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# ANALYZING HISTORICAL & CONTEMPORARY FISHERIES POLICY

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*A Science Literacy Unit for High School*



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# **Fisheries Technology**

## *A Science Literacy Unit for High School*

### **Introduction**

Alaska is the Russian version of the Aleutian word Alakshak, which means great lands or peninsula. The great lands of Alaska have drawn people to them for the last 10,000 years. In recent history, there were over 80,000 Tlingit, Haida, and Tsmishians living throughout Southeast Alaska. The dynamic landscape of Southeast Alaska shapes the cultures who reside there. To merely survive, thorough observation of the physical, biological, and geologic processes that affect marine and terrestrial life is required. To thrive for thousands of years, however, coastal ecology, oceanography, climatology, population dynamics, and understanding the interconnectedness of natural systems had to be mastered. Alaska's dramatic, and oftentimes harsh, landscapes remained a source of mystery until explorers began pursuing manifest destiny "rights". With the influx of settlers seeking the riches the allure of Alaska promised through mining, tourism, and seal hunting, the demand on local resources reached an exhausting level. One resource profoundly impacted and forever altered by the population increase of our state is Alaska's fisheries. Today, Pacific salmon remains a cornerstone for cultural identity, nutrition, medicine, and economy for all of Alaska's residents.

### **Overview**

This course will investigate the challenges and opportunities created by Alaskans fisheries through an exploration of the combination of current management and traditional stewardship. Students will practice reading, writing, listening, and oratory strategies while developing an understanding for western and Tlingit science. This multi-week, seven-lesson unit focuses on the interdisciplinary study of the oral narratives, "Salmon Boy" and "Eagle Boy Harvest" to establish equity in science, math, and literacy. Students will learn fundamentals and relevant terminology in fish and wildlife issues in Southeast Alaska as they student fishing technology and gear, Pacific salmon habitats and life cycles, historical and contemporary fish and wildlife policy. The student will be challenged to assess their individual philosophies of fish and wildlife policy and programs as they engage in projects, case studies, field investigations, and research to answer the questions, "how should local knowledge influence future policies?"

### **Why Use Oral Narratives?**

Tlingit oral narratives contain many layers which enrich our knowledge and imagination. On one level, these stories are great entertainment. Some Tlingit narratives explain how aspects of our world came to be. Other oral narratives relate epic adventures of specific clan ancestors. Stories involving Raven often include humorous exploits which may lead us to reflect upon respectful treatment of others. However, oral narratives were not told solely for entertainment.

In the past, oral narratives were used to convey many forms of knowledge. They taught about place names, property, geography, and science. From these stories, younger generations would learn about food preparation, the ebb and flow of the tides, and behavioral patterns of hunted mammals. Many of these stories assisted in the teaching of life skills such as navigation and obtaining food from the land. In addition, oral narratives were used to convey traditional values and social responsibility: They explore human nature and may involve

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concepts of identity, alienation and isolation, coming of age, loyalty, pride, loss, and other conflicts humans experience throughout life. These stories are spiritual, intellectual gifts which have been passed down from esteemed ancestors. Like all good literature, Tlingit oral narratives can be used to enhance content learning in the classroom. These stories can be used as a springboard to teach history, geography, science, mathematics, Tlingit heritage language, reading, writing, and more.

**Note:** *Tlingit oral narratives are the property of specific clans. For many stories, permission is needed before they are used in the classroom. The Eagle Boy story this unit refers to is originally a Wooshkeetaan clan story of Aak'w Kwáan (Auke tribe) from the Haa Atxaayí Haa Kusteeyíx Sitee, Our Food is Our Tlingit Way of Life as compiled by Richard G. Newton and Madonna L. Moss and as told by John C. Jackson of Kake. The Salmon Boy story is a composite of the versions collected by John R Swanton and George T. Emmons at the Tlingit villages of Sitka and Wrangell.*

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## Unit Objectives:

### As a result of this unit students will understand:

- As different cultures have opposing views about resource management, regulating fisheries is a controversial topic for our state
- Local policy makers, enforcement agencies, and enhancement hatcheries: Alaska Department of Fish & Game (ADF&G), National Oceanographic Atmospheric Association (NOAA), National Marine Fisheries Service (NMFS), and Douglas Island Pink and Chum, Incorporated (DIPAC, Inc), United States Fish and Wildlife Service (USFWS)
- The differences and similarities of traditional stewardship and current management
- Local ecosystems, habitat, life cycles, and human impacts that affect Pacific salmon

### As a result of this unit students will be able to:

- Analyze and evaluate information related to Alaska fisheries and express ideas both in writing and orally.
- Examine how moving from an attitude of land stewardship to resource management has impacted Tlingit culture.
- Evaluate the value of functioning in a western world (literacy and advocacy) as well as counting to uphold tradition.

### Tlingit Educational Significance

- Students benefit from listening to elders and cultural specialists. An elder or cultural specialist should be invited to tell *Salmon Boy & Eagle Boy* in their own words to ensure accuracy, clan proprietorship, and complexity of the oral narratives.
- Tlingit heritage language speakers can teach Tlingit vocabulary and phrases related to stewardship, management, coastal ecology, and other factors that influence fisheries.
- This unit will validate Tlingit understanding of the ecology and geography of the local bioregion and the significance of oral narratives for promoting ethics and responsibility.
- This unit will enable Alaska Native students to understand the Tlingit ingenuity of their ancestors and will help non-Native students better understand landscape ecology and cultural history.

### Culminating Project or Event

- Groups create co-management plan with accompanying outreach and education visuals (can be informational pamphlet, podcast, iMovie, or Garage Band productions if time and resources are available).
- Present visuals and plans to elders, cultural specialists, community professionals, and extended family members and offer them traditional food to thank them for their support in the classroom.

### Supplemental Materials & Suggested Texts

This unit consists of project rubrics, concept maps, student worksheets, PowerPoints, and articles.

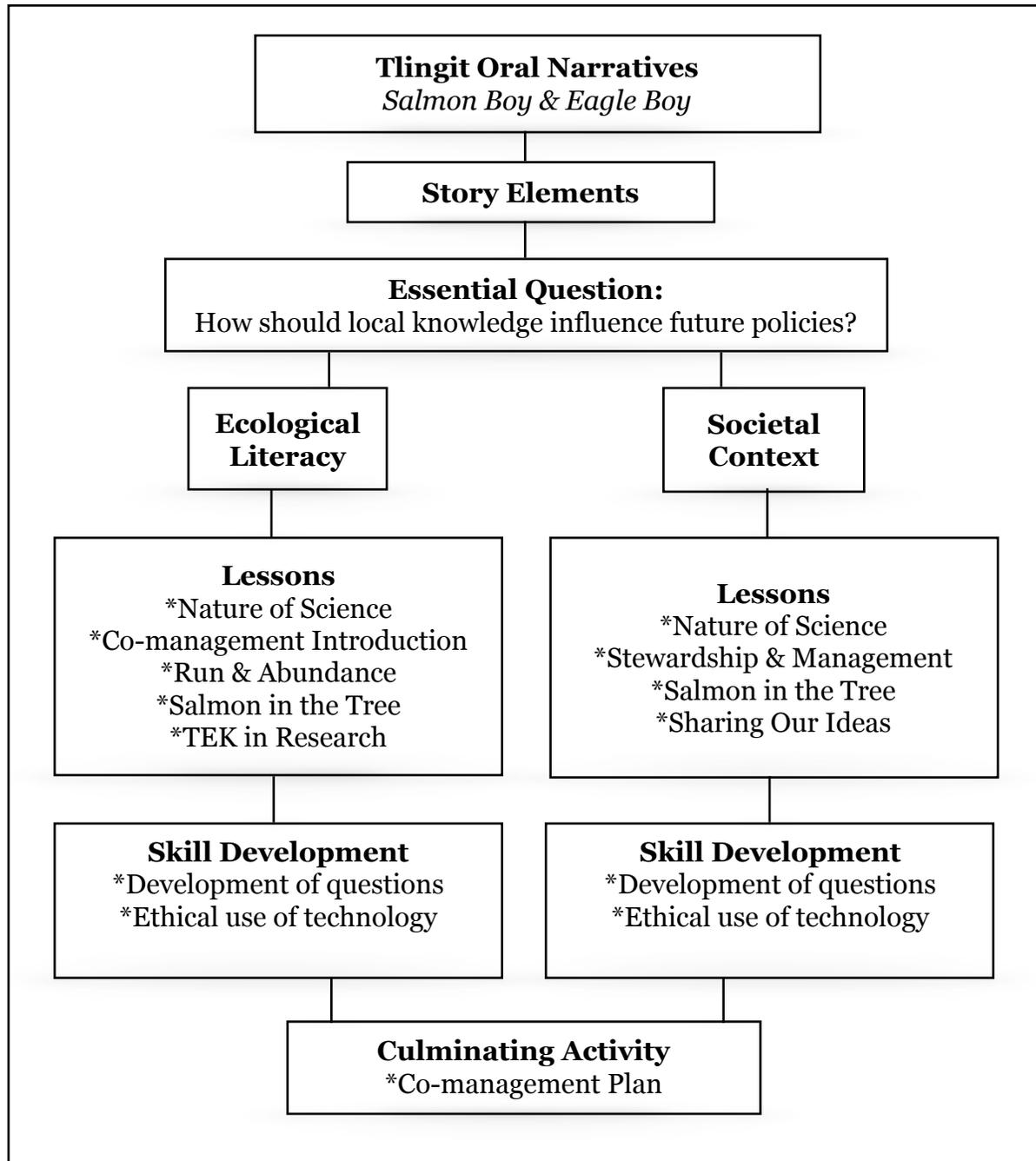
- Haa Shuká, Our Ancestors: Tlingit Oral Narratives. Nora Marks Dauenhauer and Richard Dauenhauer. 1987. Volume 1.
- Haa Atxaayí Haa Kusteeyíx Sitee, Our Food is Our Tlingit Way of Life. Excerpts from Oral Interviews. Richard G. Newton and Madonna L. Moss. USDA 3rd Edition.
- Alaska Native Science: A Curriculum Guide. Dr. Dolly Garza, the Alaska Native Knowledge Network. 2011.
- “Traditional Knowledge and Harvesting of Salmon by Huna and Hinyaa Tlingit” Final Report (102 pages of incredible information to accompany this unit)

## Tlingit Story Elements

This unit will focus on two Tlingit story elements: *ecological literacy* and *societal context*. Students will build background knowledge as they meet and listen to elders and community professionals, read informational and narrative text, study local harvest gear and techniques, practice traditional processing and preservation techniques, conduct scientific experiments, and prepare a presentation as the culminating activity to address the essential question:

- How should local knowledge influence future policies?

The following chart illustrates how lessons were derived from the Tlingit oral narratives.



# Embedded Literacy Strategies

The lessons in this unit utilize specific literacy strategies to scaffold student learning. Guided reading strategies ensure comprehension of informative and narrative text. Guided writing strategies allow students to communicate what they learned and to engage in the writing process effectively. The following chart defines the strategies which are incorporated into this unit.

| Reading Strategies   | Writing Strategies   |
|--|--|
| <p><b>Guided Reading:</b> Teacher models specific strategies to guide students through challenging text.</p> <p><b>Predicting:</b> Students make guesses about the text by using text features; title, pictures, and/or thinking ahead about events which could occur, based on evidence in the text.</p> <p><b>Marking the text:</b> Students select text by highlighting or underlining specific components such as the main idea.</p> <p><b>Summarizing/Paraphrasing:</b> Students restate in own words the essential information or main idea of a text.</p> <p><b>Story Maps:</b> Students use a clearly defined graphic organizer to identify story elements.</p> <p><b>Word Maps:</b> Students use a clearly defined graphic organizer to identify and reinforce word meanings.</p> | <p><b>Guided Writing:</b> Teacher models the writing students are expected to do by guiding them through the writing process before students are expected to perform the same process.</p> <p><b>Brainstorming:</b> Students list multiple ideas in a short amount of time without excluding any ideas.</p> <p><b>Drafting:</b> Students incorporate brainstorming ideas into a written format or story.</p> <p><b>Marking the Draft:</b> Students highlight or underline or code areas for revision.</p> <p><b>Generating Questions:</b> Students clarify and develop ideas by asking questions of the draft. This may be a part of self-editing or peer editing.</p> <p><b>Adding Details:</b> Students enhance text by adding additional words, phrases, sentences, or ideas.</p> <p><b>Self-Editing/Peer Editing:</b> Students work alone or with a partner to examine and identify areas that might need correction for grammar, punctuation, and spelling.</p> |
| Speaking Strategies  | Math Strategies  |
| <p><b>Oral Reading:</b> Students read aloud one’s own text or the texts of others to share work, build fluency and increase confidence in presenting to a group.</p> <p><b>Rehearsal:</b> Students engage in multiple practices of a piece of text prior to performance to refine use of story telling techniques.</p>   | <p><b>Think-Pair-Share:</b> Students work individually to analyze the problem and partner up to share reflections.</p> <p><b>Graphic Representation:</b> Students interpret mathematical concepts to create visual organization of data.</p> <p><b>Group Presentation:</b> Students work together to share graphic representations, analysis, and conclusions.</p>   |

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## Standards Addressed in this Unit

Themes (*parallels AP Environmental Science Content as found at <http://apcentral.collegeboard.com/apc/public/repository/ap-environmental-science-course-description.pdf> and Juneau School District's science content standards*)

### Science

1. Science as Inquiry and Process:

- Science is a method of learning and constantly changes the way we understand the world.  
SA1.1 Students ask questions, predict, observe, describe, measure, classify, make generalizations, analyze data, develop models, infer, and communicate.  
SA1.2 Students recognize and analyze multiple explanations and models, use information to revise student's own explanation or model if necessary.  
SA2.1 Evaluate credibility of cited sources when conducting the student's own scientific investigation.  
SA3.1 Conducts research and communicates results to solve a problem.

2. Energy conversions underlie all ecological processes:

- Energy cannot be created; it must come from somewhere.  
SC3.1 Relate carbon cycle to global climate change.

3. The Earth itself is one interconnected system:

- Biogeochemical and natural systems vary in ability to recover from disturbances  
SC3.2 Analyze potential impacts of changes.

4. Humans alter natural systems:

- Technology and population growth have enabled humans to increase both the rate and scale of their impact on the environment.  
SD3.1 Describe causes, effects, preventions, and mitigations of human impact

5. Environmental problems have a cultural and social context:

- Understanding the role of cultural, social, and economic factors is vital for solutions  
SE1.1 Research how social, economic, and political forces strongly influence which technology will be developed.

6. Human survival depends on developing practices that will achieve sustainable systems:

- A suitable combination of conservation and development is required.  
SF1.1-SF3.1 Investigate the influences of societal and or cultural beliefs on science.

### Language Arts

a. The student restates/summarizes and connects information.

R4.2 Summarize information or ideas from a text and make connections between summarized information or sets of ideas and related topics or information.

b. Student analyzes content of text to differentiate fact and opinion.

R2.9 a. Differentiate between fact and opinion. b. Express opinions about text with support.

c. Student connects and evaluates cultural influences/events.

R3.10 Compare and contrast how texts reflect historical and cultural influences.

R4.9 Analyze the effects of cultural and historical influences on texts.

### Cultural Standards

B.4 Identify appropriate forms of technology and their use for improving community.

D.3 Interact with Elders in a loving and respectful way that demonstrates and appreciation of their role as culture-bearers and educators in the community.

E.2 Understand the ecology and geography of the bioregion they inhabit.

| <p style="text-align: center;"><b>Final Project Rubric:</b><br/><i>Co-management Plan (including Outreach &amp; Education Visuals)</i></p> | <p><b>Name:</b></p> <p><b>Group Members:</b></p> |     |
|--|--|-----|
| <b>Grading Criterion (3 points/each)</b>   | No   | Yes |
| <b>Preparation:</b> Student utilized regulation guidelines and project rubric to organize & plan their work.                               |  |     |
| <b>Focus on Task:</b> Used time well, focused on the project, worked well with others.   |  |     |
| <b>Essential Question:</b> Created an original, interesting way to address the essential question in their presentation.                   |  |     |
| <b>Audience Awareness:</b> Design, vocabulary, audio, and graphics fit target audience   |  |     |
| <b>Voice Consistency:</b> Voice quality is clear and audible throughout the presentation   |  |     |
| <b>Voice Pacing:</b> The pace fits the information presented and draws the audience into the story.  |  |     |
| <b>Narration:</b> Each member narrates a section within the presentation. Tingit and English names of resources are given.                 |  |     |
| <b>Imagery:</b> Appropriate use of images for education and outreach visuals.  |  |     |
| <b>Detail:</b> Presentation has exactly the right amount of detail-not too short or too long.  |  |     |
| <b>Purpose:</b> Establishes purpose early and maintains that focus throughout.   |  |     |
| <b>Duration:</b> Group presentation is between 3 to 5 minutes in length.   |  |     |
| <b>Requirements:</b> Product includes all required elements.   |  |     |
| <b>Total Points (36 points available):</b>   |  |     |

| Overview of Lessons   | Literacy Strategies   | Academic Vocabulary  | Assessments   |
|---|---|--|---|
| <p><b>Lesson 1: Nature of Science</b><br/> <i>Science is a Process</i><br/>           Students explore the convergence of western and traditional science through guided reading, discussion, and reflection writing.</p> <ul style="list-style-type: none"> <li>• Student Page: “Ways of Knowing” article</li> <li>• Student Page: “Western science &amp; traditional knowledge” article</li> </ul>  | <ul style="list-style-type: none"> <li>• Guided writing</li> <li>• Quick-write</li> <li>• Think-Pair-Share</li> <li>• Mark the text</li> <li>• Paraphrasing</li> </ul>                                  | <ul style="list-style-type: none"> <li>• traditional ecological knowledge</li> <li>• western science</li> <li>• empiricism</li> </ul>  | <ul style="list-style-type: none"> <li>• Journal Prompt</li> <li>• Peer Reflections</li> </ul>  |
| <p><b>Lesson 2: Stewardship &amp; Management</b><br/> <i>Science is a Process</i><br/>           Students practice problem-solving strategies as they create graphic representations of abstract concepts regarding historical and contemporary fishery policy.</p> <ul style="list-style-type: none"> <li>• Student Page: What is an oral narrative?</li> <li>• Student Page: Copy of <i>Eagle Boy Harvest</i></li> <li>• Student Page: Stewardship &amp; Management Table</li> </ul>  | <ul style="list-style-type: none"> <li>• Graphic representation</li> <li>• Generating questions</li> <li>• Annotations</li> <li>• Quick-write</li> <li>• Paraphrasing</li> </ul>                        | <ul style="list-style-type: none"> <li>• oral narrative</li> <li>• cultural context</li> <li>• permits</li> <li>• regulations</li> <li>• enforcement</li> <li>• stewardship</li> <li>• management</li> </ul> | <ul style="list-style-type: none"> <li>• Article summary &amp; annotation (peer review)</li> <li>• Class Venn Diagram</li> <li>• Table</li> </ul> |
| <p><b>Lesson 3: Co-management Introduction</b><br/> <i>Humans alter natural processes</i><br/>           Students are introduced to the unit’s culminating activity expectations to use the problem-solving strategy of working backwards to find the answer.</p> <ul style="list-style-type: none"> <li>• Student Page: Aak’w Kwáan &amp; Taak’u Kwáan Map</li> <li>• Student Page: Final project scoring guide</li> </ul>   | <ul style="list-style-type: none"> <li>• Note-taking</li> <li>• Generating questions</li> <li>• Debriefing</li> <li>• Quick-write</li> <li>• Work backward</li> <li>• Graphic Representation</li> </ul> | <ul style="list-style-type: none"> <li>• co-management</li> <li>• conservation/management plans</li> <li>• local resources</li> </ul>  | <ul style="list-style-type: none"> <li>• Table</li> <li>• Journal Prompt</li> </ul>   |
| <p><b>Lesson 4: Run &amp; Abundance</b><br/> <i>Humans alter natural processes</i><br/>           Students make predictions, run a simulation, generate questions, and discuss the challenges of estimating stock abundance of Pacific salmon.</p> <ul style="list-style-type: none"> <li>• Student Page: Predicting Uncertainty Table</li> </ul>   | <ul style="list-style-type: none"> <li>• Note-taking</li> <li>• Generating questions</li> <li>• Discussion group</li> <li>• Graphic Representation</li> </ul>   | <ul style="list-style-type: none"> <li>• population dynamics</li> <li>• fecundity</li> <li>• run</li> <li>• recruitment</li> <li>• escapement</li> <li>• abundance</li> </ul>                                | <ul style="list-style-type: none"> <li>• Table</li> </ul>   |
| <p><b>Lesson 5: Salmon in the Trees</b><br/> <i>The Earth is one interconnected system</i><br/>           Students explore the concept of keystone species and the energy transfer of the different components of ecosystems through the combination of Tlingit oral narratives and academic journals. Students will work together to identify key components of local coastal food webs through stream quality testing.</p> <ul style="list-style-type: none"> <li>• Student Page: Copy of <i>Salmon Boy-Moldy End</i></li> <li>• Student Page: Storyboard</li> <li>• Student Page: Free Response Quiz</li> <li>• Student Page: Fish Policy PowerPoint</li> <li>• Student Page: Excerpts from TEK &amp; Fishery Article</li> </ul> | <ul style="list-style-type: none"> <li>• Quick-write</li> <li>• Think-Pair-Share</li> <li>• Mark the Text</li> <li>• Oral Reading</li> <li>• Note-taking</li> <li>• Paraphrasing</li> </ul>             | <ul style="list-style-type: none"> <li>• water quality</li> <li>• dissolved oxygen</li> <li>• pH</li> <li>• fishing gear</li> <li>• fermentation</li> <li>• food preservation</li> </ul>                     | <ul style="list-style-type: none"> <li>• Free Response Quiz</li> <li>• Article Summary</li> </ul>   |
| <p><b>Lesson 6: TEK in Research</b><br/> <i>Human survival depends on sustainable practices</i><br/>           Students will demonstrate understanding of the importance of ancient knowledge in today’s changing world as they prepare for the final presentation.</p> <ul style="list-style-type: none"> <li>• Student Page: Interview Template (Short Project)</li> <li>• Student Page: Anadromous Waters Catalog (GIS)</li> </ul>   | <ul style="list-style-type: none"> <li>• Think-Pair-Share</li> <li>• Note-taking</li> <li>• Work backwards</li> </ul>   | <ul style="list-style-type: none"> <li>• Geographical Information System (GIS)</li> <li>• Anadromous</li> </ul>  | <ul style="list-style-type: none"> <li>• Interview</li> <li>• Final project prep</li> </ul>   |
| <p><b>Lesson 7: Sharing Our Ideas</b><br/> <i>Science is a Process</i><br/> <ul style="list-style-type: none"> <li>• Student Page: Final presentation</li> </ul> </p>   | <ul style="list-style-type: none"> <li>• Graphic representation</li> <li>• Paraphrasing</li> </ul>  | <ul style="list-style-type: none"> <li>• respect</li> </ul>  | <ul style="list-style-type: none"> <li>• Final project</li> </ul>   |

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## *Lesson 1*

### *Nature of Science*

#### **Purpose**

To introduce students to primary resource analysis and interpretation regarding the nature of science; to develop the skill of gathering information from multiple resources; to assess and build background knowledge of traditional ecological knowledge; to increase listening, reading, and writing fluency.

#### **Essential Questions**

- What is the nature of science?

#### **Duration**

75 minutes (1-2 sessions)

#### **Lesson Objectives: Connecting to the Standards**

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| SA2.1 Evaluate credibility of cited sources when conducting the student's own scientific investigation |
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| SA3.1 Conducts research and communicates results to solve a problem |
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| SF1.1-SF3.1 Investigate the influences of societal and or cultural beliefs on science |
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| R3.10 Compare and contrast how texts reflect historical and cultural influences. |
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| R4.2 Summarize information or ideas from a text and make connections between summarized information or sets of ideas and related topics or information |
|--|

#### **Academic Vocabulary**

- Traditional ecological knowledge
- Western science
- Methodologies
- Empiricism

#### **Materials**

- Student composition notebooks
- “Ways of knowing” article: <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1479546/>
- “Western Science and traditional knowledge” article

#### **Suggested Guests**

- Elder to introduce Tlingit science (David Katzeek, Paul Marks-Goldbelt Heritage Foundation)
- Paul Berg (Juneau School District) to speak to high and low context cultural differences

#### **Literacy Strategies**

- Guided writing

- Quick-write
- Think-Pair-Share
- Marking the text
- Adding details
- Annotations
- Paraphrasing

### Assessments

- Pre-assessment journal response: *Essential Question*
- Check for student understanding: *Think-Pair-Share*; *Class list of science methodology factors*

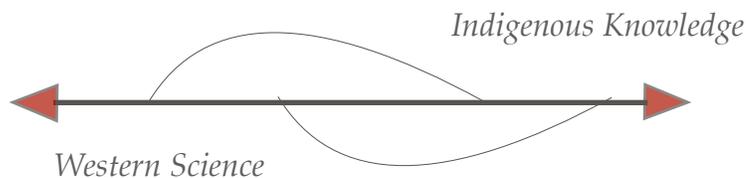
### Procedure

#### Step 1) Introducing Content: 15 minutes

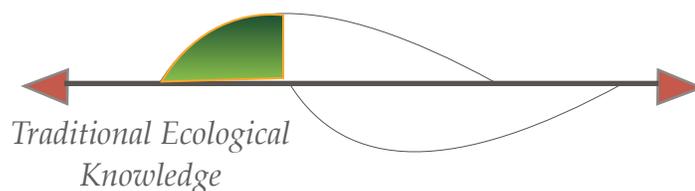
- Welcome students to a class that will challenge the way they approach science and the way they interpret the world around them. Students can expect to utilize familiar concepts such as the scientific method, but will also learn from Tlingit pedagogy in the search to find previously undiscovered commonalities and differences in the two methodologies.
- Draw a timeline on the board (this timeline was originally presented to Paul Berg of Goldbelt Heritage Foundation by a Oglala-Sioux Elder in South Dakota):



- The timeline represents time immemorial to the left (all that humans remember in our history) and the future. The curve represents knowledge held by many cultures worldwide about how the world works. It extends far into the past and includes the future.



- The second arc underneath the timeline represents what collectively is called western science, what students are familiar from learning in school. It is not as ancient as indigenous knowledge, but with tools and technology, western science is able to examine microcosms and extend theories into the future.



- Finally, the green shaded in area is what the class will be focusing on. This knowledge is held by indigenous cultures worldwide and is called Traditional Ecological

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Knowledge. It is a wealth of knowledge and explanations of other macro- and micro-dimensions western science has yet to consider.

### **Step 2) Assessing Background Knowledge: 30 minutes**

Explain:

- In order to move forward together, there needs to be a common definition of science. Hand out student binders and answer essential questions in composition notebook as a pre-assessment and present the essential questions of the lesson:  
Question 1) *What is the nature of science?*
- Teacher can use guided writing strategy to model their journal response to the question. Responses should take in consideration factors such as:
  - ❖ how do researchers conduct science, what are they looking for, how do scientists communicate their findings, and the role of ethics, culture, tools and technology (*answers will be shared during a think-pair-share session*).

Assess:

- Pair the students and have them read their answers for just Question 1.
  - Student pairs should compare and contrast their answers to create a list of unifying factors both of their reflections share
  - Student pairs should take the overlapping factors and create a working definition of science (2-3 sentences)
- Create a class list of student-driven scientific factors on the board for students to take down as notes
- Have each pair read aloud their definition of science to the class

### **Step 3) Building Background Knowledge: 30 minutes**

- Discuss the similarities and differences in their individual responses. Read aloud (or hand out quote to staple into science notebook) the definition of science as given by the Dalai Lama of Tibet when asked to compare contemplative and scientific explanations of the world:  
*“For me, science is first and foremost an empirical discipline that provides humanity with a powerful access to understanding the nature of the physical and living world. It is essentially a mode of inquiry that gives us fantastically detailed knowledge of the empirical world and the underlying laws of nature, which we infer from the empirical data. Science processes by means of a very specific method that involves measurement, quantification, and intersubjective verification through repeatable experiments. This, at least, is the nature of the scientific method as it exists within the current paradigm.”*
- Add any factors to the class list such as measurement, quantification, and verification through repeatable experiments if they are missing and check for student understanding
- Finish presenting the Dalai Lama’s definition:  
*“Within this model, many aspects of human existence, including values, creativity, and spirituality, as well as deeper metaphysical questions, lie outside the scope of scientific inquiry.”*

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- Reemphasize the intention of the class is to find the overlap between western and traditional science methodology, the overlap will naturally be found in the humanizing elements of how and why science is conducted.
  - Pass out the “Ways of Knowing” article and allow time for students to read in class. Encourage marking the text.
    - ❖ **Marking the text:** If your students are unfamiliar with this strategy, demonstrate how to mark the text for main ideas using the first few sentences. Underline or circle key words or phrases which help to answer the question: What is an oral narrative? Have students use the strategy for the remaining paragraphs for homework.
  - Add additional factors to the what is science class list that may have been generated from the article and have students save article in notebook for the next class.

Homework: *Reading for Information & Summarizing*

- **Homework:** Pass out “Western Science and Traditional Knowledge”
- Students will read to answer the question: What is the nature of science?
- **Marking the text:** If your students are unfamiliar with this strategy, demonstrate how to mark the text for main ideas using the first few sentences. Underline or circle key words or phrases which help to answer the question: What is the nature of science? Have students use the strategy for the remaining paragraphs for homework.
- **Make annotations:** Students should write down thoughts or questions in the margins as they read.
- **Reread:** Students should be encouraged to reread the text to check for details they may have missed the first time.
- **Paraphrase:** Students will need to paraphrase their new understanding of *what is the nature science* in their journals for homework (1-2 paragraph response).

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## Lesson 2

### *Traditional Stewardship & Current Management*

#### **Purpose**

To introduce students to Tlingit oral narratives and cultural ways of knowing; to create graphic representations of abstract concepts relating to historical and contemporary resource management; to build primary resource analysis and interpretation skills; to identify individual learning styles; to develop the skill of gathering information from multiple resources; to assess and build background knowledge of Tlingit and western science; to increase listening, reading, and writing fluency.

#### **Essential Questions**

- How do different cultures maintain healthy populations of their resources?

#### **Duration**

75 minutes (2-3 sessions)

#### **Lesson Objectives: Connecting to the Standards**

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|--|
| SA1.2 Students recognize and analyze multiple explanations and models, use information to revise student's own explanation or model if necessary |
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|   |
|---|
| SA3.1 Conducts research and communicates results to solve a problem |
|---|

|   |
|---|
| SF1.1-SF3.1 Investigate the influences of societal and or cultural beliefs on science |
|---|

|  |
|--|
| R4.2 Summarize information or ideas from a text and make connections between summarized information or sets of ideas and related topics or information |
|--|

|   |
|---|
| R2.9 a. Differentiate between fact and opinion. b. Express opinions about text with support |
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|  |
|--|
| D.3 Interact with Elders in a loving and respectful way that demonstrates and appreciation of their role as culture-bearers and educators in the community |
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|  |
|--|
| E.2 Understand the ecology and geography of the bioregion they inhabit |
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#### **Academic Vocabulary**

- oral narrative
- cultural context
- permits
- regulations
- monitoring
- enforcement

#### **Materials**

- Student composition notebooks
- "What is an oral narrative" worksheet
- Copy of *Eagle Boy Harvest*
- Stewardship & Management table

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- “Traditional Knowledge and Harvesting of Salmon by Huna and Hinyaa Tlingit” Final Report (102 pages of incredible information for use with this unit)

### **Suggested Guests**

- Elder to introduce Tlingit oral narrative (contact Goldbelt Heritage Foundation)
- Paul Berg (Juneau School District) to speak to high and low context cultural differences and the role of culture in science today
- ADF&G representative to discuss how permits and regulations are turned into legislation and the process of science that determines permit numbers each year

### **Literacy Strategies**

- Graphic representation
- Generating questions
- Marking the Text
- Quick-write
- Rereading
- Annotations
- Paraphrasing

### **Assessments & Student Pages**

- Pre-assessment: Peer review and share out of article summaries (homework from lesson #1)
- Assessment: *What is an oral narrative?*
- Assessment: *Venn Diagram of Tlingit and Western Science (whole class: what parts of the two methodologies overlap?)*
- Assessment: *Creating a stewardship & management table (compare and contrast historical and contemporary policies)*

### **Procedure**

#### **Step 1) Introducing Content: 30 minutes**

- Begin with summarizing the article students read for homework, “Western science and traditional knowledge.”
- Model peer review and discuss how self and peer revision will be a regular part of the class. When reading, reviewing, and editing each other’s work, suggestions and reflections should be given in a respectful manner.
- Students should exchange their article summaries for peer revision and group discussion about the new topic of western science and traditional knowledge

#### **Step 2) Assessing Background Knowledge: 20 minutes**

Explain:

- As the author of “Western science and traditional knowledge,” Fulvio Mazzocchi stated:  
*“despite their variations, different forms of knowledge can learn from each other...the British anthropologist Gregory Bateson has compared knowledge about the material world to a map and the terrain it describes: the map itself is not the terrain, but only one representation of it (Bateson, 1979). Just as different maps can give accounts of the same territory, so too can different*

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*forms of knowledge about the material world. Its actual representation ultimately depends on the observer's view."*

- With great societal change and challenges, tremendous solutions wait on the horizon. Scientific reductionism has explained in great detail many components of the natural world. Western science, however, becomes a cultural myth when stated as the only way to approach truth. Traditional scientific approaches of controlled, repeatable experiments cannot be applied to phenomena that fall outside of specific conditions.  
*"...Hence, the integration of methods and results from different approaches and levels of analysis can become essential. These considerations seem to be particularly relevant for studying biological, ecological and social phenomena that include different levels of complexity. As already mentioned, the Western tradition of thinking is developing a different approach to gaining knowledge from complex systems, but it would be equally useful to learn how traditional approaches explain such complexity. Not only are they more holistic, but also they seem to be better suited to coping with the uncertainty and unpredictability that are viewed as intrinsic characteristics of natural systems. Western science and traditional knowledge constitute different paths to knowledge, but they are rooted in the same reality. We can only gain from paying attention to our cultural history and richness."*

Assess:

- Using their resources (notes, summaries, and the two annotated articles from lesson #1 "Ways of knowing" and "Western science and traditional knowledge") students should contribute to a class construction of a Venn diagram that displays the similarities and differences in western and Tlingit science. The overlapping circle is the heart of true science.

### **Step 3) Building Background Knowledge: 25 minutes**

*Cultural Ways of Knowing:*

- Cultural ways of knowing have been categorized into high and low context cultures. There is no good or bad within these schemas, it just refers to how people in varying societies learn and conduct their daily lives.
  - ❖ Low context refers to cultures that depend heavily on directional language for communication, understanding, and reference. Families tend to be nuclear and societal systems are divided and reduced for simplification. Examples of low context culture are many Western societies and institutions. American education system is extremely low context as demonstrated by 70% of the school day being devoted to instructions "take out your book, turn the page, change classes, etc..."
  - ❖ High context cultures consist of many Indigenous cultures. Words are more of a releaser between community members, with many things being communicated through body language and context. It is not unusual for individuals to be multi-talented in dancing, singing, musical instruments, acting, producing art work and crafts. Families are community-oriented and there are usually multi-generations living in one household. French society is another example of high context culture.
- Oftentimes, placing high context individuals in low context settings does not work well. Americans can go both ways. Low context within our institutions and dominant language, but high context on special events like graduation and weddings.
- Explain that just as there are cultural ways of knowing, individual ways of knowing also differ greatly across humanity. Pass out "Brain dominance assessment" for

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students to fill out for homework. Explain that they are to answer the questions based on their true tendencies and to not overthink each question to vary the answers.

- Due to a great difference in ways of knowing, there are a variety of ways of sharing knowledge. Within today's Western paradigm, science theories and facts are only accepted out of peer-reviewed scientific journals where multiple experts have checked experiments and conclusions. In Tlingit culture, information is shared through oral narratives and *At.oow'*, sacred belongings of families and clans. Just as the Smithsonian Institute contains libraries of knowledge, elders hold ancient knowledge that was tested as true through the act of living in Alaska's dynamic landscapes. The oral narratives, Chilkat and button blankets, hats, armor, wooden sculptures, and other *At.oow'* act as the peer-reviewed journals that communicate and verify certain theories, facts, and conclusions about natural systems.

*Tlingit Oral Narratives in this Unit:*

- Introduce Tlingit oral narratives by creating a discussion around what students think an oral narrative might be.
- Explain that oral narratives have different purposes and pass out the "what is an oral narrative?" worksheet. Students should read through the description remembering to mark the text, annotate, and paraphrasing their understanding of the significance of oral narratives. As a class, two Tlingit oral narratives will accompany science lessons to better understand the ecology and natural history of Alaska to help answer the unit's essential question, "*how should local knowledge influence future policies?*"
  - If possible, have a Tlingit knowledge bearer such as David Katzeek, Paul Marks, or Fred White visit the class to lead the discussion of what is an oral narrative and to share one with the class. Depending on clan rights and who is able to present to the class, it would be ideal to have *Eagle Boy (Wooshkeetaan clan story)* be told, but students will benefit from any oral narrative shared with them.
- Deeper exploration of the two oral narratives and interactions with Tlingit elders and knowledge bearers will be presented throughout the unit. Two oral narratives will accompany this unit, both are stories of humans saved by animals who in turn become a part of the animal community whom they learn from. Both speak of stewardship practices in Southeast Alaska.

*Homework: Reading for Information & Graphic Representation*

- *Homework:* Students to read *Eagle Boy* and complete the "Stewardship and Management" table to identify the similarities in historical and contemporary policies.
- **Paraphrase:** In their science notebooks, students should summarize the way regulations are communicated in both cultures and how those approaches work (or don't work) across cultures.

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## Lesson 3

### Co-management Introduction

#### **Purpose**

To introduce students to unit and final presentation; to reinforce student understanding of text through storyboard creation; to understand the challenges of estimating run and abundance; to simulate population dynamics calculations; to build primary resource analysis and interpretation skills; to develop the skill of gathering information from multiple resources; to assess and build background knowledge of Tlingit and western science; to increase listening, reading, and writing fluency.

#### **Essential Questions**

- How do different cultures maintain healthy populations of their resources?
- What are the challenges of fishery management?

#### **Duration**

150 minutes (2 75-minute sessions)

#### **Lesson Objectives: Connecting to the Standards**

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| SA1.1 Students ask questions, predict, observe, describe, measure, classify, make generalizations, analyze data, develop models, infer, and communicate      |
| SF1.1-SF3.1 Investigate the influences of societal and or cultural beliefs on science  |
| R4.2 Summarize information or ideas from a text and make connections between summarized information or sets of ideas and related topics or information       |
| R2.9 a. Differentiate between fact and opinion. b. Express opinions about text with support  |
| D.4 Gather oral and written history information from the local community and provide an appropriate interpretation of its cultural meaning and significance. |
| E.2 Understand the ecology and geography of the bioregion they inhabit   |

#### **Academic Vocabulary**

- fisheries
- ecosystem dynamics
- run
- abundance
- uncertainty

#### **Materials**

- Dr. Dolly Garza’s [Alaska Native Science: A Curriculum Guide](#) (available through Alaska Native Knowledge Network; highly recommended; lesson #3 inspired by and modified from “Co-Management: the Eskimo-Walrus Commission”
- Student composition notebooks

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- Aak'w Kwáan and Taak'u Kwáan Map
  - Final Project Student Rubric
  - Use <http://www.adfg.state.ak.us/> and [www.fws.gov](http://www.fws.gov) (1-800-362-5148) to locate local conservation and management plans (plans not included, can be specific resource of interest to class)

### **Suggested Guests**

- Cultural Specialist of GHF to explain traditional stewardship and clan protection of water systems
- ADF&G representative to discuss how permits and regulations are turned into legislation and the process of science that determines permit numbers each year
- ADF&G representative to present current Pacific Salmon management plan
- NMFS agent to discuss research vessel expeditions and methodologies regarding run and abundance
- US Fish & Wildlife Service representative to discuss federal regulations regarding marine mammals of cultural significance

### **Literacy Strategies**

- Note-taking
- Generating questions
- Debriefing
- Quick-write
- Work backward
- Paraphrasing

### **Assessments**

- Pre-assessment: *Think-Pair-Share stewardship and management tables*
- Assessment: *What you think you need to know (journal prompt)*

### **Lesson Extensions**

- Utilize GHF's "Bristol Bay Fishery" written by Paul Berg of Juneau School District to add math components of a commercial fisherman's annual expenses

### **Procedure**

#### ***Step 1) Making Connections: 15 minutes***

- Much of what elders and cultural specialists say is full of rich and rigorous science content. Listening for the science is like learning to speak another language, it comes naturally by broadening our vocabulary and opening our minds to listen to what is truly being said behind each story, phrase, or discussion.
- Students should think-pair-share their tables from the night before to lead into a class discussion of the overlap and differences of traditional stewardship and contemporary management. Discuss with the class how both cultures are trying to prevent disrespectful actions, but how broad rules and regulations may oftentimes be inappropriate for some communities given its geography, dependence on harvested food, or cultural celebration needs (pg 72 of [Alaska Native Science](#)).
- In the book, [Haa Atxaayí Haa Kusteeyíx Sitee, Our Food is Our Tlingit Way of Life](#), immediately following the *Eagle Boy* story is this literary analysis:

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*This story is particularly rich in content, only some of which will be discussed here. It clearly demonstrates that hunting knowledge was considered a privilege and that the hunter was invested with special power over the natural world. The power was to be used judiciously, with due respect afforded to the prey. The story begins with the young boy's attempt to provide for his aging grandparents. This kind of motivation was very important in strengthening the fabric which binds the extended family together. The grandparents caution their grandson to be careful, to watch the tides, emphasizing the inherent danger in the traditional quest for survival. The young boy is rescued by an eagle, and in Tlingit legend, animals often appear as benevolent beings with powers to save humans, especially from disasters deriving from a person's lack of knowledge or inexperience. Later on, the boy recognizes the eagle as a beautiful young woman. The world is filled with animals emerging as humans, and humans being transformed into animals. This, in and of itself, demonstrates the interdependence and intimacy of humans and those beings of the natural world. The boy is an orphan, but aspires to hunt with the skill of an eagle. He is adopted by the eagle family; the father-in-law gives him the various shirts which symbolize inherited power. This parallels the human world in which privilege and power is passed on through clan of family ranks. But along with increasing power, comes greater responsibilities. In the end, the boy, now a grown man, abuses his power by killing more than he needs. The ubiquitous raven crows, as the man dies in punishment for his transgression.*

## **Step 2) Assessing Background Knowledge: 30 minutes**

Explain:

- Explain that in this unit, students will be working in small groups to find a middle ground between traditional stewardship and contemporary management referred to as co-management. Juneau sits on Tlingit territory known as Aak'w Kwáan (north and west of Juneau) and Taak'u Kwáan (south east of Juneau, area between Juneau and Taku Glacier approximately). Explain the history of the formation of Southeast Alaska's archipelago, and how islands created natural boundaries for distinct clans to protect and identify with natural resources. Aak'w Kwáan consists of L'eeneidi (Raven moiety) and the Wooshkeetaan people (Eagle moiety). Taak'u Kwáan was the Yanyeiidi clan (Eagle). Hand out map so students can visualize the place the Eagle Boy story derived from. In order for Tlingits to thrive in Southeast Alaska for thousands of years, they must have developed and mastered an intimate understanding of the land and ocean.
- Explain that some countries are moving towards co-management. Present on Parks Canada of the Yukon Territory's Kluane National Park or the Eskimo Walrus Commission presented in Dr. Dolly Garza's Alaska Native Science: A Curriculum Guide. In Canada, the national parks followed a similar pattern of the United States, they removed and relocated First Nations people who had lived within the newly defined park boundaries for thousands of years and restricted their ability to hunt or gather within the new national park. The national park hired only empirically trained scientists and college graduates to staff the park, issue the permits, and educate the visitors in only French and English. Recently, Parks Canada has made formal apologies to the First Nations people and have dropped their hunting, fishing, and harvesting

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regulations for First Nations people. Biologists have also begun to hire First Nations hunters to contribute to research and more accurate permitting processes. Following the advice of a local elder, permits were redesigned for moose hunting to allow the moose population to bounce back from their formally precarious state. The visitor center is now located in a building owned by the local tribe, and the park has hired indigenous knowledge bearers to inform the public oftentimes in English, French, and their native language. Interpretive signs throughout the park also acknowledge the land and culture of the First Nations people. Populations of animals and berry patches now thrive and residents are more likely to agree with and understand developed co-management regulations. The First Nations tribes are moving towards a healthier and more sustainable relationship with the federal government built on mutual respect rather than mistrust and misuse of local resources.

- The culminating activity consists of group presentations of co-management plans that will take into consideration natural resource stewardship and current management, cultural inclusion and sensitivity, traditional ecological knowledge, information generated by local community members, population dynamics, natural systemic changes, global concepts and challenges, and must convey the ability to express out the new co-management policy to the surrounding communities through outreach and education. Roles can be assigned for the final project that include:
  - Resource Advocate: This student represents the voice of the resource.
    - For example: What are the ecological conditions that make this resource thrive? How would it be harvested and what is it's relationship with humans? What other animals depend on this resource? What are the challenges and opportunities existing as this resource?
  - Historian: Student gives an overview of the previous health of the resource and traditional stewardship practiced to maintain stock levels.
    - For example: For example, if using herring as a resource, this person would explain the abundance of herring as evidenced in Tlingit historical oral records/narratives, the location of the populations, and the fact that preferred herring egg substrate (rocks) used to be placed in harbors. Additionally, Tlingits used seaweed and branches to create even more (harvestable) substrate for eggs. With the introduction of foreign, commercial-size fisheries collecting herring eggs, the herring population has virtually disappeared from many areas along the coast.
  - Co-management Presenter: Presents existing contemporary management plans and the solutions presented through co-management. Clearly voices how and why co-management is necessary.
  - Communicator: Student has a plan to advocate for co-management to the audiences affected by policy changes.
  - Educator: Student works closely with the communicator to develop visuals to inform the public as to how/why co-management plans should be implemented.
- Hand out final scoring rubric and discuss expectations (student page).
- Students need to know where they are going by understanding the final project rubric. One problem-solving strategy is to work backwards. On the learner's model students first need to ask questions in order to move forward seeking answers. What do students need to understand to be able to understand to develop a co-management plan of a local resource?

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Assess:

- Using their resources (the Aak’w and Taak’u map, notes, and the final scoring rubric), students need to do a quick write to answer “what do I need to know to be able to develop a co-management plan to encourage the cooperation of local hunters/gatherers and resource managers?”
- Partner students up to compare and contrast essential factors and things to know. Have students continue to add details to their own responses.

### ***Step 3) Building Background Knowledge: 45-75 minutes***

#### *Developing Local Management*

- Invite guest speakers of federal agencies to discuss the development of local management if possible.
- Review a local management or conservation plan (might be found in both) as a class. Use literacy strategies such as reading aloud, marking the text, and annotations to make the document easy to digest. Students should be reading for information to answer the question, “what do I need to know to be able to develop a co-management plan to encourage the cooperation of local hunters/gatherers and resource managers?”

#### *Homework: Reading for Information*

- *Homework:* Send a copy of the conservation/management plan home with students. They should generate a graphic organizer to include their answers to what do I need to know to be able to develop a co-management plan to encourage the cooperation of local hunters/gatherers and resource managers? They should make a graphic organizer of their factors to keep as reference for the creation of their final project.

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## Lesson 4

### Estimating Stock Run and Abundance

#### Purpose

To investigate the relationship between resources and people; to explore abiotic and biotic factors that influence resource health and status; to introduce students to primary resource analysis and interpretation regarding the interconnectedness of the world demonstrated by the carbon cycle; to develop the skill of gathering information from multiple resources; to assess and build background knowledge of traditional ecological knowledge; to increase listening, reading, and writing fluency.

#### Essential Questions

- What ecological conditions affect population dynamics and distribution?
- What are the challenges of fishery management?

#### Duration

75 minutes (1 sessions)

#### Lesson Objectives: Connecting to the Standards

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| SC3.1 Relate carbon cycle to global climate change   |
| SA1.2 Students recognize and analyze multiple explanations and models, use information to revise student's own explanation or model if necessary |
| SF1.1-SF3.1 Investigate the influences of societal and or cultural beliefs on science  |
| R4.9 Analyze the effects of cultural and historical influences on texts.   |
| A.2 Students will recount their own genealogy and family history   |
| E.2 Understand the ecology and geography of the bioregion they inhabit   |

#### Academic Vocabulary

- population dynamics
- fecundity
- run & abundance
- recruitment
- escapement
- stock status
- limiting factors
- habitat

#### Materials

- Presentation on salmon life cycles and habitat (not included).
- Dr. Dolly Garza's [Alaska Native Science: A Curriculum Guide](#) (available through Alaska Native Knowledge Network); highly recommended; lesson #4 inspired by and modified from "Herring Management: Traditional & Contemporary"
- Student composition notebooks
- 8 lunch size paper bags with top half cut off

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- 100's of green (or any color) beans
  - 100's of brown (or any different color) beans
  - blindfolds

### **Suggested Guests**

- Cultural Specialist of GHF to explain traditional stewardship and clan protection of water systems
- ADF&G representative to discuss how permits and regulations are turned into legislation and the process of science that determines permit numbers each year
- ADF&G representative to present current Pacific Salmon management plan
- NMFS agent to discuss research vessel expeditions and methodologies regarding run and abundance
- US Fish & Wildlife Service representative to discuss federal regulations regarding marine mammals of cultural significance

### **Literacy Strategies**

- Quick-write
- Think-Pair-Share
- Mark the Text
- Oral Reading
- Note-taking
- Debriefing

### **Assessments**

- Pre-assessment: *Collect Basket Bay History worksheet (homework)*
- Assessment: Short-term project

### **Lesson Extensions (Field Study Experience)**

- Take a field trip to NMFS at the NOAA building in Juneau to explore tools and technology used on research vessel to estimate stock abundance

### **Procedure**

#### ***Step 1) Introducing Content: 15 minutes***

- Students should peer review their list of factors. As a class, generate a list that includes these factors (page 73 of Alaska Native Science):
  - the status of the stock
  - the historic biomass/size of stock
  - the “whys” of rules and regulations
  - how the rules and regulations are monitored and enforced
  - how the health of the stock is monitored in-season
  - how new biological information is gathered and updated
  - how can local knowledge be included in the future policies?
- Remind students of abiotic and biotic factors. Create class posters of the abiotic and biotic ecological conditions that affect Pacific Salmon. Posters should include other plants, animals, bacteria, viruses, spawning rock size, nutrients from eroding sediments, water temperature, stream quality, river channels and depth, currents, open ocean basins, etc.

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### **Step 2) Assessing Background Knowledge: 15 minutes**

- Move into a conversation about the population dynamics and how an organism's success or group size depends on abiotic and biotic factors. Tlingit harvesters designated community members to officially caretake or observe fish population dynamics year to year. Create a group discussion in small groups regarding: Do you think fish populations stay the same year to year? What influences the group size? How would you measure population size? Students write a math equation that represents population size, births, and deaths. (Correct answer:  $\text{Population} = \text{Fecundity} - \text{Mortality}$ ).
- Choose a Pacific salmon species relevant to your region (should match the conservation/management plan from previous lesson). The status of Chinook is precarious presently for many factors, some known and some unknown, and might be appropriate for many regions across Southeast. They have been threatened by over harvest, and populations damaged by dams, climate change, and habitat degradation.

### **Step 3) Building Background Knowledge: 60 minutes**

*\*Full detailed lesson in [Alaska Native Science: A Curriculum Guide](#) (page 27)*

- Give presentation on salmon life cycles and habitat (not included).
- Clan ownership of water systems can be compared to CDQs (Community Development Quotas) or IFQs (Individual Fishing Quotas). "Rituals and legends often dictated clan members' actions." For example, "salmon rituals include showing respect to the first salmon coming up the river...It is told the salmon spirits would tell their fellow salmon that they were treated well and that the other salmon should come up river and give themselves to the people." Today, contemporary management refers to this tool as escapement. The salmon returning to an area is called recruitment.
- Tlingits studied the return of anadromous fish very carefully as they knew the fish populations year after year and understood the local landscape ecology.
- Fisheries managers today have a more difficult time estimating total stock abundance throughout Southeast Alaska. Next, the class will create a model/run a simulation of predicting with uncertainty (pg. 47 of [Alaska Native Science](#)).
- In small groups, pass out paper bags with a known, but secret amount of beans. Students shouldn't know how many of each color are in the bags, and each group can be a little different (Group A: 20 green and 80 brown, Group B: 25 green, 75 brown, etc)
- Each group should write down a hypothesis of how many green beans out of every 10 they will draw. Test the hypothesis by blindfolding one member of the group and having them draw 10 balls and the group should record the results (student page: Uncertainty Results table) to test if the hypothesis held true. Repeat experiment 4 more times and find the average amount of green balls.
- Students can rewrite their hypothesis and repeat the experiment 5 times to compare the two averages.

### **Homework: Generating conclusions**

- Students should respond to the following statements in their science journal:
- Without the teacher knowing the correct amount, is it possible to ever know if their estimate is correct? Discuss how this relates to the challenges fishery biologists face in every ocean/river/or pond.

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## Lesson 5

### Salmon Boy

#### Purpose

To investigate the relationship between the environment and people; to use literary analysis when reading Tlingit oral narratives and academic journals; to introduce students to primary resource analysis and interpretation regarding the interconnectedness of the world demonstrated by food webs; to develop the skill of gathering information from multiple resources; to assess and build background knowledge of traditional ecological knowledge; to increase listening, reading, and writing fluency.

#### Essential Questions

- How is an ecosystem weaved together like a Chilkat blanket?
- How are producers and consumers connected?
- How is science communicated?

#### Duration

60-120 minutes (2-75 minute sessions)

#### Lesson Objectives: Connecting to the Standards

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| SE1.1 Research how social, economic, and political forces strongly influence which technology will be developed |
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| SA1.2 Students recognize and analyze multiple explanations and models, use information to revise student's own explanation or model if necessary |
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|---|
| SF1.1-SF3.1 Investigate the influences of societal and or cultural beliefs on science |
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| R4.2 Summarize information or ideas from a text and make connections between summarized information or sets of ideas and related topics or information |
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| B.4 Identify appropriate forms of technology and their use for improving community |
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| E.2 Understand the ecology and geography of the bioregion they inhabit |
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#### Academic Vocabulary

- water quality
- dissolved oxygen
- pH
- fishing gear
- fermentation

#### Materials

- Copy of *Salmon Boy-Moldy Ends*
- Storyboard
- Free Response Prompt
- Presentation on salmon species lifecycle and habitat (not included)

- 
- Tlingit Gear & Technology PowerPoint (included)
  - Excerpts from “Traditional Ecological Knowledge of Tlingit People Concerning the Sockeye Salmon Fishery of the Dry Bay Area” (full version at [https://www.academia.edu/948885/Traditional Ecological Knowledge of Tlingit People Concerning the Sockeye Salmon Fishery of the Dry Bay Area](https://www.academia.edu/948885/Traditional_Ecological_Knowledge_of_Tlingit_People_Concerning_the_Sockeye_Salmon_Fishery_of_the_Dry_Bay_Area))

### **Suggested Guests & Field Experience**

- Dr. Rick Edwards of US Forest Service PNW Lab; Lead Stream Ecology Scientist
- Visit the new US Forest Service Héen Latinee Experimental Forest with Dr. Rick Edwards and a GHF cultural specialist to test for stream quality, rock size, and forest types that affect Pacific salmon species of study in addition to the affects of the carbon cycle and climate change
- Cultural Specialists of GHF to speak to fishing gear, Tlingit & Haida canoes, and food preservation
- Henry Hopkins of JSD and Helen Watkins (contract through GHF) to speak to canoe design, fishing gear, and food preservation

### **Literacy Strategies**

- Quick-write
- Mark the Text
- Oral Reading
- Note-taking
- Debriefing

### **Assessments**

- Assessment: Free Response Prompt
- Assessment: Article summary

### **Procedure**

#### **Step 1) Introducing Content: 30 minutes**

- Begin class with a group discussion reflecting on the main themes presented in the model. Explain that there are many factors influencing salmon recruitment and escapement. To examine the overlap between Tlingit salmon rituals and resource management, hand out copies of *Salmon Boy-Moldy Ends*.
- Students should mark-the-text and annotate as they read. Students should think-pair-share the main concepts of the story. Afterwards, they should use the storyboard template to draw and sketch the main components of the oral narrative. In their science journals, students should summarize the parallels of historical and contemporary management conveyed in the story.

#### **Step 2) Assessing Background Knowledge: 45-60 minutes**

Explain:

- Explain that ecology is a concept that has always been understood by cultures over time. Navigation, fishing technology, trade, and food preparation all require a deep exploration of ecosystems and the activities that potentially cause changes to surroundings.

Assess:

- 
- Present students the Free Response Prompt that is a modified version of questions used on the AP Environmental Science exam each year. Students should complete the free response (*to be collected*).

**Step 3) Building Background Knowledge: 30 minutes**

- Introduce the standard “SE1.1 Research how social, economic, and political forces strongly influence which technology will be developed”
- Visit the Héen Latinee Experimental Forest, the Mendenhall River, Montana River, or the confluence of both to conduct water quality sampling, rock size pebble counts, and forest type surveys.
- Technology, in turn, can have potential for great impacts intellectually, socially, for health and wellness, and on the environment. Explain that students will be examining some of the forms of technology designed by Tlingit ingenuity that affects the fishing technology seen in the world today.
- Show “Tlingit Fishing Gear & Food Preservation” PowerPoint and have students take notes. Have guest speakers present on the topics of Tlingit and Haida canoes, fish gear, fermentation, food preparation, and navigation if possible.

*Homework:*

- Pass out excerpts from “Traditional Ecological Knowledge of Tlingit People Concerning the Sockeye Salmon Fishery of the Dry Bay Area” (full version at [https://www.academia.edu/948885/Traditional Ecological Knowledge of Tlingit People Concerning the Sockeye Salmon Fishery of the Dry Bay Area](https://www.academia.edu/948885/Traditional_Ecological_Knowledge_of_Tlingit_People_Concerning_the_Sockeye_Salmon_Fishery_of_the_Dry_Bay_Area))
- Students should read, mark the text, annotate, reread if necessary, and paraphrase in their science journals to answer the question, “what is the relationship between traditional ecological knowledge, current research, and future fisheries policies?”

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## Lesson 6

### *Traditional Ecological Knowledge in Research*

#### **Purpose**

To develop the skill of gathering information from multiple resources; to assess and build background knowledge of traditional ecological knowledge; to combine previous knowledge into preparation for culminating activity; to introduce students to primary resource analysis and interpretation; to increase listening, reading, and writing fluency.

#### **Essential Questions**

- How do we monitor the health of an ecosystem?
- What insights can elders share about our local resources?

#### **Duration**

150-225 minutes (2-3 75 minute sessions)

#### **Lesson Objectives: Connecting to the Standards**

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|--|
| SA1.1 Students ask questions, predict, observe, describe, measure, classify, make generalizations, analyze data, develop models, infer, and communicate    |
| SA3.1 Conducts research and communicates results to solve a problem  |
| SF1.1-SF3.1 Investigate the influences of societal and or cultural beliefs on science  |
| R4.2 Summarize information or ideas from a text and make connections between summarized information or sets of ideas and related topics or information     |
| B.4 Identify appropriate forms of technology and their use for improving community   |
| D.3 Interact with Elders in a loving and respectful way that demonstrates and appreciation of their role as culture-bearers and educators in the community |
| E.2 Understand the ecology and geography of the bioregion they inhabit   |

#### **Academic Vocabulary**

- Geographical Information System (GIS)

#### **Materials**

- Computer lab for GIS work (Explore ADF&G's Anadromous Waters Catalog: <http://extra.sf.adfg.state.ak.us/FishResourceMonitor/?mode=awc>)
- Computer lab for exploring outreach and education materials from fishing regulation agencies
- Computer lab for conducting group research on species-specific co-management plan
- Interview templates

#### **Suggested Guests**

- Cultural Specialist of GHF to discuss traditional and customary harvest
- Subsistence fishermen, hunter, and/or harvester

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## Literacy Strategies

- Conduct an interview
- Note-taking
- Work backwards
- Quick-write
- Graphic Representation

## Assessments

- Pre-assessment: Article summary
- Assessment: Completed interview
- Assessment: Anadromous waters catalog
- Assessment: Final Project Preparation

## Procedure

### ***Step 1) Introducing Content: 30 minutes***

- Students should think-pair-share about the article excerpts from the day before.

### ***Step 2) Assessing Background Knowledge: 45-60 minutes***

Explain:

- Explain that Tlingit, Haida, and Tsmishian lived throughout Southeast Alaska due to their comprehensive understanding of coastal ecology, geology, and oceanography.
- As a short term project, students will need to conduct an interview with a local community member (Native or non-Native) about their hunting, fishing, or harvesting practices.
- Introduce the concept of Geographical Information Systems (GIS). GIS is defined to: “integrate hardware, software, and data for capturing, managing, analyzing, and displaying all forms of geographically reference information. GIS allows us to view, understand, question, interpret, and visualize data in many ways that reveal relationships, patterns, and trends in the form of maps, globes, reports, and charts. A GIS helps you answer questions and solve problems by looking at your data in a way that is quickly understood and easily shared.”

Assess:

- Students should work individually to explore the GIS map of the Anadromous Waters of Southeast Alaska at <http://extra.sf.adfg.state.ak.us/FishResourceMonitor/?mode=awc>. Layers to turn on and off include:
  - Fish type
  - Fish passage
  - Life cycles of fish by species type (spawning and rearing)
  - 2009 aerials
  - Topographic lines
- Allow students to explore the coastlines of Aak’w Kwaan and Taak’u Kwaan for their species type.

### ***Step 3) Building Background Knowledge: 30 minutes***

- Use the book Haa Léelk’w Hás Aaní Saax’ú: Our Grandparents’ Names on the Land. Edited by Thomas F. Thornton. 2012. to have students research certain sites of interest

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of their species found in the catalog to look for evidence in Tlingit place names and history.

- Students should prepare their final presentation slides for a class slideshow on their proposed co-management plan. They should explore current education and outreach materials to aid in the design of their co-management visuals. Students should ask themselves what works well in agency outreach and education, and what areas could improve, especially when reaching across cultures.
- If students are focusing on a different species than the one studied throughout this unit, students should conduct their own research as to the current conservation and management plans and the challenges faced with current management.
- Teacher can prepare for final presentation event:
  - Have students sign thank you cards for guest speakers
  - Make sure all groups complete their visual slides and narration
  - Secure a venue for culminating activity
  - Invite elders, cultural specialists, and extended family members to come to the event
  - Assign students to prepare and bring traditional food and drinks for the events
  - Run a dress rehearsal with the students so they have a chance to practice presenting their work to a larger audience

### **Short-Term Project: *Generating Questions***

- *Homework:* Students should use the interview template to conduct a local interview with a family member or community member to gather information about hunting, fishing, or harvesting practices, especially related to their co-management plan. Explain that harvesting techniques and abundance is a very sensitive issue. Elders may also not be comfortable with the word resource since it implies living things are commodities. Students should approach this assignment with sensitivity and care.

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## Lesson 7

### Sharing our Ideas

#### **Purpose**

To combine previous knowledge into preparation for culminating activity; to assess student understanding and ability to communicate knowledge; to assess and build background knowledge of traditional ecological knowledge; to increase listening, reading, and writing fluency.

#### **Essential Questions**

- How should local knowledge influence future policies?

#### **Duration**

60-90 minutes

#### **Lesson Objectives: Connecting to the Standards**

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|--|
| SA1.1 Students ask questions, predict, observe, describe, measure, classify, make generalizations, analyze data, develop models, infer, and communicate    |
| SA3.1 Conducts research and communicates results to solve a problem  |
| SF1.1-SF3.1 Investigate the influences of societal and or cultural beliefs on science  |
| R2.9 a. Differentiate between fact and opinion. b. Express opinions about text with support  |
| B.4 Identify appropriate forms of technology and their use for improving community   |
| A.2 Students will recount their own genealogy and family history   |
| D.3 Interact with Elders in a loving and respectful way that demonstrates and appreciation of their role as culture-bearers and educators in the community |
| E.2 Understand the ecology and geography of the bioregion they inhabit   |

#### **Materials**

- Completed Final Presentation Visuals
- Traditional food and drinks for guests to share
- Electronic equipment to present students' work
- Microphone and sound system
- Elders, cultural specialists, and extended family members

#### **Literacy Strategies**

- Generating Questions
- Rehearsal
- Oral Reading
- Group Presentations

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## **Assessments**

- Final Project Presentations (willingness to share and demonstrate respectful listening skills)

## **Procedure**

### ***Step 1) Preparation for Event***

- Gather presentation materials
- Arrange traditional snacks and drinks for guests
- Assign students to usher guests in and help seat and serve elders

### ***Step 2) Culminating Event***

- Two students (preferably an Eagle and a Raven) introduce themselves to the group, thank the elders, cultural specialists, and panel members for helping them during the unit, thank people for coming, and invite people to have something to eat while they share their work. Show respect for Aak'w Kwaan and Taak'u Kwaan before the presentations begin.
- Students share the final presentation and show reverence to *Eagle Boy and Salmon Boy-Moldy End* oral narratives and their respective clans.
- Students present thank you cards to guest speakers. Guests can respond to the student presentations.
- Teacher thanks the students for all their hard work and thanks the audience for their support. Teacher encourages students to help clean up and usher elders to their transportation.