



Statewide Framework Document for: Cip Code 010303

**Introduction to Aquaculture and Fisheries**

Standards may be added to this document prior to submission but may not be removed from the framework to meet state credit equivalency requirements. Performance assessments may be developed at the local level. In order to earn state approval, performance assessments must be submitted within this framework. **This course is eligible for 1.0 credit in lab science or 1.0 credit for Algebra I/ Integrated Math I.**

The Washington State Science Standards performance expectations for high school blend core ideas (Disciplinary Core Ideas, or DCIs) with scientific and engineering practices (SEPs) and crosscutting concepts (CCCs) to support students in developing usable knowledge that can be applied across the science disciplines. These courses are to be taught in a [three-dimensional manner](http://nextgenscience.org/three-dimensions). The details about each performance expectation can be found at [Next Generation Science Standards](http://nextgenscience.org/next-generation-science-standards).

Washington Mathematics Standards (Common Core State Standards) support foundational mathematical knowledge and reasoning. While it is important to develop a conceptual understanding of mathematical topics and fluency in numeracy and procedural skills, teachers should also focus on the application of mathematics to career fields to support the three (3) key shifts of CCSS. The Standards for Mathematical Practice develop mathematical habits of mind and are to be modeled and integrated throughout the course. The details about each mathematical standard can be found at [Common Core Mathematics Standards](http://www.corestandards.org/Math/).

Washington English Language Arts Standards (Common Core State Standards) establish guidelines for literacy in history/social studies, science, and technical subjects. The College and Career Readiness Anchor Standards form the backbone of the ELA/literacy standards by articulating core knowledge and skills, while grade-specific standards provide additional specificity. The details about English Language Arts Standards can be found at [Common Core English Language Arts Standards.](http://www.corestandards.org/ELA-Literacy/)

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| **School District Name** | | |
| **Course Title:** Introduction to Aquaculture and Fisheries | | **Total Framework Hours:** 180 |
| **CIP Code:** 010303 | Exploratory **X** Preparatory | **Date Last Modified:** September 2025 |
| **Career Cluster:** Agriculture, Food and Natural Resources | | **Cluster Pathway:** Natural Resources Systems |
| **Course Summary**: Introduction to Aquaculture and Fisheries is a year-long high school course that integrates applied science, mathematics, engineering design, and industry practices to explore aquatic food systems and sustainable fisheries. Students investigate fish biology, water quality, aquatic ecology, and the design of aquaculture systems, while applying Algebra 1 and data analysis skills to solve authentic industry challenges.  Aligned with Next Generation Science Standards (NGSS) and Common Core State Standards (CCSS), the course emphasizes hands-on labs, fieldwork, and computational modeling. Students conduct water chemistry tests, design and evaluate aquaculture systems, and analyze ecological and economic impacts of fisheries management. Technical communication and marketing skills are also developed through outreach projects and presentations.  This course meets requirements for 1.0 Lab Science credit or 1.0 Integrated Math I, preparing students for postsecondary study in environmental science, biology, aquaculture, or natural resources, as well as career pathways in fisheries, aquaculture production, and aquatic system management. | | |
| **Eligible for Equivalent Credit in:** This course is eligible for 1.0 credit in lab science or 1.0 credit for Algebra I/ Integrated Math I. | | **Total Number of Units:** 9 |

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| **Unit 1:** Safety and Well-Being | **Total Learning Hours for Unit:** 10 |
| **Unit Summary**: This unit will highlight the physical, mental, and teamwork skills necessary to work safely and effectively onsite at a production facility or in the field. | |
| **Performance Assessments**:(Districts to complete for each unit)  *Example assessments for this unit include:*   * Perform facility and field work safely and properly (ex: pacing, adequate food, water, sleep, and use of personal protective equipment). * Practice safe crew practices (includes skills in listening, following directions, keeping other crew members safe). * Practice safe and proper hand tool use. * Adhere to community partner’s safety plans and protocols. * Use results of online research to list preventative measures to avoid slips, trips, and falls. * Practice first aid skills through role play activities. * Read a weather report and make safety decisions based on forecast. * Read a tide chart, and make safety decisions based on the information (where applicable) * Read the Study guide from the Washington Boater Education Safety Course. * Related to Supervised Agricultural Experience (SAE): * Describe the importance of safety protocols in workplaces. * Create a list of supplies and personal protective equipment needed to implement the final project. * Implement biosecurity protocols/ equipment disinfection. | |
| **Leadership Alignment**: (Districts to complete for each unit)  *Leadership alignment must include a unit specific project/activity that aligns with the 21st Century Leadership Skills.*   * **3.B.3:** Assume shared responsibility for collaborative work, and value the individual contributions made by each team member ***by practicing safe crew practices***. * **4.B.1:** Use information accurately and creatively for the issue or problem at hand ***by using information about weather reports, and map reading to navigate and make informed safety decisions.*** * **7.A.1:** Adapt to varied roles, job responsibilities, schedules, and contexts ***in the field as a member of the crew***. * **12.D.2:** Understanding preventive physical and mental health measures, including proper diet, nutrition, exercise, risk avoidance and stress reduction ***by performing facility and field work safely and properly (ex: pacing, adequate food, water, sleep, and use of personal protective equipment).*** * **12.D.3:** Using available information to make appropriate health-related decisions ***by adhering to community partner’s safety plans and protocols.*** | |
| **Industry Standards and/or Competencies**: National Council for Agriculture Education  **AFNR Cluster Skills**   * CS.03. Examine and summarize the importance of health, safety, and environmental management systems in AFNR workplaces.     **Career Ready Practices Strand**   * CRP.01.01. Model personal responsibility in the workplace and community. * CRP.09.03. Demonstrate behaviors that contribute to positive morale and culture in the workplace and community. | |
| |  |  |  |  | | --- | --- | --- | --- | | **Aligned Washington State Academic Standards** | | | | | **Mathematics** | **Algebra I**   * N-Q.A.1–3: Reason quantitatively and use units to solve problems. * A-CED.A.1: Create equations and inequalities in one variable and use them to solve problems.   **Geometry**   * G-MG.A.1–3: Apply geometric concepts to model real-world objects. * G-GMD.A.1: Give an informal argument for the formulas for circumference, area, and volume. | | | | **Science** | **Engineering Design**   * HS-ETS1-1: Analyze a major global challenge to specify criteria and constraints for solutions. * HS-ETS1-3: Evaluate a solution to a complex real-world problem. | | | | **Science and Engineering Practice** | | **Disciplinary Core Idea** | **Crosscutting Concept** | | Asking questions and Defining Problems (HS-ETS1-1)  Constructing Explanations and Designing Solutions (HS-ETS1-3) | | ETS1.A: Defining and Delimiting Engineering Problems (HS-ETS1-1)  ETS1.B: Developing Possible Solutions (HS-ETS1-3) | Influence of Science, Engineering, and Technology on Society and the Natural World (HS-ETS1-1) | | |

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| **Unit 2: Stewardship and Sustainability** | | | | **Total Learning Hours for Unit:** 20 |
| **Unit Summary**: This unit will engage students in dialogue about sustainability and stewardship related to humans’ roles in ecosystems. Sustainability concepts will be considered from First Peoples’ historical and contemporary perspectives on stewardship and sovereignty rights. | | | | |
| **Performance Assessments**:(Districts to complete for each unit)  *Example assessments for this unit include:*   * Identify possible approaches to resolve conflict within 1) an organization and 2) between an organization and external partners and/or agencies. * Engage in dialogue with peers to create stewardship-based protocols for propagating, harvesting, and sustaining A&F systems. * Define co-management and cite an example in Washington State. * Identify egg sharing and permitting policies to be used in A&F systems. * Research permits requirements to get, raise, release salmon and/or other farmed aquatic species. * Study the following Billy Frank, Jr. quote ([quote source](https://faculty.washington.edu/jlreid/wordpress/2017/11/28/billy-frank-jr-leadership-qualities/#:~:text=Bill%20Frank%20once%20said%20that,)) to answer reflection questions:   + “I don’t believe in magic. I believe in the sun and the stars, the water, the tides, the floods, the owls, the hawks flying, the river running, the wind talking. They’re measurements. They tell us how healthy things are. How healthy we are. Because we and they are the same. That’s what I believe in.”   + Reflection questions:     - How can observation identify relationships between elements within natural systems?     - How can observation identify conditions within a system (ex: Fish health)?     - What types of measurements could we collect from one “element” described by Billy Frank, Jr.? (ex: sun, stars, tides). * Know the species name and related story from the local tribal community for what the organism being raised (source: [Indigenous Leaders and Activists](https://faculty.washington.edu/jlreid/wordpress/category/currentevents/)). * Research the range and role of at least one commercial aquatic species in the larger ecosystem to enhance and maintain the environment beyond aquaculture and fisheries (A&F) systems. * Demonstrate a working knowledge of propagation, harvest, and understanding of how to harvest for sustainability. * Design sustainable harvest plans that account for a reduction in human impacts on multiple levels of the local ecosystem. * Evaluate the impacts of climate change on ecosystems and the ability of humans to grow food. * Compare algae growth (exponential) to shellfish growth (linear) in co-culture systems. * Describe how management decisions regarding propagation and/or harvest can impact the natural world both positively and negatively. * Participate in indigenous A&F practices (ex: Harvesting or management strategies; cultural ceremonies). * Investigate a local organization that is addressing an A&F-related community issue. * Students interpret the meaning of the “r” (growth rate) parameter in an exponential algae growth model and explain how nutrient availability affects it. * Students analyze a dataset comparing water temperature and fish disease occurrence, explain correlation results, and argue whether causation is likely, supporting with research. * Students use a simple spreadsheet to model a fishery population under different harvest limits. They run at least two scenarios (e.g., unrestricted harvest vs. regulated quotas), chart population changes over 10 years, and write a one-page recommendation for sustainable harvest levels.   Related to SAE:   * Give examples of ways A&F professionals interact with indigenous communities. * Include recommendations for integrating culturally responsive practices in final SAE project. | | | | |
| **Leadership Alignment**: (Districts to complete for each unit)  *Leadership alignment must include a unit specific project/activity that aligns with the 21st Century Leadership Skills.*   * **12.E.1:** Demonstrate knowledge and understanding of the environment and the circumstances and conditions affecting it, particularly as relates to air, climate, land, food, energy, water, and ecosystems ***by demonstrating a working knowledge of propagation, harvest, and understanding how to harvest for sustainability.*** * **12.E.2:** Demonstrate knowledge and understanding of society’s impact on the natural world (e.g., population growth, population development, resource consumption rate, management decision, stewardship actions, etc.) ***by demonstrating how management decisions regarding propagation and/or harvest can impact the natural world both positively and negatively.*** | | | | |
| **Industry Standards and/or Competencies**: National Council for Agriculture Education  **Agriculture, Food, and Natural Resources Standards: Natural Resources Sciences**   * NRS.02.01. Analyze the interrelationships between natural resources and humans. * NRS.01.02.05. c. Evaluate the non-living resources present in an area to determine the best practices for improving, enhancing and protecting an ecosystem. * NRS.01 Plan and conduct resource management activities that apply logical, reasoned and scientifically based solutions to natural resource issues and goals. * NRS.04. Demonstrate responsible management procedures and techniques to protect, maintain, enhance, and improve natural resources. * NRS.02.01. Examine and interpret the purpose, enforcement, impact and effectiveness of laws and agencies related to natural resource management, protection, enhancement, and improvement (e.g., water regulations, game laws, historic preservation laws, environmental policy, etc.). * NRS.02.05.01. c. Devise and implement a strategy for communicating a natural resources message through media. * NRS.02.03.03. b. Analyze and document how some technological advancements changed how natural resources were used and viewed (e.g., Industrial Revolution, fossil fuels, green technology, etc.).   **AFNR Cluster Skills**   * CS.04.01. Identify and implement practices to steward natural resources in different AFNR systems. * CS.04.02: Assess and explain the natural resource related trends, technologies, and policies that impact AFNR systems. * CS.04.01: Identify and implement practices to steward natural resources in different AFNR systems. * CS.04.02: Assess and explain the natural resource related trends, technologies, and policies that impact AFNR systems.   **Career Ready Practices Strand**   * CRP.04.02. Produce clear, reasoned, and coherent written and visual communication in formal and informal settings. | | | | |
| **Aligned Washington State Academic Standards** | | | | |
| **Mathematics** | **Algebra I**  **(Data Science/ Statistics & Probability)**   * HS.DS.1 Formulate multivariable statistical investigative questions and determine how data can be collected and provide an answer, consider causality and prediction when posing the question. *(S-IC.A.1, S-IC.A.3, S-IC.B.6, S-ID.C.7–9)* * HS.DS.2 Understand the issues of bias and confounding variables when collecting data and their impact on interpretation. Understand practices for collecting and handling data, including sensitive information and concerns for privacy and how that may affect data collection. *(S-IC.A.3, S-IC.A.4, S-IC.B.6)* * HS.DS.3 Create and analyze data sets and data displays, including but not limited to scatter plots, regressions, histograms, and boxplots using technology to sort or filter data, summarize, and describe relationships between quantitative variables. (S-ID.A.1–3, S-ID.B.6, S-ID.C.7–9, F-IF.B.4, F-IF.C.7) * HS.DS.4 Acknowledge the presence of missing data values and understand how missing values may add bias to analysis and interpretation. Examine and discuss competing explanations for data trends observed such as confounding variables. Respond to competing arguments or interpretations of the data of different community groups, pay careful attention to what conclusions the data supports. (S-ID.A.1–3, S-IC.A.1, S-IC.B.6, S-CP.A)   **(Creating Equations)**   * A.CED. A.2 Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.   **(Linear, Quadratic and Exponential Models)**   * F-LE.A.3 – Compare exponential vs. linear growth   **Geometry**   * G-MG.A.1–3: Apply geometric concepts to model real-world objects. * G-GPE.B.6: Find the point on a directed line segment that partitions the segment in a given ratio. | | | |
| **Science** | **Life Science**  HS-LS2-1. Use mathematical and/or computational representations to support explanations of factors that affect carrying capacity of ecosystems at different scales.  HS-LS2-7. Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity.  **Earth and Space Science**  HS-ESS3-6. Use a computational representation to illustrate the relationships among Earth systems and how those relationships are being modified due to human activity.  **Engineering Design**  HS-ETS1-1. Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants. | | | |
| **Science and Engineering Practice** | | **Disciplinary Core Idea** | **Crosscutting Concept** | |
| Using Mathematics and Computational Thinking (HS-LS2-1, HS-ESS3-6)  Constructing Explanations and Designing Solutions (HS-LS2-7)  Asking Questions and Defining Problems (HS-ETS1-1) | | LS2.A: Interdependent Relationships in Ecosystems (HS-LS2-1)  LS2.C: Ecosystems Dynamics, Functioning, and Resilience (HS-L2-7)  ESS2.D: Weather and Climate (HS-ESS3-6)  ESS3.D: Global Climate Change (HS-ESS3-6)  ETS1.A: Defining and Delimiting Engineering Problems (HS-ETS1-1) | Scales, Proportion, and Quantity (HS-LS2-1)  Stability and Change (HS-LS2-7)  Systems and System Models (HS-ESS3-6)  Influence of Science, Engineering, and Technology on Society and the Natural World (HS-ETS1-1) | |

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| **Unit 3:** **Species Identification & Population Dynamics** | | | | **Total Learning Hours for Unit: 20** |
| **Unit Summary**: Students will learn to identify common aquaculture species and analyze their life cycles, habitat needs, and population dynamics. The unit integrates mathematical modeling of population growth, including applying **linear and/or exponential functions** to approximate early-stage growth in species whose populations follow logistic curves. Students will explore how environmental factors and carrying capacity influence growth patterns, and use real or simulated datasets to fit and interpret quadratic models for decision-making in aquaculture operations. | | | | |
| **Performance Assessments**:(Districts to complete for each unit)  *Example assessments for this unit include:*   * **Species ID Portfolio** – Students create a digital or physical portfolio of 10+ aquaculture species, including taxonomy, habitat, feeding habits, and market value. * **Growth Modeling Project** – * Collect or use provided early-growth population data for a selected species. * Determine a line of best fit to model (F-IF.C.7a) the collected data. * Evaluate the model and equation that represents the line of best fit (A-REI.B.3) to determine the time to reach specific population targets. * Interpret results in the context of operational decisions (stocking, harvesting). * **Population Dynamics Report** – Students explain how environmental variables (temperature, oxygen levels, feeding rate) might shift the growth curve and affect carrying capacity * Students develop an equation relating daily feed mass to fish biomass using real hatchery data, then use it to predict feed needs at different biomass levels. * Students plot a biomass-over-time function from field measurements, identify maximum growth period, and explain how water temperature data might shift the curve. * Given data on tank size, water quality, and fish biomass, students calculate maximum sustainable biomass. They create a graph showing how different stocking densities impact dissolved oxygen and survival rate, then present recommendations for optimal stocking. * Using real or simulated local fisheries survey data, students calculate biodiversity indices, identify trends, and revise management suggestions based on new data sets provided mid-project.   Related to SAE:   * Use terminology and scientific names to accurately describe aquatic organisms in presentation. * List biological and ecological factors that impact a local A&F production facility. * Research species being managed at a local employer (ex: anatomy, terminology, physical traits). * Select species to include in final SAE project.   Describe how species included in SAE project impact biology and ecology of local ecosystems. | | | | |
| **Leadership Alignment**: (Districts to complete for each unit)   * **1.B:** Work creatively with others. * **3.A.1:** Articulate thoughts and ideas effectively using oral, written, and nonverbal communication skills in a variety of forms and contexts. * **3.A.2:** Listen effectively to decipher meaning, including knowledge, values, attitudes, and intentions. * **3.B.3:** Assume shared responsibility for collaborative work, and value the individual contributions made by each team member. * **7.B.1:** Incorporate feedback effectively. * **9.B.2:** Respond open-mindedly to different ideas and values. | | | | |
| **Industry Standards and/or Competencies**: National Council for Agriculture Education  **Agriculture, Food, and Natural Resources Standards: Natural Resources Sciences**   * NRS.01.02. Classify different types of natural resources to enable protection, conservation, enhancement and management in a particular geographical region. * NRS.01.04. Apply ecological concepts and principles to aquatic natural resource systems. | | | | |
| **Aligned Washington State Academic Standards** | | | | |
| **Mathematics** | **Algebra I**   * HS.F.LE.A.1 Distinguish between situations that can be modeled with linear functions and with exponential functions. * HS.F.LE.B.5 Interpret the parameters in a linear or exponential function in terms of a context. * **HS. F-IF.C.7a** – Graph functions expressed symbolically and show key features of the graph; graph quadratic functions and show intercepts, maxima, and minima. * **HS. A-REI.B.3** – Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters. * **HS. S-ID.B.6** – Represent data on two quantitative variables, describe the relationship, and fit a function.   **Geometry**   * G-MG.A.1–3: Apply geometric concepts to model real-world objects. * G-GMD.A.1–3: Explain volume formulas and use them to solve problems. | | | |
| **Science** | **Earth and Space Science**   * HS-ESS3-6. Use a computational representation to illustrate the relationships among Earth systems and how those relationships are being modified due to human activity.   **Life Science**   * HS-LS2-1 – Use mathematical and/or computational representations to support explanations of factors that affect carrying capacity. * HS-LS2-2 – Use mathematical representations to support and revise explanations based on evidence about factors affecting biodiversity and populations. * HS-LS2-4. Use mathematical representations to support claims for the cycling of matter and flow of energy among organisms in an ecosystem. | | | |
| **Science and Engineering Practice** | | **Disciplinary Core Idea** | **Crosscutting Concept** | |
| Using Mathematics and Computational Thinking (HS-LS2-1, HS-LS2-2. HS-LS2-4, HS-ESS3-6) | | LS2.A: Interdependent Relationships in Ecosystems (HS-LS2-1, HS-LS2-2)  LS2.B: Cycles of Mather and Energy Transfer in Ecosystems (HS-LS2-4)  LS2.C: Ecosystem Dynamics, Functioning, and Resilience ( HS-LS2-2)  ESS2.D: Weather and Climate (HS-ESS3-6)  ESS3.D: Global Climate Change (HS-ESS3-6)  LS2.A: Interdependent Relationships in Ecosystems (HS-LS2-1) | Systems and System Models (HS-ESS3-6)  Scales, Proportion, and Quantity (HS-LS2-1)  Energy and Matter (HS-LS2-4) | |

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| **Unit 4: Water Quality and Animal Husbandry** | | | | **Total Learning Hours for Unit: 20** |
| **Unit Summary**: Students will explore the variables involved in maintaining acceptable water quality conditions in efficient aquaculture production and good aquatic animal husbandry practices. | | | | |
| **Performance Assessments**:(Districts to complete for each unit)   * Handle organisms using correct safety and animal welfare protocol under direct supervision of instructor. * Use a water quality test to determine water quality parameters of the aquatic habitat. * Use the 4 Cs (cool, clear, complex, clean) to describe water quality characteristics. * Identify ingredients in feed and understand the value of those ingredients to the organism. * Describe variables that impact quantity and type needed (ex: nutritional needs, growth rates, number of organisms, water system size). * Calculate quantity of feed needed based on determined factors. * Follow proper protocol for safe disposal of byproducts. * Demonstrate proper protocol to euthanize and dispose of dying animals. * Distinguish between healthy organisms and unhealthy organismsand signs of distress. * Develop or revise a simulation that shows the impact of a common disease and/or pest on a specific aquatic species. * Compare multiple shellfish growing methods. Consider the advantages and disadvantages of each method. * Study the foundational design and functions of an A&F system to minimize environmental impact. * Students receive raw sensor data for dissolved oxygen, pH, and temperature. They must choose which quantities are most relevant to model fish growth rate, justify choices, and produce a labeled table with units. * Students design and carry out a simple experiment growing algae under different light intensities. They record biomass increase over time, then create a diagram linking light input to stored chemical energy in the algae. * Students trace feed nutrients into fish tissue using feed composition labels and growth data. They create a labeled flowchart showing how carbon from carbohydrates is incorporated into proteins and fats.   Related to SAE:   * List biotic and abiotic factors that impact a local A&F production facility. * Research how aquatic organisms at a local facility depend on and may compete for biotic and abiotic resources. * Select species to include in final project. * Describe how selected species will impact water quality at a local facility. | | | | |
| **Leadership Alignment**: (Districts to complete for each unit)  *Leadership alignment must include a unit specific project/activity that aligns with the 21st Century Leadership Skills.*   * **2.A.1:** Use various types of reasoning (inductive, deductive, etc.) as appropriate to the situation ***by comparing multiple shellfish grow-out methods and considering the advantages and disadvantages of each.*** * **2.B.1:** Analyze how parts of a whole interact with each other to produce overall outcomes in complex systems ***by using a water quality test to determine water quality parameters of the aquatic habitat.*** * **2.D.2:** Identify and ask significant questions that clarify various points of view and lead to better solutions ***by studying the foundational design and functions of a fishery/aquaculture system to identify those features that minimize its impact on the environment.*** | | | | |
| **Industry Standards and/or Competencies**: National Council for Agriculture Education  **Agriculture, Food, and Natural Resources Standards: Natural Resources Sciences**   * NRS.03.01: Sustainably produce, harvest, process and use natural resource products (e.g., forest products, wildlife, minerals, fossil fuels, shale oil, alternative energy, recreation, aquatic species, etc.). * NRS.04.01: Demonstrate natural resource protection, maintenance, enhancement, and improvement techniques. * NRS.04.02: Diagnose plant and wildlife diseases and follow protocols to prevent their spread. * NRS.04.03: Prevent or manage introduction of ecologically harmful species in a particular region. | | | | |
| **Aligned Washington State Academic Standards** | | | | |
| **Mathematics** | **Algebra I**  **(Data Science/ Statistics & Probability)**   * HS.DS.1 Formulate multivariable statistical investigative questions and determine how data can be collected and provide an answer, consider causality and prediction when posing the question. *(S-IC.A.1, S-IC.A.3, S-IC.B.6, S-ID.C.7–9)* * HS.DS.2 Understand the issues of bias and confounding variables when collecting data and their impact on interpretation. Understand practices for collecting and handling data, including sensitive information and concerns for privacy and how that may affect data collection. *(S-IC.A.3, S-IC.A.4, S-IC.B.6)* * HS.DS.3 Create and analyze data sets and data displays, including but not limited to scatter plots, regressions, histograms, and boxplots using technology to sort or filter data, summarize, and describe relationships between quantitative variables. (S-ID.A.1–3, S-ID.B.6, S-ID.C.7–9, F-IF.B.4, F-IF.C.7) * HS.DS.4 Acknowledge the presence of missing data values and understand how missing values may add bias to analysis and interpretation. Examine and discuss competing explanations for data trends observed such as confounding variables. Respond to competing arguments or interpretations of the data of different community groups, pay careful attention to what conclusions the data supports. (S-ID.A.1–3, S-IC.A.1, S-IC.B.6, S-CP.A) * HS.S.ID**:** A.3 Interpret differences in shape, center, and spread in the context of the data sets, accounting for possible effects of extreme data points (outliers). * HS.S.IC**:** A.1 Understand statistics as a process for making inferences about population parameters based on a random sample from that population.   **(Creating Equations)**   * A-CED.A.1–4: Create and solve equations/inequalities in one and multiple variables.   **(Numbers and Quantity)**   * N-Q.A.1–3: Reason quantitatively and use units to solve problems.   **Geometry**   * G-GMD.A.1–3: Explain volume formulas and use them to solve problems. * G-MG.A.1–3: Apply geometric concepts to model real-world objects. | | | |
| **Science** | **Earth and Space Science**   * HS-ESS2-5 – Plan and conduct an investigation of the properties of water and its effects on Earth materials and surface processes. * HS-ESS3-4**:** Evaluate or refine a technological solution that reduces impacts of human activities on natural systems.   **Life Science**   * HS-LS2-4**:** Use mathematical representations to support claims for the cycling of matter and flow of energy among organisms in an ecosystem. * HS-LS2-7**:** Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity. * HS-LS4-6**:** Create or revise a simulation to test a solution to mitigate adverse impacts of human activity on biodiversity. | | | |
| **Science and Engineering Practice** | | **Disciplinary Core Idea** | **Crosscutting Concept** | |
| Constructing Explanations and Designing Solutions (HS-ESS3-4)  Using Mathematics and Computational Thinking (HS-LS2-4)(HS-LS4-6)  Constructing Explanations and Designing Solutions (HS-LS2-7) | | ESS3.C: Human Impacts on Earth Systems (HS-ESS3-4)  LS2.B: Cycles of Matter and Energy Transfer in Ecosystems (HS-LS2-4)  LS2.C: Ecosystem Dynamics, Functioning, and Resilience (HS-LS2-4)  LS4.C: Adaptation (HS-LS4-6)  LS4.D: Biodiversity and Humans (HS-LS4-6) | Stability and Change (HS-ESS3-4)  Influence of Science, Engineering, and Technology on Society and the Natural World (HS-ESS3-4)  Energy and Matter (HS-LS2-4)  Stability and Change (HS-LS2-7)  Cause and Effect (HS-LS4-6) | |

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| **Unit 5:** **Data Science and Analysis** | | | | **Total Learning Hours for Unit: 10** |
| **Unit Summary**: Students will explore how to quantify physical and anecdotal observations to make comparisons and predictions. Students will learn best practices to collect data, make inferences, and evaluate their findings. | | | | |
| **Performance Assessments**:(Districts to complete for each unit)  *Example assessments for this unit include:*   * Describe the difference between accuracy and precision. * Evaluate the quality and validity of personally generated and internet sources of data. * Collect a data set with appropriate accuracy and precision. Example data sets include tracking organismal growth, population survey, population mortality rates, water quality parameters, or accounting for the effect of water weight when assessing the mass of wet specimens or living organisms. * Organize and manipulate data in a spreadsheet (ex: Sort, table, graph functions). * Use probabilities to make decisions surrounding care of organisms. * Accurately complete food check entries. * Extract and archive data from external sources (ex: Using a public data set, make predictions of weather in an area over a growing season). * Construct production growth models from hatchery monthly output data. * Students calculate the break-even price per pound of fish given cost and revenue constraints, showing all steps and checking their solution. * Students use regression output of fish weight vs. age, then explain the real-world meaning of the slope and intercept in terms of growth. * Students diagram an aquaculture system’s energy flow using collected feed, waste, and biomass data. They include percentages for each pathway (growth, respiration, waste) and explain how efficiency could be improved.   Related to SAE:   * Collect data to measure change over time based on a chosen variable. * Use proper documentation and sourcing for final project. * Use findings from a model to make recommendations or test a hypothesis within an A&F system. * Create a presentation that describes data used to predict the impact of one or more variables on an A&F system. * Utilize gathered data in final report. | | | | |
| **Leadership Alignment**: (Districts to complete for each unit)  *Leadership alignment must include a unit specific project/activity that aligns with the 21st Century Leadership Skills.*   * **2.C.4:** Interpret information and draw conclusions based on the best analysis ***by accessing a data set and extract information from it*** * **4.A.1:** Access information efficiently (time) and effectively (sources) ***by accurately completing food check entries*** * **4.A.2:** Evaluate information critically and competently ***by using probability to make decisions surrounding care of organisms.*** * **4.B.1:** Use information accurately and creatively for the issue or problem at hand ***by collecting a data set that tracks organismal growth*** * **4.B.2:** Manage the flow of information from a wide variety of sources ***by inputting and analyzing data relevant to the industry’s record keeping/admin needs (ex. completion of table, forms)*** * **4.B.3:** Apply a fundamental understanding of the ethical/legal issues surrounding the access and use of information ***by recognizing the importance of and the difference between precision and accuracy in data science.*** | | | | |
| **Industry Standards and/or Competencies**: National Council for Agriculture Education   * CRP.07.01. Select and implement reliable research processes and methods to generate data for decision-making in the workplace and community. * CRP.07.02. Evaluate the validity of sources and data used when considering the adoption of new technologies, practices and ideas in the workplace and community. * CRP.08.01. Apply reason and logic to evaluate workplace and community situations from multiple perspectives. | | | | |
| **Aligned Washington State Academic Standards** | | | | |
| **Mathematics: Common Core** | **Algebra I**  **(Data Science/ Statistics & Probability)**   * HS.DS.1 Formulate multivariable statistical investigative questions and determine how data can be collected and provide an answer, consider causality and prediction when posing the question. *(S-IC.A.1, S-IC.A.3, S-IC.B.6, S-ID.C.7–9)* * HS.DS.2 Understand the issues of bias and confounding variables when collecting data and their impact on interpretation. Understand practices for collecting and handling data, including sensitive information and concerns for privacy and how that may affect data collection. *(S-IC.A.3, S-IC.A.4, S-IC.B.6)* * HS.DS.3 Create and analyze data sets and data displays, including but not limited to scatter plots, regressions, histograms, and boxplots using technology to sort or filter data, summarize, and describe relationships between quantitative variables. (S-ID.A.1–3, S-ID.B.6, S-ID.C.7–9, F-IF.B.4, F-IF.C.7) * HS.DS.4 Acknowledge the presence of missing data values and understand how missing values may add bias to analysis and interpretation. Examine and discuss competing explanations for data trends observed such as confounding variables. Respond to competing arguments or interpretations of the data of different community groups, pay careful attention to what conclusions the data supports. (S-ID.A.1–3, S-IC.A.1, S-IC.B.6, S-CP.A) * HS.S.ID A.3**:** Interpret differences in shape, center, and spread in the context of the data sets, accounting for possible effects of extreme data points (outliers). * HS.S.IC A.1**:** Understand statistics as a process for making inferences about population parameters based on a random sample from that population. * HS.S.IC. B.6**:** Evaluate reports based on data. * HS.S.CP. A.1**:** Describe events as a subset of a sample space (the set of outcomes) using characteristics (or categories) of the outcomes, or as unions, intersections, or complements of other events (“or,” “and,” “not). * HS.S.CP. A.4**:** Construct and interpret two-way frequency tables of data when two categories are associated with each object being classified. Use the two-way table as a sample space to decide if events are independent and to approximate conditional probabilities.   **(Linear, Quadratic, and Exponential Models)**   * F-LE.A.2 – Build linear/exponential models from data   **Geometry**   * G-MG.A.1–3: Apply geometric concepts to model real-world objects. | | | |
| **Science** | Engineering Design   * HS-ETS1-2: Design a solution to a complex real-world problem. | | | |
| **Science and Engineering Practice** | | **Disciplinary Core Idea** | **Crosscutting Concept** | |
| Designing Solutions  Using Mathematics and Computational Thinking | | ETS1.B – Developing Possible Solutions  LS2.C – Ecosystem Dynamics and Resilience | Systems and System Models  Cause and Effect | |

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| **Unit 6:** **Facility and Equipment Operations and Maintenance** | | | | **Total Learning Hours for Unit:** 30 |
| **Unit Summary**: This unit will explore the operation and maintenance of basic facilities and equipment. | | | | |
| **Performance Assessments**:(Districts to complete for each unit)  *Example assessments for this unit include:*   * Read safety manuals for equipment (pressure washer, weed eater, blower, mower) and develop a written, oral, and demonstration test from the material. * Describe the purpose of a Material Safety Data Sheet (MSDS). * Locate MSDS sheet in the facility. * Draw a schematic of a pump system. * Develop a schematic of hatchery infrastructure. * Describe or present the schematic. * Develop an electrical schematic to demonstrate understanding of volts, amps, and ohms. * Given the pump flow equation Q= v × A, students solve for velocity v given desired flow and pipe diameter, then select an appropriate pump from a catalog. * Students compare two water filtration systems for a hatchery using provided specs (cost, efficiency, energy use, maintenance). They create a scored comparison chart, justify trade-offs, and recommend the best option for a given budget and facility type.   Related to SAE:   * Design an A&F system that utilizes tools, equipment, electricity, and pumps. | | | | |
| **Leadership Alignment**: (Districts to complete for each unit)  *Leadership alignment must include a unit specific project/activity that aligns with the 21st Century Leadership Skills.*  *Example: Students will develop a safety plan for the robotics classroom.*   * 2.D.1 Solve different kinds of non-familiar problems in both conventional and innovative ways. * 2.D.2 Identify and ask significant questions that clarify various points of view and lead to better solutions * 7.A.1 Adapt to varied roles, jobs responsibilities, schedules, and contexts * 7.A.2 Work effectively in a climate of ambiguity and changing priorities * 8.B.1 Monitor, define, prioritize, and complete tasks without direct oversight * 10.B.1 Demonstrate additional attributes associated with producing high quality products including the abilities to: * 10.B.1.a Work positively and ethically * 10.B.1.b Manage time and projects effectively * 10.B.1.c multi-task * 10.B.1.d Participate actively, as well as be reliable and punctual * 10.B.1.e Present oneself professionally and with proper etiquette * 10.B.1.f Collaborate and cooperate effectively with teams * 10.B.1.g Respect and appreciate team diversity * 10.B.1.h Be accountable for results | | | | |
| **Industry Standards and/or Competencies**: National Council for Agriculture Education  **Cluster Skills**   * CS.03.01. Identify and explain the implications of required regulations to maintain and improve safety, health and environmental management systems. * CS.03.04. Use appropriate protective equipment and demonstrate safe and proper use of AFNR tools and equipment. | | | | |
| **Aligned Washington State Academic Standards** | | | | |
| **Mathematical Practices** | **Algebra I**   * HS.A.CED. A. 4: Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations. * N-Q.A.1–3: Reason quantitatively and use units to solve problems. * A-REI.A.1: Explain each step in solving a simple equation.   **Geometry**   * G-GMD.A.1–3: Explain volume formulas and use them to solve problems. * G-MG.A.1–3: Apply geometric concepts to model real-world objects. | | | |
| **Science** | **Earth and Space Science**   * HS-ESS3-4: Evaluate or refine a technological solution that reduces impacts of human activities on natural systems.   **Engineering Design**   * HS-ETS1-3: Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics as well as possible social, cultural, and environmental impacts.   **Physical Science**   * HS-PS2-1 – Analyze data to support the claim that Newton’s Second Law describes the motion of a system. * HS-PS2-6 – Communicate scientific and technical information about why molecular-level structure is important in designing materials. * HS-PS3-5 Develop and use a model of two objects interacting through electric or magnetic fields to illustrate the forces between objects and the changes in energy of the objects due to the interaction. | | | |
| **Science and Engineering Practice** | | **Disciplinary Core Idea** | **Crosscutting Concept** | |
| Engaging in Argument from Evidence  Using Computational Thinking | | ESS3.C – Human Impacts on Earth Systems  LS4.D – Biodiversity and Humans | Scale, Proportion, and Quantity  Stability and Change | |

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| **Unit 7:** **Communication and Marketing** | **Total Learning Hours for Unit:** 10 |
| **Unit Summary**: Students practice communicating about facility operations. understand the importance of what (what is appropriate or not) and how best to communicate about A&F operations. | |
| **Performance Assessments**:(Districts to complete for each unit)  *Example assessments for this unit include:*   * Identify key components of digital citizenship. * Prepare a 30-second speech to describe a topic of interest. * Describe a schematic describing facility operations to a peer, teacher, or community member. * Provide a written or oral response to the request “Tell me about the program”. * Identify key features that create a quality product using a google slide presentation. Explore basic outreach/communication regarding the A/F industry and how the system resides within a larger ecosystem outside the school.   Related to SAE:   * Develop and host a student-led town hall or presentation for the city council, tribal council or other decision-making body addressing a current A&F local issue or topic.   Identify culturally relevant species to integrate into the final project. | |
| **Leadership Alignment**: (Districts to complete for each unit)  *Leadership alignment must include a unit specific project/activity that aligns with the 21st Century Leadership Skills.*  *Example: Students will develop a safety plan for the robotics classroom.*   * **5.A.1** Understand both how and why media messages are constructed, and for what purposes ***by identifying media formats to use to promote and communicate.*** * **5.A.2** Examine how individuals interpret messages differently, how values and points of view are included or excluded, and how media can influence beliefs and behaviors ***by exploring the meaning of digital citizenship***. * 5.A.3 Apply a fundamental understanding of the ethical/legal issues surrounding the access and use of media ***by exploring the meaning of digital citizenship.*** * **3.A.1** Articulate thoughts and ideas effectively using oral, written, and nonverbal communication skills in a variety of forms and contexts ***by providing a written response to the request “Tell me about the program”.*** * 3.A.3 Use communication for a range of purposes (e.g. to inform, instruct, motivate and persuade) ***by describing a facility’s operation to members of the public.*** | |
| **Industry Standards and/or Competencies**: National Council for Agriculture Education  **Agriculture, Food, and Natural Resources Standards: Natural Resources Sciences**   * NRS.05.01 Communicate natural resource information to the public.   **AFNR Cluster Skills**   * CS.02.02. Examine the components of the AFNR systems and assess their impact on the local, state, national and global society and economy.   **Career Ready Practices Strand**   * CRP.01.02 Evaluate and consider the near-term and long-term impacts of personal and professional decisions on employers and community. before CRP.04.01. Speak using strategies that ensure clarity, logic, purpose and professionalism in formal and informal settings. * CRP.04.02. Produce clear, reasoned and coherent written and visual communication in formal and informal settings. * CRP.04.03. Model active listening strategies when interacting with others in formal and informal settings. * CRP.09.02. Implement personal management skills to function effectively and efficiently in the workplace (e.g., time management, planning, prioritizing, etc.). | |

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| **Unit 8:** **Career Pathways** | **Total Learning Hours for Unit:** 10 |
| **Unit Summary**: This unit will expose students to various career pathways in the natural resources profession and provide opportunities for students to  develop and enhance their employability skills. | |
| **Performance Assessments**:(Districts to complete for each unit)  *Example assessments for this unit include:*   * Complete a self-assessment to identify qualifications and reflect on opportunities for future job skill growth. * Create a list of gained individual skills and experiences that are relevant to natural resource jobs. * Write a resume and cover letter that integrates the skills learned through the course. * Complete a practice job application. * Prepare for, and participate in, a mock job interview for a natural resources position. * Describe how course learning relates to the students’ future academic and career goals. * Research certifications, training, or postsecondary programs that relate to student's career goals. * Conduct a job search. * Through research or a field visit to a facility, generate a list of possible A&F jobs (both direct and indirect). * Select one job that is matched to personal skills, talents, and career goals and that directly or indirectly involves aquaculture and fisheries and design a poster, or presentation to share with peers. Include information about workplace environment, etiquette, and how communication happens in the workplace. * Based on career presentations by peers, identify transferable skills necessary to perform the duties of selected A&F positions. * Research and present more than one source of information that addresses the cultural, recreational, or commercial value of an aquatic species in Washington State.   Related to SAE:   * Present SAE project to the public and potential employers. * List knowledge, skills, and abilities gained during the course. | |
| **Leadership Alignment**: (Districts to complete for each unit)  *Leadership alignment must include a unit specific project/activity that aligns with the 21st Century Leadership Skills.*  *Example: Students will develop a safety plan for the robotics classroom.*   * **3.A.1:** Students will articulate thoughts and ideas effectively using oral, written, and nonverbal communication skills in a variety of forms and contexts in ***a mock interview for a natural resources position and by selecting one career that directly or indirectly involves aquaculture and fisheries and design a poster, or presentation to share with peers.*** * **4.A.1:** Access information efficiently (time) and effectively (sources) ***by researching more than one source of information that addresses the cultural, recreational, or commercial value of an aquatic species in Washington state and present the information to your peers.*** * **4.A.2:** Evaluate information critically and competently ***by identify some skills necessary to perform the duties of selected positions within the field of aquaculture and fisheries that could be transferrable to other positions (ability to work on a crew, for example).*** * **8.A.2:** Students willbalance short-term and long-term goals ***to create a list of gained individual skills and experiences that are relevant to natural resource jobs.*** * **8.C.2:** Students will demonstrate the initiative to advance skill levels towards a professional level by ***contacting a natural resources organization to request an informational interview.*** * **8.C.4**: Students will reflect critically on past experiences to inform future progress ***by completing a self-assessment to identify qualifications and reflect on opportunities for future job skill growth.*** | |
| **Industry Standards and/or Competencies**: National Council for Agriculture Education  **AFNR Cluster Skills**   * CS.05. Describe career opportunities and means to achieve those opportunities in each of the Agriculture, Food & Natural Resources career pathways. * CS.05.02: Examine and choose career opportunities that are matched to personal skills, talents, and career goals in an AFNR pathway of interest. * CRP.10.01. Identify career opportunities within a career cluster that match personal interests, talents, goals and preferences.   **Career Ready Practices Strand**   * CRP.01.03. Identify and act upon opportunities for professional and civic service at work and in the community. * CRP.02.01. Use strategic thinking to connect and apply academic learning, knowledge and skills to solve problems in the workplace and community. * CRP.04.01. Speak using strategies that ensure clarity, logic, purpose and professionalism in formal and informal settings. * CRP.04.02. Produce clear, reasoned, and coherent written and visual communication in formal and informal settings. * CRP.10.01. Identify career opportunities within a career cluster that match personal interests, talents, goals, and preferences. | |

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| **Unit 9: Supervised Agricultural Experience (SAE) Project** | **Total Learning Hours for Unit:** 10 |
| **Unit Summary**: Students will demonstrate their learning by completing a Supervised Agricultural Experience Project (SAE). Students will work individually and, in a group, to consider their strengths as well as their areas for future learning in performing aquaculture and fisheries work. | |
| **Performance Assessments**:(Districts to complete for each unit)  *Example assessments for this unit include:*   * Select a final project format that effectively delivers content (ex: PowerPoint, YouTube video, report, radio public service announcement, poster, tri-fold display, brochure, map, website or blog, event, phone app, etc.) * Write a report that investigates a topic covered in the course. * Use Ag Experience Tracker (AET) System or equivalent utilized to track SAE Project. * Outline the components to be used in final project: * Determine the goals of the SAE project. * Identify resources and data to be collected to meet project goals. * Select the types of data that will be meaningful. * Collect data to be used in the final project. * Keep records that pertain to the chosen SAE project. * Enter data into an Excel spreadsheet. * Create maps that display necessary data. * Cite sources that are included in the proposal. * Prepare and deliver final project deliverables. | |
| **Leadership Alignment**: (Districts to complete for each unit)  *Leadership alignment must include a unit specific project/activity that aligns with the 21st Century Leadership Skills.*  *Example: Students will develop a safety plan for the robotics classroom.*   * Students will **demonstrate initiative to advance skill levels towards a professional level (8.C.2**) and **balance short-term and long-term goals (8.A.2) as** they enter their own data into the system and use Ag Experience Tracker (AET) System or equivalent utilized to track SAE project. | |
| **Industry Standards and/or Competencies**: National Council for Agriculture Education  **Agriculture, Food, and Natural Resources (AFNR) Standards: Natural Resource Science (NRS)​**   * NRS.03. Develop plans to ensure sustainable production and processing of natural resources. * NRS.03.01. Sustainably produce, harvest, process and use natural resource products (e.g., forest products, wildlife, minerals, fossil fuels, shale oil, alternative energy, recreation, aquatic species, etc.).   + NRS.03.02.01. b. Apply cartographic skills and tools and technologies (e.g., land surveys, geographic coordinate systems, etc.) to locate natural resources. Create GIS maps that show different projects in a forest and the ongoing results of those projects.     **AFNR Cluster Skills**   * CS.01.05.  Awareness: Desire purposeful understanding related to professional and personal activities. * CS.05. Describe career opportunities and means to achieve those opportunities in each of the Agriculture, Food & Natural Resources career pathways.   Level 2   * CS.01.05.01.b.  Analyze the impact of trends and issues on the community.   Level 3   * CS.01.05.01.c.  Articulate current issues that are important to the local, state, national and global communities. * CS.01.05.02.c.  Perform leadership tasks associated with citizenship.     **Career Ready Practices Strand**   * CRP.01.03. Identify and act upon opportunities for professional and civic service at work and in the community. * CRP.02.01. Use strategic thinking to connect and apply academic learning, knowledge, and skills to solve problems in the workplace and community. * CRP.04.01. Speak using strategies that ensure clarity, logic, purpose, and professionalism in formal and informal settings. * CRP.04.02. Produce clear, reasoned, and coherent written and visual communication in formal and informal settings. * CRP.10.01. Identify career opportunities within a career cluster that match personal interests, talents, goals and preferences.   **SAE**   * SAE.01.01   Students will establish and conduct Supervised Agricultural Experience Projects (SAE).   + SAE.01.01.b.     Explain the benefits of SAE projects to skill development, leadership and career success.   + SAE.01.01.c.     Explain the connection between SAE and FFA.   + SAE.01.01.d.     Explain the five types of SAE. (Entrepreneurship, Placement, Research, Exploratory, Improvement)   + SAE.01.01.e.     Explore ideas for SAE projects.   + SAE.01.01.f.      Explain how SAE projects support academic achievement.   + SAE.01.01.g.     Select and establish an SAE project.   + SAE.01.01.h.     Explain and keep records on established SAE projects.   + SAE.01.01.i.      Explain SAE project Supervision, visitation and assessment.   + SAE.01.01.l.      Explain the three-circle concept for SAE, FFA Leadership, Classroom/Laboratory in an Agriculture Education Program. | |