MARITIME HIGH SCHOOL
INTEGRATED PROJECT DESIGN PLANNER

1. Project Overview

Use this planner in conjunction with the MHS Project Design Rubric to ensure your project design contains the essential elements of a high quality PBL project.

	Focus Area(s)	Quarter	Number of Weeks	Start Date	End Date
Project Focus Area & Timeline	**Climate change, fisheries, and aquaculture**	**Q1**	**10**	**9/6/22**	**11/10/22**

Project Title	**Fisheries management and aquaculture**
Driving Question(s)	What is the difference between fisheries and aquaculture? What are the environmental requirements of a specific aquaculture species? What are the different aquaculture systems and methods? What important nutrients and feed are needed for a specific species? What career pathways are connected to aquaculture? What are PNW treaty fishing rights and how did people take action during the Fish Wars? What was the Boldt Decision and why is it important? What kinds of actions can lead to justice? What are indigenous aquaculture practices and how are they re-emerging in modern times? How is the climate changing and how is that impacting marine organisms and the communities that rely on them?
Project Summary	Students will learn about the history and practices of fisheries management and aquaculture in the Puget Sound region, and how these practices have evolved over time. Through fieldwork experiences and in-class lessons, they will explore the life cycle and ecological role of various fish, shellfish, and macroalgal species, and the role they play in local food systems, both of the Indigenous tribes and commercial industries. Climate change is a current threat to many of these species, in many cases exacerbated by previous choices around land and water management (dams, deforestation, eutrophication, etc). Students will explore the impact of a changing climate on a species of their choice in a controlled laboratory setting, and relate their observations to (a) physical, biological, and chemical conditions and cycles in Puget Sound; (b) commercial uses and traditional lifeways; and (c) projected climate change impacts. Throughout the project students will have the opportunity to interact with professionals in the aquaculture industry, commercial fishing, and ecological restoration spheres, using their expertise both as a resource for learning as well as a feedback mechanism. By the end of this project, students will choose a potential location and shellfish species for a new hatchery by comparing experimental lab data around climate change and overlay on different regional data in Puget Sound, and include recommendations for mitigating the effects of climate change Both fin fish and shellfish species play an important food, commercial, and cultural role for many of the inhabitants of the Salish Sea. The shellfish farming industry creates thousands of jobs and produces more than $100 million in revenue in Washington State, and Washington State is the country's top producer of several farmed shellfish species. In addition to the commercial hatcheries and shellfish farms, several tribes in the region farm shellfish, and even more rely on both fish and shellfish for their livelihood as well as culture and sustenance. Commercial fish farms, in the form of open water fish net pens, have been a source of antagonism between commercial industry and conservationists. Our goal through this project is for students to understand the range of relationships people of this region have with fish and shellfish (and what happens when these relationships lead to different needs/desires), what equitable access to resources means, and how to mitigate

the effects of climate change for the ongoing health and sustainability of fish and shellfish populations, as well as the process for developing a new aquaculture/shellfish farming business.

Finally, the Puget Sound region is one of complex oceanographic behavior, demonstrating significant seasonal and regional variability, particularly in pH, temperature, salinity, and dissolved oxygen content. Land use changes such as logging, development, and farming, and the accompanying addition of excess nutrients into the basin, can have significant impacts on marine organisms across different trophic levels (levels of the food web). Because both fish farming and shellfish farming occur within the context of the marine environment, they are both susceptible to marine conditions and also contribute to changes in the environment, sometimes positive and sometimes negative. Our goal is that this project will allow students to understand not only the basic structure of the marine environment and the life cycle of various species of farmed shellfish, but also how different farming practices interact with their environmental context, and how these in turn affect human relationships with the environment and each other.

From STEM Project: Aquaculture, the farming of aquatic plants and animals, is an ancient form of agriculture that has seen a meteoric rise in the past 30 years. Today, aquaculture accounts for >50% of all seafood eaten in the US. The vast majority of aquaculture products come from Asia; seafood imports in America amount to the second-largest trade deficit behind only oil. Despite the imbalance, domestic aquaculture is also the fastest growing sector of agriculture in America. This burgeoning industry will drastically change the way we conceptualize marine resources in the coming decades, and the next generation of regulators, farms, and farmers will dictate whether this industry is a burden or a boon to aquatic ecosystems.

From Humanities Project: Despite treaty laws that legally protected lifeways of Pacific Northwest Nations, Native communities faced immense challenges to abandon their "usual and accustomed" fishing grounds. In response, Native communities petitioned the United States government to honor treaty language. The Fish Wars of the 1960s and 1970s were pivotal in enforcing treaty fishing rights. Students will gain an understanding of the historical and ongoing issues with treaty rights and fisheries, as well as the practices, traditions, and culture around commercial fishing. Students will also examine Indigenous aquaculture systems that have existed for millennia, continue to unite cultural practices and ecosystems, and deepen place-based food connections throughout the Pacific. We will examine past aquaculture practices that influence current practices. As students work on their project for a potential location and shellfish species for a new hatchery, we will focus on professional writing and presentation skills.

Public Product(s) (Individual and Team)

Note which products are individual or team and the product/performance's intended audience.
Group presentation on proposed aquaculture plan (site, organism, environmental context)-Shark Tank Style to live audience
Business plan for proposed aquaculture plan (TBD?)

Important Documents

Initial Brainstorming Document Link: Aquaculture/Fisheries Project

Authentic Connections

Field Work Experiences	Community Collaborators & Industry Contacts (Some options)
2022: Fisherman's terminal Industry Panel Issaquah Hatchery Ballard Locks NOAA Manchester (Pacific Hybreed Hatchery, Puget Sound Restoration Fund, NWFSC) Poverty Bay Shellfish Panel Salish Seas Expedition (Schooner Zodiac) MaST Center/Redondo Beach Water Quality testing	**FWE Collaborators (2022):** Paul McElhany, NOAA Bill Dewey, Taylor Shellfish Molly Jackson, Taylor Shellfish Jeremy Esposito, Pacific Hybreed Todd Hunsdorfer, King County Poverty Bay Aquaculture manager David Winfrey, Puyallup Tribe University of Washington Shellfish Researchers Amanda Carr, PlaucheCarr Environmental attorneys

Future: Farm/hatchery tours (through Pacific Coast Shellfish Grower's Association (PCSGA) or Taylor Shellfish) Shellfish packing facility/restaurant Smith Cove and/or other restoration site Research labs (UW?)	Jeremy Walls, King County Water and Land Resources Karina Martija-Harris, Maritime Blue **Other collaborators (2022):** Sara Smith, Bellingham Technical College Molly Jackson, Taylor Shellfish Rachel Wold, NANOOS (UW APL) **Future (?):** Aimee Christy (Pacific Shellfish Institute) Sam Klein (Pacific Coast Shellfish Growers Association) SeaPotential

2. Learning Goals

Use this section to outline the competencies that the project will target (according to the MHS competencies), as well as the content knowledge, skills, and dispositions that align with each of those competencies. There is space for STEM, Humanities, and Maritime. If Math, Spanish, or other subject areas are involved in project, add a column for those subjects.

Subject Area	STEM	Humanities	Maritime
Competencies MHS competencies	Scientific reasoning *-This goal is to think like a scientist : to use empirical evidence, numerical or qualitative data from your own or others' observations, and logical processes to make decisions, evaluate hypotheses, and develop informed conclusions.* *-Understand and apply essential concepts, theories, relationships and experimental processes of a particular field of science; investigate, through research and inquiry, important principles, theories, and relationships from a field of science.* Mathematical Reasoning *-Create, interpret and use appropriate models to make predictions, analyze relationships and draw inferences from data.*	Social reasoning *-Investigate the dynamic relationships between ecological and human systems & ways of life.* *-Examine political and social systems: historical context, effects on individuals & society; rights & responsibilities.* Communication –Gather, synthesize, and cite information from accurate and relevant sources across multiple media. -Present work in various contexts. Receive and respond appropriately to feedback.	See below
Knowledge, Skills, and Standards	-Climate change effect on ocean -Life cycle of fish, shellfish -Impact of climate change on fish/shellfish -Environmental effects of fish/shellfish farming -Create and interpret data and figures from scientific research -Data analysis: interpreting graphs and plots, graphing and analyzing experimental/ observational data (using basic statistics) (in class experimental data, fisheries data, oceanographic data) -Support claims using data	-Treaty rights/lifeways around fishing/shellfish -History of aquaculture, fishing, and treaty rights -Legislative pathways for environmental protection -Socially responsible business/innovation -Permitting process for aquaculture -Synthesize data from research, experiments, and FWEs to develop a proposal -Formal, informal presentations of learning to mixed audiences	Refer to **Maritime Learner Profile** for Maritime Focus Area content, skills & knowledge (see below)
Dispositions	Curiosity	Ethical behavior and civic responsibility	

Identity[1] How will your teaching help students learn something about themselves and/or others?	Learners will explore their role as a member of a particular human community as well as a human who is part of a complex environmental system. Humans are an integral part of the environment, who both affect and are affected by climate change.
Criticality[1] How will you engage your thinking about power, equity, and anti-oppression in the text, in society, and in the world?	Learners will identify issues of equity in the management of fish and shellfish populations, including who has access, whose voice/knowledge is respected, and who is most susceptible to climate change impacts, and incorporate this understanding into their final products.
Elements of **Maritime Learner Profile** for Maritime Focus Area content, skills & knowledge, authentic experiences, etc:	• *Visit a shellfish farm or hatchery, Salmon hatchery, Marine Science & Technology Center (MaST) (Authentic Experience)* • *Effectively utilize analytical, writing, and critical thinking skills to develop logical arguments supporting a point of view (Skills, Law and Policy)* • *Climate change & adaptation & resilience, ocean acidification (IOOS/NANOOS), emissions reduction, fisheries, energy (renewable/efficiency), marine debris, sea level rise, circular economy (Skills and Content Knowledge, Sustainability Thread)* • ***Biological Systems:** Learn how physical processes impact biology in the marine ecosystem and different components of biodiversity (major Puget Sound habitats, biodiversity - genetic/species/population, environmental pressures, food web, nutrient cycling, carbon cycling, erosion process, & shoreline drift) (Marine Resources/Research content knowledge)* • ***Intersectional Environmentalism:** exploring issues around distribution and access to resources (equal vs equitable) (Marine Resources/Research content knowledge)* • *There will be additional elements related to what appears in the Maritime Learner profile (eelgrass/Kelp surveys/monitoring, classroom discussions/poster sessions, ability to work as a team, understanding there are many perspectives on use of a resource, etc.* • *Aquaculture - select a site for a shellfish farm in Puget Sound* • *Local jurisdictions, municipal codes, permits* • *Tribal treaties, federal and state laws and court decisions governing and affecting treaty rights*

RUBRICS	Link/name rubric(s) you intend to use; template for your use

3. Project Milestones

Directions: Use this section to create a high-level overview of your project. Think of this as the broad outline of the story of your project, with the milestones representing the significant **'moments'** or **'stages'** within the story. As you develop these, consider how the inquiry process is unfolding and what learning will take place. The Project Calendar (Section 5) will allow you to build out the milestones in greater detail. You may have more than 6 milestones, in which case make an additional copy of the chart below.

Milestone: an action or event marking a significant change or stage in development

Artifact: an object made by a human being, typically an item of cultural or historical interest.

Milestones, Assessments & Artifacts (STEM)

Milestone #1 Consider indicating if this is tied to team or individual learning/products	**Milestone #2**	**Milestone #3**	**Milestone #4**	**Milestone #5**	**Milestone #6** Public Product
Who eats fish and shellfish? How do they contribute to the global economy and global food sources?	How do we select a site for a shellfish hatchery that might operate for 30+ years?	How does stock improvement use knowledge of genetics to develop more robust species? (this ties to both in class genetics activities as well as the FWE to Manchester)	Methods for aquaculture (including an introduction to indigenous aquaculture)	Laboratory experiment about shellfish feeding rates (?) in relation to a oceanic variable impacted by climate change (pH, temperature, salinity, nutrients)	Students work as a group to craft a proposal for an aquaculture business, including species and location.
Key Student Question	**Key Student Question**	**Key Student Question**	**Key Student Question**	**Key Student Question**	**Key Student Question**
	How is the climate changing? How does climate change affect the ocean? What is the regional variability in Puget Sound conditions? How do these conditions affect shellfish?	What are genes? How is DNA passed from parent to offspring? How do we select organisms with the preferred genes? How do populations grow and change? How do humans interact with these populations to influence these changes?	What are the lifecycle stages of fish and shellfish?	How does the changing climate affect marine species? How do filter feeders eat? How does filter feeding affect water quality (ties to water quality testing at Redondo beach AND previous water quality projects)	
Formative Assessment(s)	**Formative Assessment(s)**	**Formative Assessment(s)**	**Formative Assessment(s)**	**Formative Assessment(s)**	**Summative Assessment(s)**

[1] Muhammad, Gholdy. *Cultivating Genius: An Equity Framework for Culturally and Historically Responsive Literacy*. Scholastic, 2020.

This would be a good opportunity to develop ideas for the final project.	After doing an exploration of data in Puget Sound, students will research the requirements for a particular shellfish species and look for possible locations where they could live successfully.	Suggest ideas for a shellfish breeding program?		Students will draft preliminary observations from their experiments to share with expert scientists (grad students/postdocs from UW); they will then revise their experiment based on feedback and perform it again.	Students will present their proposal for an aquaculture species, including site location, species susceptibility to climate change, and experimental data.

Milestones, Assessments & Artifacts (Humanities)

Milestone #1 Consider indicating if this is tied to team or individual learning/products	**Milestone #2**	**Milestone #3**	**Milestone #4**	**Milestone #5**	**Milestone #6** Public Product
Introduction to Western Washington treaties: what are they, what do they do, and are (or how are) they enforced?	Native 360 Curriculum (Fish Wars)	Practices, Traditions, and Culture Around Commercial Fishing	Indigenous Aquaculture systems	Shellfish permitting and business planning: how do you develop an idea for a new business and do tasks like permitting?	Students work as a group to craft a proposal for an aquaculture business, including species and location. Present business plan to community members and stakeholders
Key Student Question	**Key Student Question**	**Key Student Question**	**Key Student Question**	**Key Student Question**	**Key Student Question**
	What is the history of treaty and fishing rights in Washington? How have climate change and fisheries management affected tribal access to fish and shellfish?				
Formative Assessment(s)	**Formative Assessment(s)**	**Formative Assessment(s)**	**Formative Assessment(s)**	**Formative Assessment(s)**	**Summative Assessment(s)**

4. Project Calendar

Use this space to connect milestones from above to specific dates, competencies, industry connections, and more details. There is space to plan both in-class and during Field Work Experiences (FWEs), but not all projects will be fully integrated between the two.

Week		Dates	Topic(s)	Competency(ies)	Industry Connection (if any)	Students will…	Deliverable(s)
1	In-class	9/6-9/10	Project Intro Why are fisheries important? What is the history of treaty rights in WA?	Scientific reasoning Social reasoning	Shellfish industry	Generate questions related to the project (knows, need to knows, next steps) (If we use the PBL approach)	List of Need to Knows for the project (if we use the PBL approach)
	FWE 1	9/7	Fisherman's Terminal		Maritime professionals (panel at Fisherman's terminal)	Ask questions to a panel of fishing industry experts	Panel questions, answers
	FWE 2	9/8	Issaquah Hatchery		Hatchery tour	Record observations and questions at a fish hatchery	Hatchery observations (life cycle, etc) Panel questions, answers
2	In-class	9/12-9/13	Fisheries statistics: what are people eating? How are fin fish and shellfish farming similar and different? Native 360: Agency and Action				
	FWE 1	9/14	Maritime Days				
	FWE 2	9/15	Maritime Days				
3	In-class	9/19	Introduction to climate change and ocean acidification Native 360: Taking Action				
	FWE 1		Maritime Days				
	FWE 2		Maritime Days				
4	In-class	9/26	Practices, traditions, and culture around commercial fishing and shellfish methods			Learn about different fishing and aquaculture methods (if we keep this, might make sense to move it earlier to closer to relevant FWEs)	
	FWE 1		Puget Sound data intensive (Group A)			Analyze data from Puget Sound to select a potential hatchery site for a sample species	

	FWE 2		Schooner Zodiac (Group B)			Salish Sea Expeditions	
5	In-class	10/3	Growth and reproduction and environmental effects				
	FWE 1		NOAA Manchester: Salmon restoration, Puget Sound Restoration Fund, Pacific Hybreed, UW (Roberts Lab) clam ocean acidification		Commercial shellfish growers (as well as "pure" science and restoration)	Visit different facilities related to scientific research about fish and shellfish for commercial, restoration, and scientific purposes	
	FWE 2		MaST Center, Redondo Beach water quality testing		Government water quality monitoring	Test water quality at beach (e. coli samples), visit aquarium to learn about different marine organisms	
6	In-class	10/10	Shellfish genetics			Learn how traits are inherited and passed down	
	FWE 1		Shellfish panel (on campus after PSAT)		Commercial and scientific shellfish activities	Ask questions to a panel of shellfish industry experts and scientists	
	FWE 2		Prep for Community Learning Showcase				
7	In-class	10/17	Practices, traditions, and culture around commercial fishing and shellfish methods			Learn about different fishing and aquaculture methods (if we keep this, might make sense to move it earlier to closer to relevant FWEs)	
	FWE 1		Puget Sound data intensive (Group B)			Analyze data from Puget Sound to select a potential hatchery site for a sample species	
	FWE 2		Schooner Zodiac (Group A)			Salish Sea Expeditions	
8	In-class	10/24	Prep for Wetlab Indigenous Aquaculture Systems			Design an experiment to test how different water conditions affect oyster feeding	
	FWE 1		Wetlab setup (2 days)				
	FWE 2						
9	In-class	10/31	Experiment revisions and data analysis			Analyze data and make changes to experiment	
	FWE 1		Wetlab (revised experiments, 2 days)				
	FWE 2		Shellfish permitting with Amanda Carr (environmental lawyer) Business startup with Karina Martija-Harris (Maritime Blue)				

10	In-class	11/7	Finaliz business plans				
	FWE 1		Business plan presentations			Present their business plans to a panel of experts	
	FWE 2		Project reflection				

5. Teacher & Student Assessment and Reflections

Before **implementing the project, use this project design rubric to self-assess your project design based on the seven essential components of PBL. If possible, bring in students, educators, and industry professionals during this pre-assessment process to enhance your project. Protocols that can be used during this peer assessment process include:**

I like, I wish, I wonder… | Seven Minute Project Tuning | Project Zero Visible Thinking

During **and** ***after*** **the project implementation, use the space below to record reflections that will help inform the next iteration of the project and ensure we center student voice.**

	Educator Reflections	**Maritime Industry Reflections**	**Student Reflections**
Reflections from this project	Link to 2022-23 STEM Project outline Link to 2022-23 Humanities Project outline From Rosalind: the oyster experiment was cool and students learned a lot, but it would have been more effective if we had started caring for the oysters earlier, using real seawater, and possible with some expert help on how to care for them. From Rosalind: Don't necessarily need a 2-week oyster lab because takes a lot of expertise to maintain oysters and this was stressful for teacher (Ros) and the main takeaway for students was that filter feeding is cool…and don't need a 2 week lab for that.	At the end of the project, industry/scientific collaborators completed a feedback form. Results of that form are HERE.	
Proposed changes for next year	More genetics/life cycle biology: in 2022-23 a group came from UW to do a genetics lesson, but it didn't go into as much depth as we hoped, so we definitely want a revamped version of that for next year. Currently working with a team from NOAA to develop what that could look like. From Rosalind: Would recommend a deeper focus on genetics in this unit. Start at fish hatcheries and learn about how they use genetics to learn where fish come from, maybe get some fin clips from them and do a lab around genetics, learn what genes are and how genetics are involved, then use this knowledge as they go to shellfisheries and learn how they use genetics in their businesses. Also connects to breeding oysters and other shellfish.		

6. *Optional*: Lesson Planner (Supporting Resource)

Specific daily lesson planning templates are often teacher-driven and so this template offers an *optional* framework to follow: Maritime High School Lesson Planning Template.
Feel free to use it, adapt it or create your own.
Typically, lesson plans include: learning objectives/standards (ie. "I can…" statements), procedure/instructional methods, materials needed, time management, assessments, rubrics and reflection.

I. **CHECKING PRIOR KNOWLEDGE** Identify how you will inventory student knowledge ahead of the task, lesson, or activity. (e.g., previous day's exit tickets, warm-up activity, need to know list review, quiz, class discussion, etc.)

II. **LEARNING OUTCOME** These can be related to success skills or standards. If your district uses a graduate profile or career pathway outcomes, include relevant outcomes here as well.

III. **KEY VOCABULARY** Note which terms or academic vocabulary will be essential to this lesson. If you serve English language learners, consider what additional vocabulary might be necessary for them to access the content/skills during the instructional activities.

IV. **FORMATIVE ASSESSMENT** For each lesson, consider which assessment type best measures the learning outcome. For example, a quiz may be the best way to check for understanding of key terms while an annotated sketch might be best for determining student understanding of how the key terms fit together. In some cases, your assessment may be informal, such as an exit ticket, or more formal, as in a rough draft. Finally, when planning your formative assessment, diversify who is doing the assessment. Include self, peer, and teacher assessment opportunities, as appropriate for the age group. When possible, have external partners or end users provide feedback to improve or guide the work.

V. **MAJOR INSTRUCTIONAL ACTIVITIES** This can include lessons, tasks, activities, or learning experiences. Choose the instructional method that will best help students achieve the learning outcome. For example, a direct instruction lesson may be appropriate for introducing the key players in World War II while an artifact inquiry activity during which students examine primary source documents would be better suited for them to understand the impact of those key players on the pivotal events

during the war. This would also be the space to include teaching and learning related to classroom culture, student collaboration, and/or project management tools or skills, as appropriate for students or project milestone needs. Included links show examples of such activities.

VI. **SCAFFOLDS** Scaffolds are intended to be temporary supports that are removed when students no longer need them. These scaffolds can be used to support either content or the project process (e.g., need to know questions). Leverage "checking prior knowledge" to ensure you are offering the right scaffolds to the students who need them. Be sure to consider a wide range of needs, such as literacy skills, language acquisition levels, auditory/visual processing, building schema, learning style preferences, academic performance levels, etc.

VII. **REFLECTION** How will students reflect on their thinking, process, or learning?

VIII. **STUDENT NEED TO KNOW QUESTIONS ADDRESSED** Which student questions will be answered, or are you aiming to answer, during this instructional activity?

IX. **TOOLS/RESOURCES** Student-facing tools, human resources such as experts or community members, teacher tools, equipment, etc.

7. Additional Supporting Resources