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# HAA ATXAAYÍ (OUR WAY OF LIFE): INVESTIGATING HARVEST ECOLOGY

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A Science and Literacy Unit for Middle School



S'áxt' (Devil's Club) photo taken by JDHS student, Cheyenne Hinckley 2012.

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# Investigating Harvest Ecology

*A Science and Literacy Unit for Middle School*

## Unit Overview

Over the course of this ecological literacy unit, students will practice science methodologies, mathematical concepts, reading, writing, listening, and oral language strategies while developing understanding for Tlingit oral narratives and our local surroundings. This multi-week unit is based upon the oral narrative *Eagle Boy*. This story explains how harvesting knowledge was considered a privilege and required a deep respect and intimate connection with the natural world. Students will have the opportunity to engage in field experience and group projects focused on art, nutrition and wellness, medicine, and traditional ecological knowledge that will bring clarity and understanding of today's relevant message of the need for stewardship conveyed through one Tlingit oral narrative.

## 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 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.*

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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 (fact versus opinion) 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 continuing 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 *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 & 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 visual presentation on resource of their choice (eulachon, salmon, berries, labrador tea, seal, or deer). Students will have roles as caretakers of knowledge (river watcher-resource ecologist, story teller-how is science communicated, harvester-phenology, protocol, and technology of harvest, and a healer-medicinal, nutritional, and cultural benefits of harvest.
- Present visuals and plans to elders, cultural specialists, community professionals, and extended family members and offer them local food to thank them for their support.

### Supplemental Materials & Suggested Texts

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

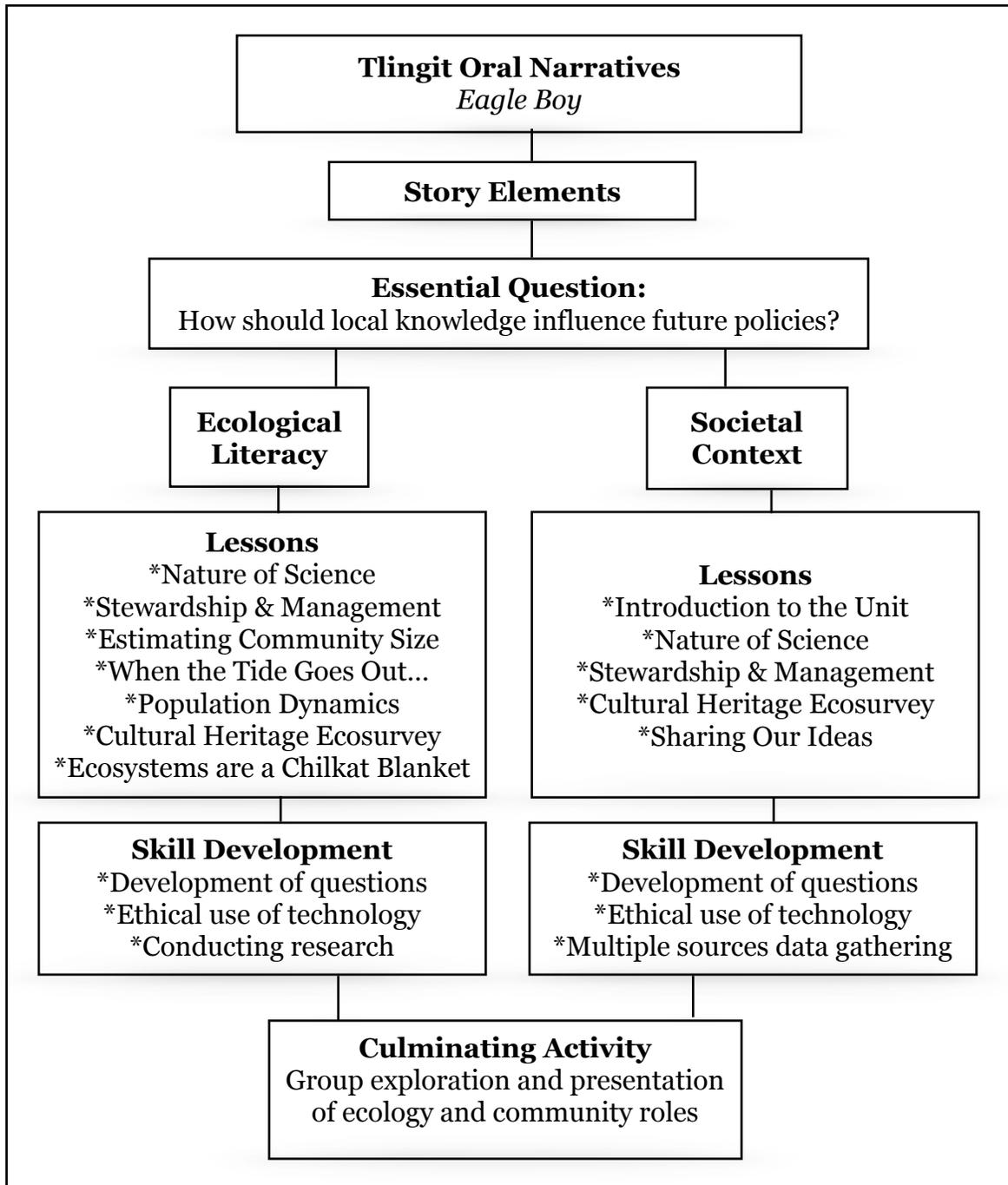
- Haa Shuká, Our Ancestors: Tlingit Oral Narratives. Nora Marks Dauenhauer and Richard Dauenhauer. 1987. Volume 1.
- Haa Atxaayí Haa Kusteeyíx Sitee, Our Food is Our Tlingit Way of Life. Excerpts from Oral Interviews. Richard G. Newton and Madonna L. Moss. USDA 3rd Edition.
- Alaska Native Science: A 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)
- SpringBoard Mathematics with Meaning: Middle School 3. Collegeboard 2010

## 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.

	<b>Nailed It! 9-10 points</b>	<b>Alright! 7-8 points</b>	<b>Getting There 4-6 points</b>	<b>Needs work 1-3 points</b>
<b>Local Knowledge</b> (Combo of western science and Tlingit science) ____/10 pts	<ul style="list-style-type: none"> <li>Scientific, Tlingit, &amp; Common name provided</li> <li>Descriptive explanations</li> <li>Content is detailed</li> <li>Use of data, graphs, titles, &amp; labels in product</li> <li>Information from multiple sources</li> </ul>	<ul style="list-style-type: none"> <li>Only 2 out of 3 names provided</li> <li>All basic project info: Background, Methods, Results, Conclusion</li> <li>Shows all four subjects (food, science, medicine, and art)</li> </ul>	<ul style="list-style-type: none"> <li>Only one name provided</li> <li>Missing components of project information</li> <li>3 out of 4 subjects represented well</li> </ul>	<ul style="list-style-type: none"> <li>Resource not labeled</li> <li>Missing more than one piece of project</li> <li>1 or 2 of subjects represented well</li> </ul>
<b>Display</b> (Verbal & Visual) ____/10 pts	<ul style="list-style-type: none"> <li>Information is typed and has no spelling or grammatical errors</li> <li>Display is creative &amp; effective</li> <li>Visuals support data &amp; information given</li> </ul>	<ul style="list-style-type: none"> <li>Product is neat, aligned, and easy to follow</li> <li>2 different types of visuals (pic, graph, data table)</li> <li>Limited spelling errors</li> </ul>	<ul style="list-style-type: none"> <li>Product is neat, but not easy to follow</li> <li>1 type of visual provided</li> <li>Some info is written messily</li> <li>Multiple spelling errors</li> </ul>	<ul style="list-style-type: none"> <li>Product could use more support and detail for audience to follow</li> <li>No visuals</li> <li>Information is unreadable</li> </ul>
<b>Community Roles</b> (How does everything connect?) ____/10 pts	<ul style="list-style-type: none"> <li>There is a clear link between the resource as food, science, art, and medicine</li> <li>Multiple cultural perspectives are represented</li> <li>Individual member roles were united</li> </ul>	<ul style="list-style-type: none"> <li>Food, science, art, and medicine are presented but as individual subjects with weak connection</li> <li>At least two cultural perspectives</li> <li>Roles were separate, but strong</li> </ul>	<ul style="list-style-type: none"> <li>Food, science, art, and medicine show no connection</li> <li>Only one perspective presented</li> <li>Community roles are divided</li> </ul>	<ul style="list-style-type: none"> <li>Food, science, art, and medicine are not addressed</li> <li>Facts are presented without perspective</li> <li>Community roles are missing</li> </ul>
<b>H.O.W.</b> (Habits of Work) ____/10 pts	<ul style="list-style-type: none"> <li>Student cooperated and helped others</li> <li>Student practiced and prepared presentation</li> <li>Student always cleaned-up</li> <li>Student contributed fairly &amp; completed evaluation</li> </ul>	<ul style="list-style-type: none"> <li>Student encouraged others to work well</li> <li>Student spoke in clear voice</li> <li>Student needed reminders to clean-up often</li> <li>Student contributed &amp; did evaluation</li> </ul>	<ul style="list-style-type: none"> <li>Student behaviors were distracting to group</li> <li>Student presentation is complete, but unprepared</li> <li>Incomplete self-evaluation</li> </ul>	<ul style="list-style-type: none"> <li>Student behaviors were disruptive to group</li> <li>Student presentation is incomplete</li> <li>Student did not complete self-evaluation</li> </ul>
<b>Total</b> ____/40 pts	<b>Comments:</b>			

Overview of Lessons	Literacy Strategies	Academic Vocabulary	Assessments
<p><b>Lesson 1: Introduction to Unit</b>  <i>Science is a Process (1 session)</i>            Students are introduced to different ways of learning, respectful protocol, and unit expectations. Student knowledge of Alaska’s ecology and local culture is assessed and activated through class discussions and journal prompts.</p> <ul style="list-style-type: none"> <li>• Student Page: Vocabulary foldable templates (3)</li> <li>• Student Page: Final project rubric</li> <li>• Student Page: Ecology project outline</li> </ul>	<ul style="list-style-type: none"> <li>• guided writing</li> <li>• think-pair-share</li> <li>• graphic representation</li> <li>• group discussion</li> </ul>	<ul style="list-style-type: none"> <li>• protocol</li> <li>• community</li> <li>• respect</li> <li>• roles</li> <li>• responsibility</li> </ul>	<ul style="list-style-type: none"> <li>• journal prompt</li> <li>• check for understanding</li> </ul>
<p><b>Lesson 2: Nature of Science</b>  <i>Science is a Process (1-2 sessions)</i>            Students explore the convergence of western and traditional science through guided reading, discussion, reflection writing, and the creation of a graphic representation of abstract concepts.</p> <ul style="list-style-type: none"> <li>• Student Page: “Ways of Knowing” article</li> <li>• Student Page: Venn diagram template</li> </ul>	<ul style="list-style-type: none"> <li>• note-taking</li> <li>• quick-write</li> <li>• think-pair-share</li> <li>• mark the text</li> <li>• annotations</li> <li>• graphic representation</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>• partner discussions</li> <li>• venn diagram</li> </ul>
<p><b>Lesson 3: Stewardship &amp; Management</b>  <i>Science is a Process (1-2 session)</i>            Students practice gathering information from multiple sources as they explore historical and contemporary fish and wildlife policies.</p> <ul style="list-style-type: none"> <li>• Student Page: What is an oral narrative?</li> <li>• Student Page: Aak’w Kwaan/Taak’u Kwaan Map</li> <li>• Student Page: <i>Eagle Boy</i> &amp; Storyboard</li> <li>• Student Page: Stewardship/Management Table</li> </ul>	<ul style="list-style-type: none"> <li>• peer review</li> <li>• group discussion</li> <li>• adding details</li> <li>• note-taking</li> <li>• oral reading</li> <li>• marking the text</li> <li>• rereading</li> </ul>	<ul style="list-style-type: none"> <li>• oral narrative</li> <li>• cultural context</li> <li>• resources</li> <li>• regulations</li> <li>• enforcement</li> <li>• management</li> <li>• stewardship</li> </ul>	<ul style="list-style-type: none"> <li>• peer review of venn diagrams</li> <li>• oral narrative worksheet</li> <li>• storyboard creation</li> <li>• completing a table</li> </ul>
<p><b>Lesson 4: Estimating Community Size</b>  <i>Humans alter natural processes</i>            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 with 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>• hypothesis</li> <li>• abiotic</li> <li>• biotic</li> <li>• abundance</li> <li>• stock status</li> <li>• escapement</li> <li>• recruitment</li> </ul>	<ul style="list-style-type: none"> <li>• Table</li> </ul>
<p><b>Lesson 5: “When the tide goes out, the table is set”</b>  <i>The Earth is one interconnected system</i>            Students are introduced to ecosystem dynamics by running a simulation of the local predator-prey relationship of herring, salmon, and humans. Students unpack embedded assessment.</p> <ul style="list-style-type: none"> <li>• Student Page: Ecosystems relationships</li> <li>• Student Page: Predator-prey data worksheet</li> </ul>	<ul style="list-style-type: none"> <li>• note-taking</li> <li>• model</li> <li>• generating questions</li> <li>• discussion group</li> <li>• debriefing</li> <li>• graphic representation</li> </ul>	<ul style="list-style-type: none"> <li>• ecosystem</li> <li>• relationships</li> <li>• predator</li> <li>• prey</li> </ul>	<ul style="list-style-type: none"> <li>• peer review of tables</li> <li>• group discussion</li> <li>• ecosystem dynamics worksheet</li> <li>• participation</li> <li>• data collection</li> </ul>

<p><b>Lesson 6: Population Dynamics</b>  <i>Humans influence natural processes</i>  Students explore the data they collected in more detail to understand population dynamics. Students demonstrate understanding through an embedded assessment.</p> <ul style="list-style-type: none"> <li>• Student Page: Population dynamics assessment</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>• population dynamics</li> <li>• limiting factors</li> <li>• carrying capacity</li> </ul>	<ul style="list-style-type: none"> <li>• peer review</li> <li>• predator-prey graph</li> <li>• formal assessment</li> </ul>
<p><b>Lesson 7: Cultural Heritage Ecosurvey</b>  <i>Science is a process</i>  Students will participate in a local field study experience to observe cultural heritage species and local biology.</p> <ul style="list-style-type: none"> <li>• Student Page: Ecological survey template</li> </ul>	<ul style="list-style-type: none"> <li>• model</li> <li>• peer review</li> <li>• quick-write</li> <li>• graphic representation</li> </ul>	<ul style="list-style-type: none"> <li>• ecological survey</li> <li>• bioblitz</li> <li>• cultural heritage species</li> </ul>	<ul style="list-style-type: none"> <li>• quick-write</li> <li>• participation in survey</li> <li>• food chain visual</li> </ul>
<p><b>Lesson 8: Ecosystems are like Chilkat Blankets</b>  <i>The Earth is one interconnected system</i>  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: Ecology free response quiz</li> <li>• Student Page: Which Niche?</li> <li>• Student Page: Interview Template</li> </ul>	<ul style="list-style-type: none"> <li>• peer review</li> <li>• note-taking</li> <li>• guided writing</li> <li>• conducting an interview</li> </ul>	<ul style="list-style-type: none"> <li>• photosynthesis</li> <li>• cellular respiration</li> <li>• primary producers</li> <li>• consumers</li> <li>• energy transfer</li> <li>• biome</li> <li>• local knowledge</li> <li>• niche</li> </ul>	<ul style="list-style-type: none"> <li>• free response quiz</li> <li>• table</li> <li>• local interview (short-term project)</li> </ul>
<p><b>Lesson 7: Sharing Our Ideas</b>  <i>Science is a Process</i>  <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

### “Introduction to Unit Expectations”

#### **Purpose**

To unpack the culminating activity for the unit; to activate and assess academic vocabulary; 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**

- What are the ways we learn?

#### **Duration**

50 minutes

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

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
R4.2 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.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

#### **Learning Targets**

- I can define protocol, community, and respect.
- I can collaborate with others to identify the protocol that we’ll adhere to while learning together.
- I understand the final project, the rubric, and group expectations.

#### **Academic Vocabulary**

- protocol
- community
- respect
- roles and responsibilities

#### **Materials**

- Student composition notebooks
- Vocabulary foldable
- Final project rubric
- Ecology project outline

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## Suggested Guests

- Cultural Specialist of GHF to discuss clan proprietorship, protection of waterways, and community roles and responsibilities.

## Assessments & Student Pages

- Pre-assessment: *What you think you know.*
- Check for understanding: *Verbal participation and/or active listening. Vocabulary foldable.*

## Procedure

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

- Gather necessary supplies.
- Write down learning targets on the board.
- Welcome students and ask them to write down their learning target in their science composition notebooks. Explain to students that we're going to be examining local ecology and traditional and contemporary methods of harvest.

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

Explain:

- This unit will be an exploration of two cultures living side by side that oftentimes have great overlap, but also have fundamental differences.

Assess:

- Ask students to use their journals to write down what they think they know about Alaska (landscape, resources, and culture). Students should share their responses with an elbow partner. As a class, create a "what we think we know about Alaska" chart to display and add to as the unit progresses.

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

*Vocabulary:*

- Introduce new vocabulary that will help create the foundation of behavior expectations for the unit. Teach students to make a vocabulary foldable by folding a blank piece of paper along the center vertical line. Open paper and cut along the perforated lines to form flashcards. Glue foldable into their science notebook. Repeat three times for all three vocabulary foldable student pages. Fold left column flaps over the top of the right column.
- Define **respect, protocol, community, and roles/responsibilities** for students to add to their foldable (vocab word on top flap, illustration on back of top flap, definition in right column).

*Unit expectations:*

- 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.
- They will be working in small groups of four students to create a visual representing what they have learned about Southeast Alaska's local ecology. Each group will pick a plant or animal to focus on for their presentation. The following animals and plants will be covered in the unit: herring, salmon, berries, labrador tea, seal, or deer (for differentiation, animals and plants not studied can be picked but will require more independent research).

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- Every student will have a community role to be responsible for in the sharing out of their presentation. Students can pick from the following roles based on their strengths and interests:
    - River Watcher-Student responsible for sharing out the ecological conditions (biology, geology, oceanography, climate, and overall ecology) that influences their chosen plant or animal.
    - Harvester-Student responsible for understanding the conditions needed for humans to harvest this plant or animal. The corresponding phenology, tools, technology, and cultural protocols of harvesting should be clearly expressed.
    - Healer-Student responsible for sharing out the “why do we harvest this plant or animal?” This includes the nutritional, medicinal, and cultural benefits of this plant or animal.
    - Story Teller-Student responsible for communicating scientific knowledge (art, songs, poems, or dance)
  - Pass out final rubric expectations and review as a class.

*Homework: Reading for Information & Graphic Representation*

- *Homework:* Students should use their science journal to reflect on the learning targets and how their behavior can adhere to the expectations of respect and protocol.

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## *Lesson 2*

### *Nature of Science*

#### **Purpose**

To introduce students to primary resource analysis and interpretation regarding the nature of science; to activate knowledge of Tlingit and western science similarities and differences; 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**

50 minutes (1-2 sessions)

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

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
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#### **Learning Targets**

- I can explain marking the text, annotations, and the importance of rereading materials.
- I can define western science and identify ways to gather information.
- I can define Tlingit science and identify ways to gather information.
- I can create a graphic representation of the two methodologies to identify similarities and differences.

#### **Academic Vocabulary**

- Traditional ecological knowledge
- Western science
- Methodologies
- Empiricism
- Scientific method

#### **Materials**

- Student composition notebooks
- “Ways of knowing” article: <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1479546/>
- Venn Diagram template

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## 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

## Assessments

- Pre-assessment journal response: *What is science?*
- Check for student understanding: *Think-Pair-Share*; *Class list of science methodology factors*
- Assessment: *Creating a Venn Diagram*

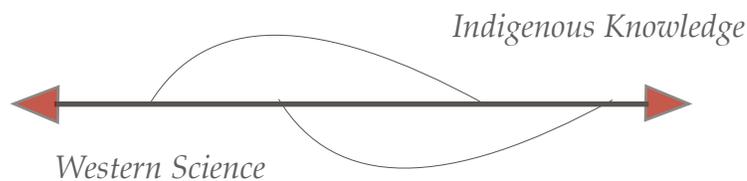
## Procedure

### Step 1) Introducing Content: 15 minutes

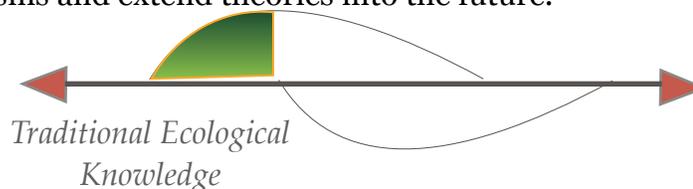
- Gather necessary supplies.
- Write down learning targets on the board.
- Welcome students and ask them to write down their learning target in their science composition notebooks. Explain to students that this unit that will challenge the way they approach science and the way they interpret the world 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. Students should add new vocabulary to their foldable.
- 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.



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- 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 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: 15 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 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: 20 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:** Students will reread the “Ways of Knowing” article 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.
- **Graphic Representation:** Students will need to create a Venn Diagram (*to be collected*) of western and Tlingit science to visualize the ways they overlap and the differences in the two methodologies.

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## Lesson 3

### 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

50 minutes (1-2 sessions)

#### Lesson Objectives: Connecting to the Standards

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

#### Learning Targets

- I can offer respectful peer review of materials.
- I can define management and stewardship.
- I can demonstrate respectful listening skills and ask our guest speaker thought provoking questions about a person's relationship with the land.

#### Academic Vocabulary

- oral narrative
- cultural context
- resources
- regulations
- enforcement
- management
- stewardship

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## Materials

- Student composition notebooks
- “What is an oral narrative” worksheet
- Aak’w Kwáan and Taak’u Kwáan Map
- Copy of *Eagle Boy* oral narrative
- *Eagle Boy* Storyboard
- Presentation by ADF&G or teacher on current fish & wildlife policy (not included)
- Water and comfortable seat for guest if applicable
- Stewardship & Management table

## Suggested Guests

- Cultural Specialist of GHF 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, USFW, or NMFS representative to discuss how permits and regulations are turned into legislation and the process of science that determines permit numbers each year

## Assessments & Student Pages

- Pre-assessment: Peer review and share out of venn diagrams (homework from lesson #1)
- Assessment: Following respect protocols and participation (active listening or contributions)
- Assessment: *What is an oral narrative?*
- Assessment: *Eagle Boy* Story Board
- Assessment: *Creating a stewardship & management table (compare and contrast historical and contemporary policies)*

## Procedure

### **Step 1) Introducing Content: 10 minutes**

- Gather necessary supplies.
- Write down learning targets on the board.
- Welcome students and ask them to write down their learning target in their science composition notebooks. Explain to students that we’re going to be examining historical stewardship and current management of the plants and animals many people refer to as resources.
- Students will be sharing their venn diagrams with a partner for peer review. 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 venn diagrams 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:

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*“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 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:

- As a class, draw a venn diagram to display throughout the unit. Students can add details to their own versions as they go.

### **Step 3) Building Background Knowledge: 20 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.
- 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, one Tlingit oral narrative will accompany the science lessons to better understand the ecology and natural history of Alaska to help answer the unit's essential question, "*what ecological conditions support life in Southeast Alaska?*"
  - 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 oral narrative and interactions with Tlingit elders and knowledge bearers will be presented throughout the unit. The oral narrative that will accompany this unit is a story about a humans saved by the Eagle Kwáan who in turn becomes a part of the animal community as he learns from their skilled ways. *Eagle Boy* speaks of true stewardship practices in Southeast Alaska and presents a clear comparison of historical and contemporary fisheries policy.
- Pass out copy of *Eagle Boy* and have the class read aloud together or in partners (if cultural specialist cannot come in to tell the story). Encourage students to mark-the-text and to annotate. Be sure to acknowledge the Wooshkeetaan clan and show students on the Aak'w Kwáan and Taak'u Kwáan map so they understand local geography.
- Students should create a story board for *Eagle Boy*, chunking the text into 6 main events that they can illustrate as a cartoon on the page provided. Within each box there is space for a 1-2 sentence summary of the event.
- 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:

*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 he young boy's attempt to provide for his aging*

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*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.*

Explain:

- Have a guest speaker from ADF&G to come in to discuss the process of fisheries policy and legislation or present the process to the students for better understanding of current management practices. Be sure to address components of current management such as permits, regulations, monitoring, enforcement, fines, and consequences.

*Homework: Reading for Information & Graphic Representation*

- *Homework:* Students to reread *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 4

### Estimating Community Size

#### 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 animals and plants within a habitat?
- What are the challenges of fishery management?

#### Duration

50 minutes (1-2 sessions)

#### Lesson Objectives: Connecting to the Standards

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

#### Learning Targets

- I can identify challenges in fisheries policy.
- I can use the scientific method to make predictions and test my hypothesis.
- I can model a fishery management technique of predicting with uncertainty.

#### Academic Vocabulary

- hypothesis
- abiotic
- biotic
- habitat
- abundance
- recruitment
- escapement
- stock status

#### Materials

- Presentation on salmon life cycles and habitat (not included).

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- 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
  - Copy of *Eagle Boy*
  - 8 lunch size paper bags with top half cut off
  - 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

### **Assessments**

- Assessment: Stewardship/Management table
- Assessment: Predicting with uncertainty data table

### **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**

- Gather necessary supplies.
- Write down learning targets on the board.
- Welcome students and ask them to write down their learning target in their science composition notebooks. Explain to students that we're going to be examining historical stewardship and current management of the plants and animals many people refer to as resources.
- Students should peer review their stewardship/management tables. As a class, generate a list of things stewards and managers need to know 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?

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

- Present students information about Pacific salmon life cycles and habitats. Help students to classify out abiotic and biotic factors. Create class posters of the **abiotic** and **biotic** ecological conditions that affect Pacific Salmon. The living things that support herring populations are known as biotic factors. The non-living (\*this could be a discussion point about reductionism, Tlingits believe everything has a spirit so would not necessarily refer to substrates as non-living) are abiotic factors. 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.
- 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.
- 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: 20 minutes***

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

- 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:

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- 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

### *“When the tide goes out, the table is set”*

#### **Purpose**

To introduce students to ecological terms, factors, and conditions; to simulate a local predator-prey relationship; 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 abiotic and biotic factors affect the balance of an ecosystem?

#### **Duration**

50 minutes (2 sessions)

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

SA1.2 Students recognize and analyze multiple explanations and models, use information to revise student’s own explanation or model if necessary
SA3.1 Conducts research and communicates results to solve a problem
R2.9 a. Differentiate between fact and opinion. b. Express opinions about text with support
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

#### **Learning Targets**

- I can participate in a science model and treat it as a tool of learning.
- I can define predator, prey, abiotic, and biotic factors.
- I can identify the key components of a local ecosystem.

#### **Academic Vocabulary**

- ecosystem dynamics
- relationships
- predator
- prey

#### **Materials**

- Student composition notebooks
- Population Dynamics embedded assessment
- Ecosystem relationships worksheet
- Predator-prey data worksheet
- Presentation by Cultural Specialist about clan proprietorship and protection of waterways

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## Suggested Guests

- Cultural Specialist of GHF to speak about clan proprietorship and protection of waterways, animals, and plants
- Cultural Specialist to speak of herring harvest and processing (Edward Hotch of GHF)

## Assessments & Student Pages

- Assessment: Peer review and group discussion of stewardship/management tables
- Pre-Assessment: Ecosystems dynamics worksheet
- Assessment: Data recording and graphing worksheet

## Procedure

### **Step 1) Introducing Content: 10 minutes**

- Gather necessary supplies.
- Write down learning targets on the board.
- Welcome students and ask them to write down their learning target in their science composition notebooks. Explain to students that we're going to be examining historical stewardship and current management of the plants and animals many people refer to as resources.
- Students will be sharing their stewardship/management tables with a partner for peer review. 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 tables for peer revision and group discussion about the new topic of stewardship and current management similarities and differences.

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

- Distribute population dynamics assessment and unpack for student understanding.
- Pass out **ecosystem dynamics** worksheet for students to complete individually in class.
- Explain that herring historically returned to their shallow coastal waters every year in spring time to spawn in bays and estuaries. Tlingit people knew herring had returned when there were early, sunny spring days before small fish began to show up. Whales, sea lions, and eagles would gather in great numbers as herring moved to shallower spawning grounds. Eel grass and other vegetation are preferred for spawning.
- If a cultural specialist or knowledge bearer is available, invite them into class to discuss herring and herring eggs. Tlingits established village sites near protected coves because there was an abundance of life associated with herring and these areas. Herring was an important resource for Tlingits-ask the students why? Create a visual poster for traditional/modern uses of herring and have the students write on it as they go (can be student-led by class or as a summary of Tlingit knowledge bearer).
- In Thomas Thornton's article, "Local & Traditional Knowledge and the Historical Ecology of Pacific Herring in Alaska," he states:  
*"historically recorded and on-going practices show that indigenous people enhance herring production through the cultivation of marinescapes and the regulation of users."*
- The article summarizes that this included habitat conservation, cultivation, selective harvesting, predator control, and transplantation of eggs. Tlingits avoided over harvest by "territoriality and limits on access; time-specific prescriptions and prohibitions on

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interactions with herring; diversifying site; **prey** and substrate choices; and sanctioning of abusive harvesters.” Herring runs also precede the return an important resource for all Alaskans, the return of Chinook salmon.

- Have students quick-write in response to “what is the relationship between Chinook, Herring, and people?”

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

- Explain going outside to simulate a herring return (or run) to natal spawning grounds. Once outside, ask students if they have family from Seet'ká Kwáan (Sitka), Aák'w Kwáan or T'aakú Kwáan (Juneau region) or Sitka region (this should be relevant to all students, Native and non-Native), have them stand on one side as herring. If there's just a couple left standing (maybe students from out of state) let them know they will be returning spring T'á (Chinook)!
- Have one student or the teacher be the recorder and create data table for **generation #**, **Herring population count**, and **T'á population count**. Herring start on one side and have a line across the field that they need to cross to indicate they successfully returned to spawn (about 20 feet away). The T'á can start out mid way on the sidelines and can only take 1 Herring each by tagging-no running needed. If T'á cannot catch a Herring, they die-return to life cycle as nutrients for Herring and so become a Herring again. Run 2 generations. For **generation #3**, turn one Chinook into a Tlingit harvester 300 years ago. The Tlingit fisherman can take 1 T'á and 1 Herring each round to turn into more people. On **generation #5**, inform students there have been some changes in the environment. Half of their spawning ground has been lost to habitat degradation (make playing area narrow and longer-like a funnel) with T'ás at the beginning wide area, and fishermen at neck of funnel. Also let them know, that it's not 500 years ago, it's just 50 years ago, and that there are now Tlingit fishermen as well as Westerners in the area competing for resources. Pick another 2 e Herring to be fishers. The habitat loss was due to a cannery site that was built at along the coast and is now leaking pollutants into the water. Herring are the first to absorb the pollutants that affect their reproduction rates, so eulachon need to hop on one foot to the other side. For **generation #6**, the T'á ate the sick Herring, and the fishermen ate the T'á and the Herring meat, so now everyone is effected-everybody needs to hop on one foot.
- Pass out predator-prey data table to students and record main set of data table on class board for students to copy down.

### *Homework: Reading for Information & Graphic Representation*

- *Homework:* Students will need to graph the herring, Chinook, and human population dynamics at home.

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## Lesson 6

### Population Dynamics

#### Purpose

To introduce students to the cause of changes in population over time; to relate other ecosystems to human behaviors and patterns; 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

- Is there a way to meet the needs of all living beings responsibly?

#### Duration

50 minutes (1 sessions)

#### Lesson Objectives: Connecting to the Standards

SA1.2 Students recognize and analyze multiple explanations and models, use information to revise student's own explanation or model if necessary
SA3.1 Conducts research and communicates results to solve a problem
R2.9 a. Differentiate between fact and opinion. b. Express opinions about text with support
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

#### Learning Targets

- I can understand changes in population over time and identify what causes those changes.
- I can define an ecosystem's carrying capacity.

#### Academic Vocabulary

- habitat
- population dynamics
- limiting factors
- carrying capacity

#### Materials

- Student composition notebooks
- Population dynamics assessment

#### Assessments & Student Pages

- Pre-Assessment: Predator-prey graph
- Assessment: Population dynamics embedded assessment

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## Procedure

### **Step 1) Introducing Content: 10 minutes**

- Gather necessary supplies.
- Write down learning targets on the board.
- Welcome students and ask them to write down their learning target in their science composition notebooks. Explain to students that we're going to be examining population dynamics of ecosystems, both local and global.
- Students will be sharing their predator-prey graph with a partner for peer review. 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 graphs for peer revision and group discussion about the new topic of population dynamics.

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

- Collect the predator-prey graphing worksheet.

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

- As a class, demonstrate graphing the predator-prey data. Illustrate that healthy populations do fluctuate, as long as there is abundant food, water, shelter, and space (components of a **habitat**) living things will flourish. If prey are abundant, then predators will follow. With an increase in predator population, comes a decrease in prey until the predators begin to exhaust a resource.
- Flat lines of population dynamics never occur naturally. Stewards and managers aim to keep populations close to an imaginary line, without huge spikes and drops in any population. This is called the **carrying capacity** of a habitat and currently permits aim to reach a healthy limit. How many members of a population can a habitat hold before any **limiting factors** (food, water, shelter, or space) begin to be stretched too thin. **Population dynamics** refers to the fluctuation of populations over time.
- In partners, students should write a mathematical equation demonstrating population dynamics over time. Their equation should include births, deaths, and total population size.
- Pass out Population dynamics assessment for students to complete in class.

### **Homework: Guided writing**

- In science notebooks, students should respond to “what else besides pollutants could be limiting factors to Herring and Chinook populations (dams-sediment and temperature releases, by-catch, dredging, harbors)?”

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## Lesson 7

### *Cultural Heritage Ecological Survey: BioBlitz*

#### **Purpose**

To participate in a field study experience; to develop the skill of observation and data recording; to create a graphic representation of a food chain; 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?

#### **Duration**

50 minutes (1-2 sessions)

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

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
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

#### **Learning Targets**

- I can conduct a field study of my surroundings by observing and exploring.
- I can understand the importance of cultural heritage species.

#### **Academic Vocabulary**

- ecological survey
- bioblitz
- cultural heritage species

#### **Materials**

- This lesson requires the ability for students to conduct a field study (can be right outside of the school or a field trip). Every year Juneau participates in a National BioBlitz day with many local experts donating their time. The lesson can align with BioBlitz is the schedule allows.
- Cultural heritage species template

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- Field guides
  - A Coyote's Guide to Connecting with Nature. Jon Young, Ellen Haas, Evan McGown 2010. \*Cultural heritage species ecological survey inspired and modified from this book.

### **Suggested Guests**

- Cultural Specialist of GHF to identify cultural heritage species
- Juneau's Pat Harris (lichens) with NOAA; James Ray (fish) & Karen Blejwas (mammals) with US Fish & Wildlife; Mark Schultz (bugs)-retired US Forest Service, have led local BioBlitz sessions

### **Assessments**

- Assessment: Quick-write
- Assessment: Participation in ecological survey
- Assessment: Graphic representation of a food chain

### **Procedure**

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

- Gather necessary supplies.
- Write down learning targets on the board.
- Welcome students and ask them to write down their learning target in their science composition notebooks. Explain to students that they will participate in an ecological survey of their area. In addition, they will be identifying cultural heritage species and their special relationships with people over time.

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

- Many surveys have been done to document ecological health indicators, mammals, birds, freshwater life, and fauna, but modifying the idea to “heritage species” can encompass all life in an ecosystem. In The Coyote Guide to Connecting with Nature, “Heritage Species” is defined as those having the wisdom of our ancestors, they are “living testaments to our irrevocable connection with nature.” In Southeast Alaska, the Tlingit language was born from an extension of an ancient Yup'ik dialect, and was literally inspired and formed by the rich biodiversity of the area. This is significantly different than the English language, formed and modified over centuries in foreign places and superimposed onto our local landscapes.
- Heritage species can include many things from salmon to steelhead, mayfly larvae, cedar trees, ravens and eagles, brown bears, medicinal plants, and invertebrates of the sea, so it might be best for students to define the list as a class-truly creating the experiment they will conduct. It might be helpful to have the school cultural specialist or an elder present to confirm the list, or a survey is included below. A knowledge bearer can help solidify the species “our ancestors have proclaimed to us: These are important to know and to honor (Jon Young et al).” Timing of the activity can be hours or minutes depending on the depth. Local scientists (suggested in the lesson “teacher resources”) can also enhance and lengthen the activity as they provide information about each species as it is related to habitat.
- Students should do a quick-write about what they expect to see when exploring the local forest or coastline. Students should share their responses with a partner. This can aid in the creation of an ecological survey if an ecosystem-specific survey is desired.

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

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- Either create and design the ecological survey or use the one provided. Prepare the students for the survey by breaking into groups and describing their area of transect (would be best if could be multiple places-such as Auke Rec because you have forest, beach fringe, and intertidal, but can be done all in the same ecosystem as well). Review the classification levels and let the students know they will be identifying heritage species further for homework.
  - Allow time for students to observe their surroundings before they begin to conduct the survey. They can take notes about what they hear, see, smell, and feel and should record data such as weather conditions and GPS locations if possible. Hula hoops or 4 cones can be used to indicate survey area.
  - Come back together as a group to create a class species list.

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

- *Homework:* Students should use their science notebooks to reflect on today's ecological survey and the topics of biodiversity, distribution, habitat, biotic & abiotic factors, levels of classification, how they felt the survey went, human impact, and cross-cultural shared heritage species. They should create a graphic representation (can be a triangle) of the local food chain.

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## Lesson 8

### *Ecosystems are like Chilkat Blankets*

#### **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?
- How should local knowledge influence future policies?

#### **Duration**

50 minutes (2-3 sessions)

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

SA1.1 Students ask questions, predict, observe, describe, measure, classify, make generalizations, analyze data, develop models, infer, and communicate
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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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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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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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#### **Learning Targets**

- I can seek out information from my community.
- I can site local knowledge for my research.
- I can show respect by listening and asking thought provoking questions.

#### **Academic Vocabulary**

- photosynthesis
- cellular respiration
- primary producers
- consumers
- energy transfer
- biome
- local knowledge

#### **Materials**

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- Presentation on photosynthesis and cellular respiration play a role in ecosystems (not included)
  - Salmon in the Trees (not included-optional)
  - Free response quiz
  - Interview templates
  - Which Niche table
  - 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.

### **Suggested Guests**

- Cultural Specialist of GHF to talk about Aas Kwaani-the people of the trees and how they support us all
- Cultural Specialist of GHF to discuss traditional and customary harvest of a plant or animal
- SEARHC representative to discuss nutrition and medicinal benefits of plants and animals
- Subsistence fishermen, hunter, and/or harvester

### **Assessments**

- Assessment: Ecosystem free response
- Assessment: Which Niche?
- Assessment: Completed interview

### **Procedure**

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

- Gather necessary supplies.
- Write down learning targets on the board.
- Welcome students and ask them to write down their learning target in their science composition notebooks. Explain to students that we're going to be how everything is connected.

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

- Students should exchange their food chain representations for peer review.
- Present to students about how abiotic and biotic factors include everything within an ecosystem. Tlingits have always understood that everything is connected. Today, concepts in science such as the water cycle, the carbon cycle, and energy transfer demonstrate the fact that there is an interconnectedness that holds everything together like a Chilkat blanket.
- Give students information on energy transfer from primary producers to consumers. Explain the process of photosynthesis cellular respiration.
- Distribute ecosystems free response quiz to check for student understanding. Explain that the quiz is about an ecosystem not associated with Southeast Alaska, but is instead about an entirely different biome-a desert. The skills they have learned can be applied across a wide-range of diversity on earth.
- Explain that Tlingit, Haida, and Tsmishian lived throughout Southeast Alaska due to their comprehensive understanding of coastal and forest 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

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practices. This can be a family member, neighbor, agency representative, elder, or cultural specialist.

- Go over respect protocol with the class for their homework/short term project.

### **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 of their species found in the catalog to look for evidence in Tlingit place names and history.
- Students should prepare their final presentation visuals for a class presentation on their selected plant or animal. They should use the rubric to guide their preparation.
- Hand out the “which niche” worksheets to guide students understanding of their individual roles for the final project.
- If students are focusing on a different species than the one studied throughout this unit, students should conduct their own research as to the historical stewardship and harvesting practices, current conservation and management plans, and challenges faced with current management.
- Students should be using 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 to research and cite medicinal and nutritional benefits of plant or animal in addition to Tlingit vocabulary.
- Allow students a few class sessions to prepare and invite experts in to work with small groups on their area of knowledge.
- 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 9

### 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

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

#### Learning Targets

- I can share my learning with my community.

#### Materials

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

#### Literacy Strategies

- Generating Questions
- Rehearsal

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- Oral Reading
  - Group Presentations

### **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 the *Eagle Boy* oral narratives and the Wooshkeetaan people.
- 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.