objective	Developing	Proficient	Expert
Students will describe the importance of vitamin C and what factors affect the biochemistry of vitamin C.	Students identify 1-2 factors that affect biochemistry of vitamin C. Students will investigate the Broad Whitefish and write a ½ - 1 page introduction. 1-2 resources listed.	Students identify 3-4 factors that affect biochemistry of vitamin C. Students will investigate the Broad Whitefish and write a 3-4 page introduction. 3-4 resources listed.	Students identify 5+ factors that affect biochemistry of vitamin C. Students will investigate the Broad Whitefish and write a 5+ page introduction. 5+ resources listed.
Student will compare and contrast the amount of vitamin C in cooked versus raw whitefish.	Student does not become engaged in the project and is a bystander.	Student is engaged in the project, but does not ask questions. Student keeping up with science journal.	Student is engaged in all aspects of the project and displays curiosity by asking questions and taking the initiative to follow through. Student going above the requirements for the science journal.
Students will communicate the project through poster or power-point and address all aspects of the scientific method.	Student has included all the following elements: question, hypothesis, materials and method, results, discussion, conclusion, bibliography (0-1 resources), background research (0.5-1pages)	Student has included all the following elements: question, hypothesis, materials and method, results, discussion, conclusion, bibliography (2-4 resources), elder/local expert resource, and background research (2-3 pages).	Student has included all the following elements: question, hypothesis, materials and method, results, discussion, conclusion, bibliography (5+ resources), elder/local expert resource, background research (6+ pages), abstract, acknowledgements.

Name: _____ **Per:**_____**Date:**_____

Does Raw Fish Contain More Vitamin C than Cooked Fish?

Background:

Our Inupiaq forefathers ate frozen raw foods known as quaq for thousands of years. Quaq was a staple food and was readily available back then. Quaq is still eaten today. Various animals were eaten in the form of quaq. These included many types of fish both marine and fresh, caribou, and whale. Our forefathers escaped scurvy even though they ate foods that were not recognized as vitamin C rich foods. One of the main foods in the Inupiaq diet was Aanaaliq also known as Broad Whitefish. This activity is designed to qualitatively determine the amount of vitamin C present in raw versus cooked whitefish.

Research question: Does raw fish contain more vitamin C than cooked fish?
Hypothesis:

_____
_____

Materials
10 test tubes, ten 150 ml beakers, 10 plastic pipettes, vitamin C indicator, mortar and pestle, cheesecloth, distilled water, graduated cylinder, whitefish, ulu, cutting board, electronic balance

Method:

1. Label 10 test tubes: 1-3 raw, 4-6 cooked, 7-9 cooking residue, 10 control. Label 10 150 ml beakers: 1-3 raw, 4-6 cooked, 7-9 cooking residue, 10 control.
2. Cut 6 pieces of 1 g of raw fish meat.
3. Add 50 ml of distilled water to three 150 ml beakers.
4. Place one piece of raw meat to each beaker and boil on hot plate for 5 minutes.
5. Remove cooked meat and place in respective labeled beaker.
6. Filter the cooking residue as it is poured into beakers labeled cooking residue.
7. Place the raw fish in respective labeled beakers.
8. One at a time place fish in cheese cloth and smash using mortar and pestle, add 2 ml of distilled water and continue to smash and mix. Transfer back to beaker and let it sit for 15 minutes. Squeeze cheesecloth with meat to remove as much liquid as possible. Discard cheese cloth with meat.
9. Add 1 ml of vitamin C indicator into test tubes 1-10.
10. Using a plastic pipette add 4 drops of fish liquid to each of the respective test tubes containing vitamin C indicator. Test tube 10 will be left alone as it is the control.
11. Observe and record color changes comparing it to the control. The lighter the color the more vitamin C is present. Color key: 0=dark black blue, 6=clear.

Broad Whitefish Results

Results Table

	Raw 1	Raw 2	Raw 3	Cooked 1	Cooked 2	Cooked 3	Residue 1	Residue 2	Residue 3	Control water
Wt. in grams										
Amt. of ml of fish juice added to test tubes										
1 ml Vitamin C indicator in each test tube	T1	T2	T3	T4	T5	T6	T7	T8	T9	T10 Control
Color change after 4 drops of fish juice added to Vit. C test tubes (6=clear, 1=dark blue)	1 2 3 4 5 6	1 2 3 4 5 6	1 2 3 4 5 6	1 2 3 4 5 6	1 2 3 4 5 6	1 2 3 4 5 6	1 2 3 4 5 6	1 2 3 4 5 6	1 2 3 4 5 6	Dark black blue
Color change after 4 additional drops of fish juice added to Vit. C test tubes (6=clear, 1=dark blue)	1 2 3 4 5 6	1 2 3 4 5 6	1 2 3 4 5 6	1 2 3 4 5 6	1 2 3 4 5 6	1 2 3 4 5 6	1 2 3 4 5 6	1 2 3 4 5 6	1 2 3 4 5 6	Dark black blue
Total Color Change Average										

1. Was your hypothesis supported? Why or why not?

2. After completing the experiment, how else can you think of other ways this project could be done?

3. Create a graph from your data table.

Appendix C

Whale Oil Soap

http://graphics8.nytimes.com/images/2007/12/14/science/whale.jpg

Place Based Lessons
Lesson Three

Grades:
9-12

Days:
10

Teacher Preparation:
2 hours for lab preparation and to review material.

Alaska State Cultural Standards:
SF1: Students develop an understanding of the interrelationships among individuals, cultures, societies, science and technology
SF2: Students develop an understanding that some individuals, cultures, and societies use other beliefs and methods in addition to scientific methods to describe and understand the world.
SF3: Students develop an understanding of the importance of recording and validating cultural knowledge.

OVERVIEW

Whaling has been an Inupiaq tradition for thousands of years. The whale was one of the main sources of food available to the Inuit along with other marine animals. During the early colonial whaling years, the whale was not only used for food it was also prized for the products that could be made from whale. One of the products was soap. Though soapmaking is not an Inupiaq tradition, there exists the element of curiosity of soapmaking from animal fat. I do recall my own parents making lye soap in our backyard. This activity involves making soap with whale oil.

ALASKA STATE STANDARDS AND GLES

Science
SE3 Students develop an understanding of how scientific discoveries and technological innovations affect and are affected by our lives and cultures.
[10] SE3.1 researching a current problem, identifying possible solutions, and evaluating the impact of each solution. (L)
SA1 Students develop an understanding of the processes of science used to investigate problems, design and conduct repeatable scientific investigations, and defend scientific arguments.
[10] SA1.1 The student demonstrates an understanding of the processes of science by asking questions,
predicting, observing, describing, measuring, classifying, making generalizations, analyzing data, developing models, inferring, and communicating.
SF3 Students develop an understanding of the importance of recording and validating cultural knowledge
[10] SF1.1-SF3.1 analyzing the competition for resources by various user groups to describe these interrelationships.
Writing
[10] W4.1.2 The student writes about a topic by writing in paragraphs that included relevant details and evidence that support the main idea of the paragraph and thesis statement, grouping ideas logically within the paragraph, and placing paragraph breaks logically.

NATIONAL STANDARDS

A. Science as Inquiry - Science as inquiry requires students to combine processes and scientific knowledge with scientific reasoning and critical thinking to develop their understanding of science.
H.A.1 Abilities necessary to do scientific inquiry:
a. Identify questions and concepts that guide scientific investigations.
b. Design and conduct scientific investigations.
c. Use technology and mathematics to improve investigations and communications.
d. Formulate and revise scientific explanations and models using logic and evidence.
e. Recognize and analyze alternative explanations and models.
f. Communicate and defend a scientific argument.
U. Unifying Concepts and Processes - Unifying concepts and processes help students think about and integrate a range of basic ideas which builds an understanding of the natural world.
H.U.2 Evidence, models, and explanation.
c. Explanations provide interpretation, meaning, or sense to objects, organisms, or events. Explanations incorporate existing scientific knowledge and new evidence from observations, experiments, or models into internally consistent, logical statements, such as hypotheses, laws, principles, and theories.

Bowhead Fact:

"Bowhead whales were hunted by commercial whalers for over four centuries, beginning in the North Atlantic in the 1500s and ending in the North Pacific by the mid-1900s. Bowhead whales are capable of breaking through sea ice at least 8 inches thick; some Eskimo hunters have reported whales surfacing through 2 feet of thick ice."

http://www.alaskatrekker.com/whales.htm

Objectives

- Students will describe the importance of whale blubber in early whaling days. Students will investigate the history of whaling.
- Student will compare and contrast the amount of different amounts of whale oil affect soap hardness.
- Students will communicate the project through poster or power point and address aspects of the scientific method.

Inupiaq Terms

Agvik

Uqsruq

English Vocabulary

Saponification

Micelle

Render

Materials Needed

Steel or glass container, wooden spoon, egg beater, lye, whale oil, water, potato masher, sieve, 5 gallon plastic container, 2 one gallon plastic containers, science journals.

Essential Research Question

How do different amounts of whale oil affect the hardness of soap?

http://img.dailymail.co.uk/i/pix/2007/06_02/BowheadWhaleG_468x266.jpg

Engagement (day 1-4)

Process skills: questioning, analyzing data.

- Ask students to discuss history of the Inupiat hunt whale.
- Ask students to discuss what foods the Inupiat made out of whale.
- Have students discuss what they think they know about whale blubber.
- Have students investigate whale blubber composition.
- Have students discuss what is done with the excess whale blubber.
- Have students investigate the history of soap making.
- Students will write what they learn in their science journals.

Exploration (day 5-8)

Process skills: questioning, observing, measuring, collecting data, inferring, predicting, analyzing, hypothesizing, controlling variables, and investigating.

- Students will make whale oil soap.
- Students will use student worksheet provided.

Explanation (day 9)

Process skills: communicating, making generalizations, analyzing data, and describing.

- Students will discuss the following questions regarding the exploration:
    a. What did the actual outcome of the investigation show? What did the results mean?
    b. Did Inupiat in the early to mid 1900's make soap?
    c. What is a micelle?

Elaboration (day 10)

Process skills: predicting and inferring.

- Ask students how they think different types of soap may be effective on certain types of stains? Have them research and explain their answers.
- Ask students if they think whale oil soap could be made justifiably today. Have them investigate and explain.
- Ask students what other types of animal fat can be made into soap.

http://www.alaskatrekker.com/whales.htm

Evaluation

Process skills: comprehension and understanding of concepts.

- Students will produce a digital video or poster product to communicate results of project.
- Students are informally observed throughout the project.

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Resources

Wikipedia: Blubber
http://en.wikipedia.org/wiki/Blubber

Saponification
http://home.pacific.net.au/~thambilton/Saponification.html

How to make lye soap and other concoctions
http://farmgal.tripod.com/lyesoapconcoctions.html

How to make lye soap with lard
http://www.ehow.com/how_4695940_lye-soap-lard.html

How to make lye soap
http://howtomakelyesoap.weebly.com/

Alaska Eskimo whaling
http://www.highnorth.no/Library/Hunts/Other/al-es-wh.htm

Inspiration for Place Based Lessons…

The lessons were inspired by the resources that are available from the North Slope region. The North Slope is a vast and unique place. Its vast landscapes and abundant wildlife have been the inspiration for the cultural traditions and subsistence lifestyle still practiced today by the Iñupiat people.

Place Based

Lesson 3

Whale Oil Soap

Project Assessment Rubric

Objective	Developing	Proficient	Expert
Students will describe the importance of whale blubber in early whaling days. Students will investigate the history of soapmaking.	Students discuss the history of whaling.. Students will investigate the soapmaking and write a ½ - 1 page introduction with 1-2 resources listed.	Students discuss the history of whaling. Students will investigate the soapmaking and write a 3-4-page introduction. 3-4 resources listed.	Students discuss the history of whaling. Students will investigate the soapmaking and write a 5+ page introduction. 5+ resources listed.
Student will compare and contrast the amount of different amounts of whale oil affect soap hardness.	Student does not become engaged in the project and is a bystander.	Student is engaged in the project, but does not ask questions. Student is keeping up with science journal.	Student is engaged in all aspects of the project and displays curiosity by asking questions and taking the initiative to follow through. Student is going above the requirements for the science journal.
Students will communicate the project through poster or power-point and address all aspects of the scientific method.	Student has included all the following elements: question, hypothesis, materials and method, results, discussion, conclusion, bibliography (0-1 resources), background research (0.5-1pages)	Student has included all the following elements: question, hypothesis, materials and method, results, discussion, conclusion, bibliography (2-4 resources), elder/local expert resource, and background research (2-3 pages).	Student has included all the following elements: question, hypothesis, materials and method, results, discussion, conclusion, bibliography (5+ resources), elder/local expert resource, background research (6+ pages), abstract, acknowledgements.

Name: _____ **Per:**_____**Date:**_____

How Do Different Amounts of Whale Oil Affect the Hardness of Soap?

Background:

Whaling has been an Inupiaq tradition for thousands of years. The whale was one of the main sources of food available to the Inuit along with other marine animals. During the early colonial whaling years, the whale was not only used for food it was also prized for the products that could be made from whale. One of the products was soap. Though soapmaking is not an Inupiaq tradition, there exists the element of curiosity of soapmaking. I recall my parents making lye soap in our backyard. This activity involves making soap with whale oil.

Research question: How do different amounts of whale oil affect the hardness of soap?

Hypothesis:

_____

_____

Materials
Steel or glass container, wooden spoon, egg beater, lye, whale oil, water, potato masher, sieve, 5 gallon plastic container, 2 one gallon plastic containers, science journals.

How to render animal fat (whale blubber): Takes about 2 class days.

1. Collect 25 – 30 lbs blubber, cut into 1 – 2 inch pieces.
2. Place in enough hot water with some salt (1 Tbs per pound of fat) to cover blubber.
3. Boil then simmer (for every pound of fat 10 minutes) If 25 lbs, boil for 25 min. The fat should come out of blubber and grizzle will be left.
4. Squeeze out excess oil from fat chunks by smashing them with a potato masher.
5. Scoop out the grizzle with a sieve and discard.
6. Pour the hot mix through the sieve into another large container (5 gallon container), discard residue in sieve.
7. Allow to cool (1/2 – 1 day).
8. Collect oil with measuring cup and place into a smaller clean container (1 gallon container).

Clarify the oil. Once the rendered oil has been collected, clarify the oil by placing the same amount of water and the oil into a pot. Heat the oil and stir. Allow to cool and collect the oil and place in another clean container.

Saponification

Saponification values are necessary to understand how much lye is needed to convert fats into soap. Multiply the saponification number of the type of oil to determine the number of ounces of lye needed to make soap.

Saponification values: baleen whale = .138; olive oil = .134; lard = .138; peanut oil/ canola oil = .136; margarine = .136; herring oil/ fish oil = .136; goose fat = .136; sesame oil = .133; deer tallow = .139; chicken fat = .138; beeswax = .069; bear tallow = .139

Determine the amount of sodium hydroxide needed:
Multiply the number of ounces of oil used by the saponification value. The result is the amount of lye (sodium hydroxide) needed in ounces. Example: 4 oz of whale oil x .138 = 0.55 ounces of lye needed. If no NaOH is available, determine the amount of potassium hydroxide needed: Determine the amount of NaOH needed then multiply by 56 and then divide by 40. (1 oz = 28.3 g)

Safety instructions and precautionary measures:

1. **Lye** which you can either make yourself from woodash, or purchase at a grocery store, is very irritating to the skin and can do severe damage to eyes and throats. Use extreme caution when using lye, always keeping it away from children. You should use rubber gloves and safety glasses when using lye. Follow the directions on the back of the lye box on how to handle lye. Red Devil is a popular brand of lye.
   You can also make your own lye by pouring water over wood ashes and saving the byproduct--lye water. The lye water is then added to fat to make soap.
2. Although **lard** is the main ingredient in soap, one can successfully substitute other oils to use in its place. Possible substitutions for lard can be sunflower, canola, or just vegetable oil. Lard can be purchased at a grocery store or a butcher shop.
3. The **utensils** you use in soapmaking should be saved for soapmaking use only and should not be use thereafter for food purposes. This goes for the kettle you cook the soap in too, although I have used my enamel-ware canning kettle to can in after using it for soapmaking...I gave it a good scrubbing, of course.
   You must not use metal pans and utensils, like aluminum, iron, tin, or teflon for soap making. You can use cast iron (as in a kettle, if you are making it outside over a fire) or enamelware, stoneware, wood, glass or plastic.
4. Always **add** lye to <u>cold</u> water. Not vise-versa. Remember to stir slowly to avoid splashes. The water will start heating up once the lye is added, due to a chemical reaction. Afterwards, pour the lye solution into the fat, once again stirring slowly.
5. **Chunks** in your bar soap is caused by the separation of the lye and the lard. The chunks are the fat. If this happens, melt the mixture and add a cup of water at a time, until the mixture is thick and syrupy again.
6. You can make your own **soap molds** out of a rag-lined box or glass cake pans or casseroles. Simply slice the bars with a knife after the soap has cured for a week.

Soapmaking

Soap Recipe

Cold Soap 2
1 c fat
½ c cold water
1 ½ T. lye
1 T. powdered borax (optional)
1 T. ammonia (optional)

Half recipe
8 oz whale oil
¼ c cold water
(1.1 oz or 31.13 g)

Melt fat. In a separate container, add borax and ammonia to lye. Add lye (with the borax and ammonia in it) to water. Then, add the lye solution to the fat. Beat with an egg beater for 20 minutes. Pour into Petri dishes lined with plastic wrap or glass cake pan lined with plastic wrap and allow to set for 3-4 days.

Method:
1. Follow the half recipe above to make the control soap.
2. Follow the half recipe but reduce the amount of whale oil to 6 oz.
3. Follow the half recipe but increase the amount of whale oil to 10 oz.
4. Record results.

Soap Results: Hardness (1=very soft; 6 = very hard)

	Control Soap	6 oz whale oil	10 oz whale oil
Trial 1	1 2 3 4 5 6	1 2 3 4 5 6	1 2 3 4 5 6
Trial 2	1 2 3 4 5 6	1 2 3 4 5 6	1 2 3 4 5 6
Trial 3	1 2 3 4 5 6	1 2 3 4 5 6	1 2 3 4 5 6
Average			

1. Was your hypothesis supported? Why or why not?

2. After completing the experiment, how else can you think of other ways this project could be done?

3. Create a graph from your data table.

Appendix D

Emergence of Arctic Chironomids

http://life.bio.sunysb.edu/marinebio/fc.chironomid.lind.jpg

Place Based Lessons
Lesson Four

Grades:
9-12

Days:
9

Teacher Preparation:
2 hours for lab preparation and to review material.

Alaska State Cultural standards:
SF1: Students develop an understanding of the interrelationships among individuals, cultures, societies, science and technology
SF2: Students develop an understanding that some individuals, cultures, and societies use other beliefs and methods in addition to scientific methods to describe and understand the world.
SF3: Students develop an understanding of the importance of recording and validating cultural knowledge.

OVERVIEW

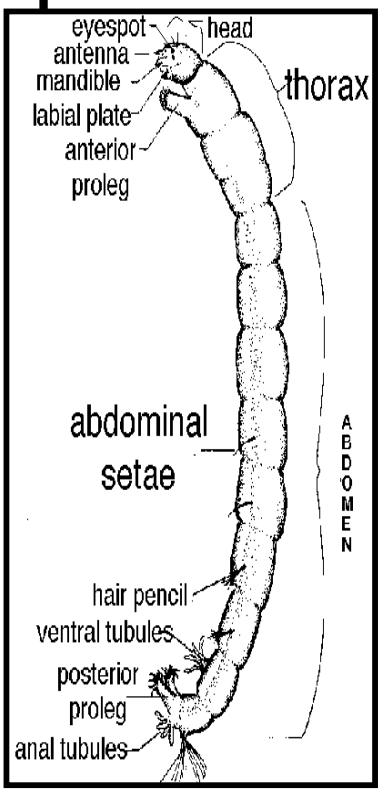
Chironomids are nonbiting midges found all across the North Slope and other regions of the world. Chironomids have hemoglobin in their "blood" and are reddish in color and are known as blood-worms. They are important indicators of freshwater systems. Chironomids are known to survive in all types of water and because they can tolerate low levels of oxygen are indicators of brackish waters. While they are a nuisance for land animals, like caribou, they are an important source of food for migratory birds and fish. The Inupiat rely on migratory birds and fish for subsistence foods even today. So, chironomids play an important role in the arctic ecosystem.

ALASKA STATE STANDARDS AND GLES

Science
SE3 Students develop an understanding of how scientific discoveries and technological innovations affect and are affected by our lives and cultures.
[10] SE3.1 researching a current problem, identifying possible solutions, and evaluating the impact of each solution. (L)
SA1 Students develop an understanding of the processes of science used to investigate problems, design and conduct repeatable scientific investigations, and defend scientific arguments.
[10] SA1.1 The student demonstrates an understanding of the processes of science by asking questions,
predicting, observing, describing, measuring, classifying, making generalizations, analyzing data, developing models, inferring, and communicating.
SF3 Students develop an understanding of the importance of recording and validating cultural knowledge
[10] SF1.1-SF3.1 analyzing the competition for resources by various user groups to describe these interrelationships.
Writing
[10] W4.1.2 The student writes about a topic by writing in paragraphs that included relevant details and evidence that support the main idea of the paragraph and thesis statement, grouping ideas logically within the paragraph, and placing paragraph breaks logically.

NATIONAL STANDARDS

A. Science as Inquiry - Science as inquiry requires students to combine processes and scientific knowledge with scientific reasoning and critical thinking to develop their understanding of science.
H.A.1 Abilities necessary to do scientific inquiry:
a. Identify questions and concepts that guide scientific investigations.
b. Design and conduct scientific investigations.
c. Use technology and mathematics to improve investigations and communications.
d. Formulate and revise scientific explanations and models using logic and evidence.
e. Recognize and analyze alternative explanations and models.
f. Communicate and defend a scientific argument.
U. Unifying Concepts and Processes - Unifying concepts and processes help students think about and integrate a range of basic ideas which builds an understanding of the natural world.
H.U.2 Evidence, models, and explanation.
c. Explanations provide interpretation, meaning, or sense to objects, organisms, or events. Explanations incorporate existing scientific knowledge and new evidence from observations, experiments, or models into internally consistent, logical statements, such as hypotheses, laws, principles, and theories.



http://life.bio.sunysb.edu/marinebio/fc.chironomid.diagram.jpg

Objectives

- Students will describe the importance of larvae and pupa in the tundra ecology.
- Students will understand how temperature affects the emergence of tundra larvae.
- Students will communicate the project through poster or power point and address all aspects of the scientific method.

Inupiaq Terms

Kiktugiaq
Qupilguq

English Vocabulary

Emergence
Chironomid
Pupa
Ecosystem

Materials Needed

Hip boots, fine mesh net with long handle, 3 five gallon buckets, sieves, small containers with fine mesh net on lids, mesh scooping utensil, vials, rubbing alcohol, 20-30 chironomids, Science journals.

Essential Research Question

How does water temperature affect the timing of emergence of chironomids?

http://www.first-nature.com/insects/diptera/images/chironomus2.jpg

Engagement (day 1-2)

Process skills: questioning, analyzing data.

- Ask students to discuss what they know of larva, where they are found, what type of insects they are…etc.
- Ask students to discuss what animals may eat larva; what do larvae consume?
- Have students investigate on the Internet types of larva found on the North Slope; have them investigate general characteristics of larvae and their importance to the ecology of the tundra.

Exploration (day 3-7)

Process skills: questioning, observing, measuring, collecting data, inferring, predicting, analyzing, hypothesizing, controlling variables, and investigating.

- Students will experiment how different temperatures affect the timing of emergence of larvae.
- Students will use student worksheet provided.

Explanation (day 8)

Process skills: communicating, making generalizations, analyzing data, and describing.

- Students will discuss the following questions regarding the exploration:
    a. What did the actual outcome of the investigation show? What did the results mean?
    b. What factors could have affected the timing of emergence of larvae?

Elaboration (day 9)

Process skills: predicting and inferring.

- Ask students how they think different ph of water may affect emergence?
- Ask students if they think different nitrogen levels may affect emergence of larvae?
- Have students investigate the two questions via Internet.

bugguide.net/node/view/271874/bgimage

Evaluation

Process skills: comprehension and understanding of concepts.

- Students will produce a digital video or poster product to communicate results.
- Students are informally observed throughout the project.

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Resources

*This project was inspired by Dr. Mac Butler of NDSU. He came up to Barrow in the 1970s to study chironomid larvae. He came back in 2007 to conduct further studies on chironomids. Students had the opportunity to work with Dr. Butler through the Science Internship program offered through Ilisagvik College. The Science Internship program was a collaborative effort between Barrow Arctic Science Consortium and Ilisagvik College and one that I put together.

Arctic Midges
http://www.ndsu.edu/ndsu/news/magazine/vol08_issue01/arctic_midges.shtml

Charles Apperson, Michael Waldvogel and Stephen Bambara, (n.d.) Extension Entomology NC Cooperative Extension Dept of Entomology Biology and control of nonbiting aquatic midges
http://www.ces.ncsu.edu/depts/ent/notes/Urban/midges.htm

Chironomids: Fly Craft Angling
http://www.flycraftangling.com/index.asp?p=125

Inspiration for Place Based Lessons…

The lessons were inspired by the resources that are available from the North Slope region. The North Slope is a vast and unique place. Its vast landscapes and abundant wildlife have been the inspiration for the cultural traditions and subsistence lifestyle still practiced today by the Iñupiat people.

Place Based

Lesson 4

Emergence of Arctic Chironomids

Project Assessment Rubric

Objective	Developing	Proficient	Expert
Students will describe the importance of larvae and pupa in the tundra ecology.	Students identify 1-2 factors that affect emergence of larvae and write a ½ - 1 page introduction. 1-2 resources listed.	Students identify 3-4 factors that affect the emergence of larvae and write a 3-4 page introduction. 3-4 resources listed.	Students identify 5+ factors that affect emergence of larvae and write a 5+ page introduction. 5+ resources listed.
Students will understand how temperature affects the emergence of tundra larvae.	Student does not become engaged in the project and is a bystander.	Student is engaged in the project, but does not ask questions. Student is keeping up with the science journal	Student is engaged in all aspects of the project and displays curiosity by asking questions and taking the initiative to follow through. Student is going above the requirements for the science journal.
Students will communicate the project through poster or power-point and address all aspects of the scientific method.	Student has included all the following elements: question, hypothesis, materials and method, results, discussion, conclusion, bibliography (0-1 resources), background research (0.5-1pages)	Student has included all the following elements: question, hypothesis, materials and method, results, discussion, conclusion, bibliography (2-4 resources), elder/local expert resource, and background research (2-3 pages).	Student has included all the following elements: question, hypothesis, materials and method, results, discussion, conclusion, bibliography (5+ resources), elder/local expert resource, background research (6+ pages), abstract, acknowledgements.

L.4: Emergence of Arctic Chironomids Student Worksheet pg 1 of 2

Name: _____ Per:_____Date:_____

How Does Water Temperature Affect the Timing of Emergence of Chironomids?

Background:

Chironomids are nonbiting midges found all across the North Slope and other regions of the world. Chironomids have hemoglobin in their "blood" and are reddish in color and are known as blood-worms. They are important indicators of freshwater systems. Chironomids are known to survive in all types of water and because they can tolerate low levels of oxygen are indicators of brackish waters. While they are a nuisance for land animals, like caribou, they are an important source of food for migratory birds and fish. The Inupiat rely on migratory birds and fish for subsistence foods even today. So, chironomids play an important role in the arctic ecosystem.

Research question: How does water temperature affect the timing of emergence of chironomids?

Hypothesis:

_____

_____

Materials
Hip boots, fine mesh net with long handle, 3 five gallon buckets, sieves, small containers with fine mesh net on lids, mesh scooping utensil, vials, rubbing alcohol, 20-30 chironomids.

Method:

1. Collect larvae/pupa from nearby ponds.
2. Label rearing containers (5 gallon buckets) with letters using the following code: pond of origin/ larvae or pupa/treatment; treatment: cool, warm, room.
3. Place 10 chironomid pupa a jar with an open netted lid in each treatment (cool, room and warm) and check for emergence daily at the same time each day.
4. Collect emerged insects with pupal remains and place in vials containing alcohol.
5. Record results daily.

Pupa will be placed in rearing treatments and placed in a jar with an open netted lid. When they emerge they will be collected and transferred into vials with isopropyl alcohol. Vials are provided with labels according to the same above instruction. A waterproof label can be placed inside each vial with the specimen. The vials will be properly sealed and sent out for proper identification.

Emergence Results

Emergence Results (Record number of emergence)

	Cool	Warm	Room
Day 1			
Day 2			
Day 3			
Day 4			
Day 5			
Day 6			
Day 7			

1. Was your hypothesis supported? Why or why not?

2. After completing the experiment, how else can you think of other ways this project could be done?

3. Create a graph from your data table.

Appendix E

Fermented Eskimo Foods

http://dnr.alaska.gov/coastal/acmp/Enews/7_07/Barrow.html

Place Based Lessons
Lesson Five

Grades:
9-12

Days:
7

Teacher Preparation:
2 hours for lab preparation and to review material.

Alaska State Cultural Standards:
SF1: Students develop an understanding of the interrelationships among individuals, cultures, societies, science and technology
SF2: Students develop an understanding that some individuals, cultures, and societies use other beliefs and methods in addition to scientific methods to describe and understand the world.
SF3: Students develop an understanding of the importance of recording and validating cultural knowledge.

OVERVIEW

The Inupiat hunt and subsist off of both land and marine animals. On land and rivers they hunt the caribou, many species of fish, and birds. Marine animals that are hunted for food include beluga, bowhead whales, bearded seal, ring seal, walrus, clams, and various fish species. One of the ways that the Inupiat people prepare food is through fermentation. Fermented foods include piguraq (caribou), mikigaq (bowhead whale), aaruq (whitefish) and urraq (bearded seal flipper). Mikigaq is a fermented delicacy served during the whale festival, Nalukataq. The goal of this exercise is to discover what kinds of bacteria grow in properly prepared mikigaq versus non-properly prepared mikigaq.

ALASKA STATE STANDARDS AND GLES

Science
SE3 Students develop an understanding of how scientific discoveries and technological innovations affect and are affected by our lives and cultures.
[10] SE3.1 researching a current problem, identifying possible solutions, and evaluating the impact of each solution. (L)
SA1 Students develop an understanding of the processes of science used to investigate problems, design and conduct repeatable scientific investigations, and defend scientific arguments.
[10] SA1.1 The student demonstrates an understanding of the processes of science by asking questions,
predicting, observing, describing, measuring, classifying, making generalizations, analyzing data, developing models, inferring, and communicating.
SF3 Students develop an understanding of the importance of recording and validating cultural knowledge
[10] SF1.1-SF3.1 analyzing the competition for resources by various user groups to describe these interrelationships.
Writing
[10] W4.1.2 The student writes about a topic by writing in paragraphs that included relevant details and evidence that support the main idea of the paragraph and thesis statement, grouping ideas logically within the paragraph, and placing paragraph breaks logically.

NATIONAL STANDARDS

A. Science as Inquiry - Science as inquiry requires students to combine processes and scientific knowledge with scientific reasoning and critical thinking to develop their understanding of science.
H.A.1 Abilities necessary to do scientific inquiry:
a. Identify questions and concepts that guide scientific investigations.
b. Design and conduct scientific investigations.
c. Use technology and mathematics to improve investigations and communications.
d. Formulate and revise scientific explanations and models using logic and evidence.
e. Recognize and analyze alternative explanations and models.
f. Communicate and defend a scientific argument.
U. Unifying Concepts and Processes - Unifying concepts and processes help students think about and integrate a range of basic ideas which builds an understanding of the natural world.
H.U.2 Evidence, models, and explanation.
c. Explanations provide interpretation, meaning, or sense to objects, organisms, or events. Explanations incorporate existing scientific knowledge and new evidence from observations, experiments, or models into internally consistent, logical statements, such as hypotheses, laws, principles, and theories.

Excerpt from Pt. Hope Nalukataq

"The crew's women dug elbow-deep into wooden barrels with mikigaq or fermented whale meat, to pass out more meat. Being the only meat that ferments itself, mikigaq takes 8 to 10 days to ferment and needs to be turned over every 12 hours. It is dark red, has a soft consistency and a sweet taste that makes the palates tingle and fills the stomach with a warm feeling."

http://www.turtletrack.org/Issues03/Co08092003/CO_08092003_PointHopeWhaling-III.htm

Objectives

- Students will investigate and describe the importance of fermented foods in the Inupiaq culture.
- Students will compare and contrast the types of bacteria found in various Inupiaq foods.
- Students will communicate the project through poster or power point and address aspects of the scientific method.

Inupiaq Terms

Mikigaq
Piguraq
Aaruq
Urraq
Puvlaq

English Vocabulary

Fermentation

Anaerobic

Respiration

Botulism

Materials Needed

Mikigaq, cotton swab, 10 Petri dishes with agar (could use various types of agar as a point of interest like blood, potato, nutrient agar), incubator and science journals.

Essential Research Question

What types of bacteria grow in properly prepared fermented Inupiaq foods versus non-properly prepared food?

Engagement (day 1-3)

Process skills: questioning, analyzing data.

- Ask students to discuss what foods the Inupiat fermented.
- Have students investigate fermented foods (aaruq, urraq, mikigaq), how they are prepared, by asking elders.
- Have students investigate the medicinal properties of fermented foods.
- Students will write what they learn in their science journals and record interviews via digital video.

Barrow Nalukataq Excerpt:

"…but even more important is the preparation of huge quantities of mikigaq which will be served to hundreds of people. This takes place a week before the Nalukataq; the timing must be exactly right so that the fermentation process is perfect."

http://www.uark.edu/misc/jcdixon/Historic_Whaling/AEWC/aewc_maggie%20presentation.htm

Exploration (day 4-5)

Process skills: questioning, observing, measuring, collecting data, inferring, predicting, analyzing, hypothesizing, controlling variables, and investigating.

- Students will conduct experiment on what types of bacteria grow in properly prepared mikigaq.
- Students will use student worksheets provided.

Explanation (day 6)

Process skills: communicating, making generalizations, analyzing data, and describing.

- Students will discuss the following questions regarding the exploration:
    a. What did the actual outcome of the investigation show?
    b. What did the results mean?

http://www.nativetech.org/inupiat/pointlayindex.html

Elaboration (day 7)

Process skills: predicting and inferring.

- Ask students if they think non-fermented foods may produce just as much or more gas than fermented foods. Have them research and explain their answers.
- Have students research anaerobic and aerobic bacteria.
- Students can experiment to see which fermented foods produce the most gas over time.
    a. What factors contributed to the release of gas? What kinds of bacteria may have contributed to the release of gas?

Evaluation

Process skills: comprehension and understanding of concepts.

- Students will produce a digital video or poster product to communicate results.
- Students are informally observed throughout the project.

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Resources

Wikipedia: Blubber
http://en.wikipedia.org/wiki/Blubber

What kinds of gases does decaying food give off?
http://www.madsci.org/posts/archives/2005-01/1106120458.Bc.r.html

Fermentation
http://en.wikipedia.org/wiki/Fermentation_%28biochemistry%29

Botulism
http://www2.cdc.gov/phtn/botulism/protection/protection.asp

AEWC
http://www.uark.edu/misc/jcdixon/Historic_Whaling/AEWC/aewc_maggie%20presentation.htm

Inspiration for Place Based Lessons…

The lessons were inspired by the resources that are available from the North Slope region. The North Slope is a vast and unique place. Its vast landscapes and abundant wildlife have been the inspiration for the cultural traditions and subsistence lifestyle still practiced today by the Iñupiat people.

Place Based

Lesson 5

Fermented Eskimo Foods

Project Assessment Rubric

Objective	Developing	Proficient	Expert
Students will investigate and describe the importance of fermented foods in the Inupiaq culture. Students will investigate bacterial types found in fermentation of proteins.	Students will investigate the fermented foods and write a ½ - 1 page introduction. 1-2 resources listed.	Students identify 3-4 factors that are important to making proper fermented foods. Students will investigate the how to make fermented foods and write a 3-4 page introduction. 3-4 resources listed.	Students identify 5+ factors that affect fermentation process of foods. Students will investigate the fermentation process and write a 5+ page introduction. 5+ resources listed.
Student will compare and contrast the various bacteria found in fermented Inupiaq foods. Students will compare and contrast the amount of gas collected.	Student does not become engaged in the project and is a bystander.	Student is engaged in the project, but does not ask questions. Student is keeping up with science journal.	Student is engaged in all aspects of the project and displays curiosity by asking questions and taking the initiative to follow through. Student is going above the requirements for the science journal.
Students will communicate the project through poster or power-point and address all aspects of the scientific method.	Student has included all the following elements: question, hypothesis, materials and method, results, discussion, conclusion, bibliography (0-1 resources), background research (0.5-1pages)	Student has included all the following elements: question, hypothesis, materials and method, results, discussion, conclusion, bibliography (2-4 resources), elder/local expert resource, and background research (2-3 pages).	Student has included all the following elements: question, hypothesis, materials and method, results, discussion, conclusion, bibliography (5+ resources), elder/local expert resource, background research (6+ pages), abstract, acknowledgements.

Name: _____ **Per:**_____**Date:**_____

Activity 1

What types of bacteria grow in properly prepared fermented Inupiaq foods versus non-properly prepared food?

Background:

The Inupiat hunt and subsist off of both land and marine animals. On land and rivers they hunt the caribou, many species of fish, and birds. Marine animals that are hunted for food include beluga, bowhead whales, bearded seal, ring seal, walrus, clams, and various fish species. One of the ways that the Inupiat people prepare food is through fermentation. Fermented foods include piguraq (caribou), mikigaq (bowhead whale), aaruq (whitefish) and urraq (bearded seal flipper). Mikigaq is a fermented delicacy served during the whale festival, Nalukataq. The goal of this exercise is to discover what kinds of bacteria grow in properly prepared mikigaq versus non-properly prepared mikigaq.

Hypothesis:

_____

_____

Materials: mikigaq, cotton swab, 10 Petri dishes with agar (could use various types of agar as a point of interest like blood, potato, nutrient agar), incubator.

Activity 1

Method:

1. Label the Petri dishes or test tubes: 1-5 good mikigaq; 5-10 puvlaq (spoiled).
2. Collect a small amount of properly prepared mikigaq. (keep in freezer until ready for use).
3. Allow a portion of the mikigaq to sit at room temp without stirring for 2-3 days.
4. Dip a cotton swab into each mikigaq.
5. Lightly smear the swab onto the agar.
6. Place in incubator.
7. Record results on a daily basis for the next week. Record color and shape of growth.
8. Repeat using other Inupiaq fermented foods.

Activity 1 Continued

Bacterial Growth Results Table

	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10
Day 1										
Day 2										
Day 3										
Day 4										
Day 5										
Day 6										
Day 7										

- Was your hypothesis supported? Why or why not?

- After completing the experiment, how else can you think of other ways this project could be done?

- Create a graph from your data table.

Name: _____ **Per:**_____**Date:**_____

Activity 2

Which fermented Inupiaq food produces the most gas over time? Can we determine the type of gas produced from fermented foods?

Background:

The Inupiat hunt and subsist off of both land and marine animals. On land and rivers they hunt the caribou, many species of fish, and birds. Marine animals that are hunted for food include beluga, bowhead whales, bearded seal, ring seal, walrus, clams, and various fish species. One of the ways that the Inupiat people prepare food is through fermentation. Fermented foods include piguraq (caribou), mikigaq (bowhead whale), aaruq (whitefish) and urraq (bearded seal flipper). Mikigaq is a fermented delicacy served during the whale festival, Nalukataq. The goal of this exercise is to discover which Inupiaq fermented food produces the most gas over time.

Which fermented Inupiaq food produces the most gas over time? Can we determine the type of gas produced from fermented foods?

Hypothesis:

_____

_____

Materials:

Fermented foods: mikigaq, urraq, aaruq, piguraq
12 small bottles
12 balloons
ulu or knife
scale
mortar and pestle
duct tape

Method:

1. Label each bottle 1-12: 1-3 mikigaq, 4-6 urraq, 7-9 aaruq,10-12 piguraq
2. Collect the same weight of each fermented food.
3. Mash food using mortar and pestle.
4. Place food in respective small bottle.
5. Place a balloon on top of bottle and secure with duct tape.
6. Let bottle sit at room temperature in a vented hood.
7. Record size of balloon daily for 4 days.
8. Tie off the balloon with a string
9. Weigh the balloon. Subtract the weight of the balloon and string. Record the weight of the gas.

Activity 2 Continued

Fermented Food Gas Production Results

	1	2	3	4	5	6	7	8	9	10	11	12
Day 1												
Day 2												
Day 3												
Day 4												
Smell Test												
Balloon wt (g)												
String wt. (g)												
Gas wt. (g or mg)												

Balloon size key: 1 = balloon on its side with very little inflation; 2 = balloon standing but very little inflation; 3 = balloon standing and firm to the touch but no head formation; 4 = balloon standing, head is half dollar size; 5 = balloon standing, head is larger than half dollar size.

- Was your hypothesis supported? Why or why not?

- After completing the experiment, how else can you think of other ways this project could be done?

- Create a graph from your data table.