



## Board/Authority Authorized Course Framework Template

<b>School District/Independent School Authority Name:</b> Abbotsford School District	<b>School District/Independent School Authority Number (e.g. SD43, Authority #432):</b> SD34
<b>Developed by:</b> Glenda Dyck	<b>Date Developed:</b> March 2018
<b>School Name:</b> Abbotsford Virtual School	<b>Principal's Name:</b> Brad Hutchinson
<b>Superintendent Approval Date (for School Districts only):</b> Dec. 5, 2018	<b>Superintendent Signature (for School Districts only):</b>
<b>Board/Authority Approval Date:</b> Dec. 1, 2018	<b>Board/Authority Chair Signature:</b>
<b>Course Name:</b> BAA Marine Science 11	<b>Grade Level of Course:</b> 11
<b>Number of Course Credits:</b> 4	<b>Number of Hours of Instruction:</b> 120
<b>Course Code:</b> YRNR-1A	

**Board/Authority Prerequisite(s):** It is recommended that students have completed Science 10 prior to taking this course.

**Special Training, Facilities or Equipment Required:** None

**Course Synopsis:**

Marine Science 11 is an introduction into mysterious world below the ocean's surface. Scientific inquiry, measurement, research and problem solving will be used to increase knowledge and understanding of Marine Science. The concepts will focus around the aquatic cycles, structures and processes that generate and sustain life in the ocean.

**Goals and Rationale:**

Through this course, students will:

1. Develop an understanding of the field of marine science and the contributions marine scientists make in promoting marine health.
2. Develop an understanding of the science of marine ecosystems and the organisms that live within it.
3. Develop an understanding of the impacts that humans have on the global and local marine environments.
4. Develop an understanding of the influence that Indigenous ways and knowledge have on marine science.

The oceans provide a significant source of oxygen that is essential for life and they are crucial in the capture and storage of carbon dioxide. As residents of the Fraser Valley living and interacting with one of the world's vast oceans we have an opportunity to ensure the health of our ocean for generations to come. This course will provide students with the scientific knowledge to understand the unique biome found in the ocean and how humans can impact that biome both positively and negatively. A deeper connection to marine science will instill a greater sense of responsibility in our students. Furthermore, no course currently exist in our district that focuses on this topic. Marine Science 11 will fill this gap and provide our Abbotsford students with the opportunity to gain a deeper connection to our surrounding environment.

**Aboriginal Worldviews and Perspectives:**

Studying and learning about Marine Science creates a sense of connection. It is important that people feel they are a part of something and that it is a part of them in order to preserve it. Indigenous knowledge is very valuable in marine conservation. Through story the history of Indigenous peoples in relationship to marine science can be told and the knowledge used for future conservation.

- Learning ultimately supports the well-being of the self, the family, the community, the land, the spirits, and the ancestors. Students will evaluate how the environment and personal health are related.
- Learning involves recognizing the consequences of one's actions. Students will examine the consequences of the choices that we make as a society and the direct impact it has on the oceans and marine life. Through this course, students will come to reflect on the choices they personally make and the impacts it might have

- Learning involves generational roles and responsibilities. Students will compare and contrast the past and future of marine science in this course.
- Learning recognizes the role of indigenous knowledge. Students will investigate the role of indigenous knowledge in the preservation of marine environments ([Marine Planning](#)).

**BIG IDEAS**

Water is a dominant feature on the Earth’s surface and it is essential for life.	The ocean is the world’s biggest biome full of life	Humans can impact the ocean both positively and negatively	Marine Scientists seek to understand and positively impact marine life
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**Learning Standards**

Curricular Competencies	Content
<p><i>Students are expected to do the following:</i></p> <p><b>Questioning and predicting</b></p> <ul style="list-style-type: none"> <li>● Demonstrate a sustained intellectual curiosity about a scientific topic or problem of personal interest</li> <li>● Make observations aimed at identifying their own questions, including increasingly complex ones, about the natural world</li> <li>● Formulate multiple hypotheses and predict multiple outcomes</li> </ul> <p><b>Planning and conducting</b></p> <ul style="list-style-type: none"> <li>● Assess risks and address ethical, cultural and/or environmental issues associated with their proposed methods and those of others</li> </ul> <p><b>Processing and analyzing data and information</b></p> <ul style="list-style-type: none"> <li>● Experience and interpret the local environment</li> <li>● Apply First Peoples perspectives and knowledge, other ways of knowing, and local knowledge as sources of information</li> <li>● Construct, analyze and interpret graphs, models and/or diagrams</li> <li>● Seek and analyze patterns, trends, and connections in data, including describing relationships between variables, performing calculations, and identifying inconsistencies</li> <li>● Use knowledge of scientific concepts to draw conclusions that are consistent with evidence</li> </ul>	<p><i>Students are expected to know the following:</i></p> <ul style="list-style-type: none"> <li>● <b>marine science terminology</b></li> <li>● <b>marine science careers and technology</b></li> <li>● <b>marine science ethics</b></li> <li>● marine science cycle</li> <li>● <b>ocean environment</b> development including:                         <ul style="list-style-type: none"> <li>○ biotic and abiotic elements,</li> <li>○ ocean layers and characteristics</li> <li>○ development of watersheds</li> <li>○ balanced and unbalanced ecosystems</li> </ul> </li> <li>● qualities of water                         <ul style="list-style-type: none"> <li>○ <b>behaviour of gases in oceans</b></li> </ul> </li> <li>● <b>freshwater and oceanic water processes</b></li> <li>● <b>First Peoples perspectives and knowledge of ocean processes</b></li> <li>● <b>aquatic populations</b></li> <li>● impacts to ocean environments and ecosystems</li> </ul>

<ul style="list-style-type: none"> <li>● Analyze cause-and-effect relationships</li> </ul> <p><b>Evaluating</b></p> <ul style="list-style-type: none"> <li>● Evaluate the validity and limitations of a model or analogy in relation to the phenomenon modelled</li> <li>● Demonstrate an awareness of assumptions, question information given, and identify bias in their own work and secondary sources</li> <li>● Consider the changes in knowledge over time as tools and technologies have developed</li> <li>● Connect scientific explorations to careers in science</li> <li>● Exercise a healthy, informed skepticism, and use scientific knowledge and findings to form their own conclusions and to evaluate claims in secondary sources</li> <li>● Consider social, ethical, and environmental implications of the findings from others' investigations</li> <li>● Critically analyze the validity of information in secondary sources and evaluate the approaches used to solve problems</li> </ul> <p><b>Applying and innovating</b></p> <ul style="list-style-type: none"> <li>● Contribute to care for self, others, community, and world through individual or collaborative approaches</li> <li>● Design projects with local and/or global connections and applications</li> <li>● Implement multiple strategies to solve problems in real-life, applied and conceptual situations.</li> <li>● Contribute to finding solutions to problems at a local and/or global level through inquiry</li> <li>● Consider the role of scientists in innovation</li> </ul> <p><b>Communicating</b></p> <ul style="list-style-type: none"> <li>● Communicate scientific ideas, claims, information, and perhaps a suggested course of action, for a specific purpose and audience, constructing evidence-based arguments and using appropriate scientific language, conventions, and representations</li> <li>● Express and reflect on a variety of experiences, perspectives, and worldviews through place</li> </ul>	<ul style="list-style-type: none"> <li>○ climate change</li> <li>○ plate tectonics</li> <li>○ <b>water quality</b></li> <li>○ weather systems</li> <li>○ human activity</li> </ul> <ul style="list-style-type: none"> <li>● <b>First Peoples knowledge of climate change and interconnectedness as related to ocean systems</b></li> <li>● <b>nutrient cycles-</b> carbon, phosphorous, nitrogen</li> <li>● <b>fluid dynamics principles</b></li> <li>● <b>food pyramids</b></li> <li>● <b>marine science history</b></li> </ul>
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## Big Ideas – Elaborations

- **Water is a dominant feature on the Earth’s surface and it is essential for life**-including distinct water qualities, water currents and tides, water, carbon and nutrient cycles
- **The ocean is the world’s biggest biome full of life**-including environmental shifts and impacts, populations within ocean layers, adaptations for survival, indigenous knowledge and interactions with marine environments, trophic levels
- **Humans can impact the ocean both positively and negatively**-including human activity impact and influences, connections to personal health, awareness and preservation
- **Marine Scientists seek to understand and positively impact marine life**-including career options, systems of thinking, contributions to scientific and ethical questions, role of technology

## Curricular Competencies – Elaborations

- **Questioning and predicting**-including biodiversity levels, impacts of human activities and decisions on a local marine ecosystem
- **Planning and conducting**-including measuring biodiversity in a local marine ecosystem, data retrieval and research, and technology used to determine health of a local marine ecosystem
- **Processing and analyzing data and information**-including water quality and biodiversity, analyzing data from a local ecosystem study, gross and net productivity of an ecosystem
- **Evaluating**: including ecological footprints, local research compared to traditional marine science knowledge, drawing conclusions based on research
- **Applying and innovating**-including improving biodiversity of a local marine ecosystem, future sustainable practices, restoration projects
- **Communicating**-including advocacy strategies, sharing findings with others

## Content – Elaborations

- **marine science terminology**- marine science, plate tectonics, scientific method, hypothesis, theory, water currents, watersheds, el Nino, water cycle, temperature regulation, tides, freshwater, brackish water, salt water, biotic factors, abiotic factors, carbon cycle, nutrient cycles, climate change, fluid dynamics, hydrostatic pressure, law of conservation of energy, waves, ocean layers, adaptation, marine populations, food pyramids, trophic levels, balanced ecosystems, unbalanced ecosystems, non-renewable resources, renewable resources, aquatic environments
- **marine science careers and technology**- role of technology, approaches and contributions
- **marine science ethics**- including systems thinking, human decision making
- **freshwater and oceanic water processes**-including tides, currents, and how freshwater replenishes ocean water
- **aquatic populations**- including adaptations, identification and monitoring techniques, factors that impact population cycles
- **ocean environment** including freshwater, brackish water, and saltwater ecosystems
- **weather systems**- levels of Earth’s atmosphere, causes of severe weather,
- **fluid dynamics principles**- including the role of hydrostatic pressure, law of conservation of mass, impact of wave interactions
- **food pyramids** including: relationships between organisms, trophic levels, interactions and interdependence
- **marine science history**- including key contributions of individuals

## Recommended Instructional Components: (this list is not exhaustive)

### Big Idea: Water is a dominant feature on the Earth's surface and it is essential for life.

- Direct instruction: understanding fluid dynamics, going with the flow, flow velocity, density, temperature, pressure, law of conservation of energy, measuring heat, wave formation mechanism, reflection, refraction and diffraction of waves and interactions of waves; waves, example of law of conservation of mass turning water into steam, calorimeter, circular motion of waves, waves being diffracted; layer of the ocean, trench,
- Videos (may be paired with a compare and contrast activity, discussion, or reflection): [how plate tectonics work](#) ,[Paul Snelgrove: A census of the ocean](#), [What is a current](#), [el Nino](#), [the water cycle](#), [how tides work](#), [David Gallo: Deep ocean mysteries and wonders](#) , [Laura Robinson: The secrets I find on the mysterious ocean floor](#), [gases in the ocean](#), [How the biggest waves in the world form](#), [Guillaume Nery - The exhilarating peace of freediving](#), [Layers of the Ocean](#)
- Interactive instruction: Quizlet (for terminology), Socrative, Flip Grid, creation of animated gifs (for vocab)
- Note-taking activities: Google Drawings (using a variety of graphic organizers for note-taking activities), sketchnoting strategies, piktocharts to create infographics of content, creation of mindmaps
- Student reflections- in a discussion forum, students will reflect on the following questions/statements:
  - Think about the region in which they live and how it was shaped by plate tectonics as well as whether it is still being impacted by the movement of plates and if so how?
  - Utilize a major news outlet to find an example of a hypothesis that has been recently proven or disproven and share it with the class. Give a brief description of the process by which the scientists reached their conclusion. Provide a link to the article that you use.
- Practical Application:
  - Research project (Features of the ocean) where students will be required to develop questions on at least 5 unique features found within the ocean that they would like to explore further. They will ensure that they also describe the feature and location, provide an image and explain how plate tectonics played a role in the development of the feature.
  - Charting the Cycles - create a presentation of one of the cycles that affects the ocean (water, carbon, nitrogen or oxygen) and create a presentation to explain in detail how the cycle works, be sure to include images and sources. Once the student has a better understanding of the cycle they will then develop hypotheses about how changes can affect their cycles.

### Big Idea: The ocean is the world's biggest biome full of life.

- Direct instruction: use of images showing the earth and its layers, plate tectonics, underwater volcanoes and scientific method; water molecule, globe showing the equator and lines of latitude and longitude, thermal map of the world, thermohaline circulation, ocean currents, el nino, water cycle and the greenhouse effect; impact of gravitational pull on tides, Solomon Island tide erosion, sea-life in the various tidal ecosystems, food chain in the ocean, invasive species and coral reefs; albinism, photosynthesis in the upper layer,

bioluminescence in the deep waters, gigantic squid, simplified food pyramid, barnacles on rock walls, bryozoan and behaviour adaptation, example of symbiotic relationship in the ocean, cod - apex predator, hurricane over the ocean, parasites on a crab;

- Videos (may be paired with a compare and contrast activity, discussion, or reflection): [Edith Widder: Glowing life in an underwater world](#), [David Gallo: Underwater astonishments](#), [Marine Food Webs](#), [Symbiosis: Mutualism, Commensalism and Parasitism](#)
- Note-taking activities: Google Drawings (using a variety of graphic organizers for note-taking activities), sketchnoting strategies, piktocharts to create infographics of content, creation of mindmaps
- Interactive instruction: using Padlet (to document research and findings in a local marine environment) and Socrative (quiz), Quizlet (for terminology)
- Research: local marine ecosystem study, Twitter search for recent research on marine science topics
- Storytelling: use storytelling as a means to bring awareness to a marine science issue
- Student reflections- in a discussion forum, students will reflect on the following questions/statements:
  - The grunion is one example of a species that depends on the tides for its survival. Find and name another example of a species that depends on the tide for its continued existence. Be sure to explain the specific role the tide has in the species' survival.
  - Find an example of an invasive species in your region. You can choose either a plant or an animal. Explain the kind of harm that it causes and what steps are being taken to minimize its impact.
  - What kinds of solutions might address the problems with dying coral reefs? Explain your answer.
  - What kind of adaptation do you think might help increase the population of the dying coral reefs? Explain your answer.
- Practical Application:
  - Relationships in the Ocean - choose a layer of the ocean and explore the roles of organisms in that layer. Include producers, consumers and decomposers and discuss at least seven organisms in the level chosen. Use sound reasoning and scientific evidence to show how the organisms interact with each other. Present through slideshow or video.
  - Creating a trophic cascade - design a new marine species and introduce it into a marine ecosystem. Include the physical description, requirements for the habitat, what the species eats, any natural predators, adaptations that will allow it to compete, the population cycle for the species and explain the impact the species will have on the trophic cascade on all levels in the pyramid. Can present information as a presentation or encyclopedia entry

**Big idea: Humans can impact the ocean both positively and negatively.**

- Direct instruction: use of images showing burning to contain an oil spill, aerial view of oil slick off the Gulf Coast, oil covered bird, seafood at a market, red tide, Plastic in the ocean, carb (invasive species), illegal fishing, releasing ballast water and the right whale; map of early trade routes, Zheng (pioneer of Chinese exploration), Captain James Cook, Jacques Cousteau, Dr. Earle, commercial fishery and fish farming;
- Videos (may be paired with a compare and contrast activity, discussion, or reflection): [Vicki Arroyo: Let's prepare for our new climate](#) , [David Sedlak: 4 ways we can avoid a catastrophic drought](#), [Jeremy Jackson: How we wrecked the oceans](#), [Stephen Palumbi: Hidden](#)



[toxins in the fish we eat](#), [Solutions to human impacts/healthy oceans](#), [PBS Newshour: Turning down the volume on the noise pollution for marine life](#), [Gulf Coast Oil Spill - 5 years later](#) [Kristina Gjerde: Making law on the high seas](#).

- **Current event connections:** Using Google trend or recent newspaper articles, students connect recent events to topics covered in this big idea
- **Interactive instruction:** using Padlet (to document research and findings in a local marine environment) and Socrative (quiz)
- **Note-taking activities:** Google Drawings (using a variety of graphic organizers for note-taking activities), sketchnoting strategies, piktocharts to create infographics of content, creation of mindmaps
- **Research:** local marine ecosystem study, Twitter search for recent research on marine science topics
- **Promotional/Awareness video:** students blog or create promotional or awareness videos about a marine science environmental issue (can be local or global)
- **Storytelling:** use storytelling as a means to bring awareness to a marine science issue
- **Student reflections-** in a discussion forum, students will reflect on the following questions/statements:  
Problems with natural populations do not occur in just marine environments. Find an article discussing a problem with an animal population in your area and briefly describe the issue. If you live near a marine environment, what negative impact is this animal having on the environment? Choose an apex predator on land or sea, and discuss the factors that keep its population in check. Do some research online to determine what seafood in your state might not be safe to eat and explain what problems are common in your region that arise from eating that particular seafood. If you could create a regulation to protect marine environments, what would it be and why?
- **Practical Application:** Research project (Global Warming: Fact or Fiction) where students will be required to formulate multiple hypotheses and predict outcomes before they analyze the evidence for and against global warming from reputable sources and determine whether global warming is science or pseudoscience. They will also explore the First People's knowledge of climate change and apply that knowledge to what they have already learned.

**Big Idea: Marine Scientists seek to understand and positively impact marine life.**

- **Direct instruction:** use of images showing counting pod whales to get samples, satellite tracker on a turtle, oceanographer, coastal engineers, marine scientists, Arctic exploration, ROV, buoys, beach regulation sign;
- **Videos (may be paired with a compare and contrast activity, discussion, or reflection):** [steps of the scientific method](#), [Career - Marine Biologists](#), [October 2013: Mote Marine Aquarium](#), [Zheng He - The Great Voyager](#), [Sylvia Earle: My wish: Protect our oceans](#), [Paul Greenberg: The four fish we're overeating and what to eat instead](#), [Mike Velings: The case for fish farming](#).
- **Note-taking activities:** Google Drawings (using a variety of graphic organizers for note-taking activities), sketchnoting strategies, piktocharts to create infographics of content, creation of mind maps
- **Research:** local marine ecosystem study
- **Student reflections-** in a discussion forum, students will reflect on the following questions/statements:  
Find an example of a marine scientist who has made a significant contribution to the field. Explain who he or she is and the nature of his or her contribution. Find an example of a scientist who is educating the public to raise awareness of a cause. Share your example and

explain how this scientist gets his or her message out there.

Which career in marine biology appeals to you the most? Explain the aspects of the job that you find appealing. If you could create a development in technology to help marine science, what would it be and why?

- **Practical Application:**
  - Exploring Ethics - choose a current ethical issue in marine science, find support for both sides and create a outline with at least five points for each side. Then have the students use those points to write a 1-2 page paper around their ethical view on the matter.
  - Recruiting Marine Scientists - choose a career in marine science to research. Include what the career entails, the education required for that position, the starting salary and the skills needed. Present the information in an informative brochure, infographic or poster that can be used to educate others.

**Recommended Assessment Components: Ensure alignment with the [Principles of Quality Assessment](#)**

Big Idea	Evidence	Curricular Competency	Content	Success Criteria- What Proficient looks like
<p>Water is a dominant feature on the Earth’s surface and it is essential for life.</p>	<ul style="list-style-type: none"> <li>● Research Project on 5 features of the ocean</li> <li>● Charting the Cycles - explore a cycle and hypothesize how changes will affect the cycle</li> <li>● Student Reflections</li> <li>● Quiz-on the layers of the Earth, plate tectonics and the scientific method; geography of the ocean, ocean currents and the water cycle; gravitational pull of</li> </ul>	<ul style="list-style-type: none"> <li>● Demonstrate a sustained intellectual curiosity about a scientific topic or problem of personal interest</li> <li>● Make observations aimed at identifying their own questions, including increasingly complex ones, about the natural world</li> <li>● Assess risks and address ethical, cultural and/or environmental issues</li> </ul>	<ul style="list-style-type: none"> <li>● marine science cycle</li> <li>● ocean environment development including:               <ul style="list-style-type: none"> <li>○ biotic and abiotic elements,</li> <li>○ ocean layers and characteristics</li> <li>○ development of watersheds</li> <li>○ balanced and unbalanced ecosystems</li> </ul> </li> <li>● qualities of water</li> </ul>	<ul style="list-style-type: none"> <li>● I can choose my own areas of interests within a topic</li> <li>● I can generate my own questions of interest based on an experience, observation, or research on a topic related to water</li> <li>● I can effectively decide which questions about water are worthy of further investigation, experimentation, or</li> </ul>

	<p>tides, food chain, layers of the atmosphere, extreme weather and gases in the ocean, understanding fluid dynamics, flow velocity, density, temperature, pressure, law of conservation of energy, measuring heat, wave formation mechanism, reflection, refraction and diffraction of waves and interactions of waves.; ocean layers</p>	<p>associated with their proposed methods and those of others</p> <ul style="list-style-type: none"> <li>Analyze cause-and-effect relationships</li> <li>Communicate scientific ideas, claims, information, and perhaps a suggested course of action, for a specific purpose and audience, constructing evidence-based arguments and using appropriate scientific language, conventions, and representations</li> </ul>	<ul style="list-style-type: none"> <li>behaviour of gases in oceans</li> <li>freshwater and oceanic water processes</li> <li>First Peoples perspectives and knowledge of ocean processes</li> <li>nutrient cycles- carbon, phosphorus, nitrogen</li> <li>fluid dynamics principles</li> </ul>	<p>research using criteria (either self or class developed)</p> <ul style="list-style-type: none"> <li>I can generate multiple hypotheses/outcomes that are relevant to marine science and can provide sound reasons based on prior knowledge</li> <li>I can effectively evaluate hypotheses about the importance of water in a marine ecosystem and determine which have value and are worth pursuing</li> <li>I can provide sound reasoning that links the evidence I find on the importance of water in a marine ecosystem to the hypothesis I have created with relevant scientific principles</li> </ul>
<p>The ocean is the world's biggest biome full of life.</p>	<ul style="list-style-type: none"> <li>Relationships in the Ocean - explore the organisms in one</li> </ul>	<ul style="list-style-type: none"> <li>Construct, analyze and interpret graphs (including</li> </ul>	<ul style="list-style-type: none"> <li>aquatic populations</li> <li>food pyramids</li> </ul>	<ul style="list-style-type: none"> <li>I can accurately record data collect on a marine biome to the</li> </ul>

	<p>layer of the ocean and explain how they interact with each other</p> <ul style="list-style-type: none"> <li>● Research Project on Creating a trophic cascade</li> <li>● Student Reflections</li> <li>● Quiz-on invasive species and coral, tidal ecosystems</li> </ul>	<p>interpolation and extrapolation), models and/or diagrams</p> <ul style="list-style-type: none"> <li>● Use knowledge of scientific concepts to draw conclusions that are consistent with evidence</li> <li>● Analyze cause-and-effect relationships</li> <li>● Demonstrate an awareness of assumptions, question information given, and identify bias in their own work and secondary sources</li> <li>● Communicate scientific ideas, claims, information, and perhaps a suggested course of action, for a specific purpose and audience, constructing evidence-based arguments and using appropriate scientific language,</li> </ul>		<p>correct level of precision (may the use of significant figures)</p> <ul style="list-style-type: none"> <li>● I can search my research and data for patterns, concrete and abstract, that represent what actually occurred in the biome/ecosystem and I can provide relevant reasons to explain those patterns</li> <li>● I can effectively communicate my findings using appropriate scientific language</li> <li>● I can accurately and succinctly articulate my understanding of the concept of biomes</li> <li>● I can effectively communicate my ideas, claims, findings about biomes using evidence-based arguments and representations</li> </ul>
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		conventions, and representations		
Humans can impact the ocean both positively and negatively.	<ul style="list-style-type: none"> <li>• Research Project on Global Warming</li> <li>• Capstone project (lab and research)</li> <li>• Student Reflections</li> <li>• Quiz-adapting to the environment and monitoring populations; food pyramids, threats to populations, competitions, predation, symbiosis, parasites and disease; environmental crisis, pollutions and keeping the environment intact</li> </ul>	<ul style="list-style-type: none"> <li>• Experience and interpret the local environment</li> <li>• Formulate multiple hypotheses and predict multiple outcomes</li> <li>• Apply First Peoples perspectives and knowledge, other ways of knowing, and local knowledge as sources of information</li> <li>• Seek and analyze patterns, trends, and connections in data, including describing relationships between variables, performing calculations, and identifying inconsistencies</li> <li>• Use knowledge of scientific concepts to draw conclusions that are consistent with evidence</li> <li>• Evaluate the validity and limitations of a</li> </ul>	<ul style="list-style-type: none"> <li>• impacts to ocean environments and ecosystems <ul style="list-style-type: none"> <li>o climate change</li> <li>o plate tectonics</li> <li>o water quality</li> <li>o weather systems</li> <li>o human activity</li> </ul> </li> <li>• First Peoples knowledge of climate change and interconnectedness as related to ocean systems</li> </ul>	<ul style="list-style-type: none"> <li>• I can accurately interpret data related to how humans impact the ocean to identify trends</li> <li>• I can make accurate calculations using data gathered about the impacts humans have on the oceans, if necessary, and draw conclusions</li> <li>• I can interpret the data gathered about human impacts on the ocean in different ways</li> <li>• I can evaluate the relevance of data I collect.</li> <li>• I can generate new ideas to solve problems related to human impacts on the oceans and marine life.</li> <li>• I can improve those ideas in future solutions to a human</li> </ul>

		<p>model or analogy in relation to the phenomenon modelled</p> <ul style="list-style-type: none"> <li>● Demonstrate an awareness of assumptions, question information given, and identify bias in their own work and secondary sources</li> <li>● Exercise a healthy, informed skepticism, and use scientific knowledge and findings to form their own conclusions and to evaluate claims in secondary sources</li> <li>● Critically analyze the validity of information in secondary sources and evaluate the approaches used to solve problems</li> <li>● Communicate scientific ideas, claims, information, and perhaps a suggested course of action, for a specific purpose and</li> </ul>		<p>impact on the oceans or marine ecosystems</p> <ul style="list-style-type: none"> <li>● I can identify potential areas of need for improvement in self, others, community, and world</li> <li>● I can report my findings in proper scientific formats and conventions</li> </ul>
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		audience, constructing evidence-based arguments and using appropriate scientific language, conventions, and representations		
Marine Scientists seek to understand and positively impact marine life.	<ul style="list-style-type: none"> <li>● Exploring Ethics</li> <li>● Recruiting Marine Scientists Project</li> <li>● Student Reflections</li> <li>● Quiz-early explorers, and medieval contributions to navigation, ethics of the ocean; careers in marine science, technology and problem solving in marine science</li> </ul>	<ul style="list-style-type: none"> <li>● Contribute to care for self, others, community, and world through individual or collaborative approaches</li> <li>● Contribute to finding solutions to problems at a local and/or global level through inquiry</li> <li>● Consider the role of scientists in innovation</li> <li>● Connect scientific explorations to careers in science</li> <li>● Consider the changes in knowledge over time as tools and technologies have developed</li> </ul>	<ul style="list-style-type: none"> <li>● marine science careers and technology</li> <li>● marine science ethics</li> <li>● marine science history</li> </ul>	<ul style="list-style-type: none"> <li>● I can identify key aspects that are transferable to current marine science issues</li> <li>● I can effectively communicate my findings about Marine Scientists using evidence-based findings</li> <li>● I can make reasoned ethical judgements about issues impacting marine science.</li> </ul>

		<ul style="list-style-type: none"> <li>● Implement multiple strategies to solve problems in real-life, applied and conceptual situations</li> <li>● Communicate scientific ideas, claims, information, and perhaps a suggested course of action, for a specific purpose and audience, constructing evidence-based arguments and using appropriate scientific language, conventions, and representations</li> <li>● Express and reflect on a variety of experiences, perspectives, and worldviews through place</li> </ul>		
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**Learning Resources:**

**Course Resource** -[www.quizlet.com](http://www.quizlet.com), Padlet, Socrative, Google Drawing, Twitter, Google Trend,

**Video Resources**

1. how plate tectonics work <https://youtu.be/kwfNGatxUJI>



2. steps of the scientific method <http://studyjams.scholastic.com/studyjams/jams/science/scientific-inquiry/scientific-methods.htm>
3. Paul Snelgrove: A census of the ocean [https://www.ted.com/talks/paul\\_snelgrove\\_a\\_census\\_of\\_the\\_ocean/up-next](https://www.ted.com/talks/paul_snelgrove_a_census_of_the_ocean/up-next)
4. What is a current <https://oceanservice.noaa.gov/facts/current.html>
5. el Nino <https://oceanservice.noaa.gov/facts/ninonina.html>
6. the water cycle. [https://pmm.nasa.gov/education/sites/default/files/videos/Earths\\_Water\\_Cycle\\_HQ.mp4](https://pmm.nasa.gov/education/sites/default/files/videos/Earths_Water_Cycle_HQ.mp4)
7. Vicki Arroyo: Let's prepare for our new climate [https://www.ted.com/talks/vicki\\_arroyo\\_let\\_s\\_prepare\\_for\\_our\\_new\\_climate/up-next](https://www.ted.com/talks/vicki_arroyo_let_s_prepare_for_our_new_climate/up-next)
8. David Sedlak: 4 ways we can avoid a catastrophic drought.  
[https://www.ted.com/talks/david\\_sedlak\\_4\\_ways\\_we\\_can\\_avoid\\_a\\_catastrophic\\_drought/up-next](https://www.ted.com/talks/david_sedlak_4_ways_we_can_avoid_a_catastrophic_drought/up-next)
9. how tides work <https://youtu.be/KIWpFLfLFB>
10. David Gallo: Deep ocean mysteries and wonders [https://www.ted.com/talks/deep\\_ocean\\_mysteries\\_and\\_wonders](https://www.ted.com/talks/deep_ocean_mysteries_and_wonders)
11. Laura Robinson: The secrets I find on the mysterious ocean floor.  
[https://www.ted.com/talks/laura\\_robinson\\_the\\_secrets\\_i\\_find\\_on\\_the\\_mysterious\\_ocean\\_floor](https://www.ted.com/talks/laura_robinson_the_secrets_i_find_on_the_mysterious_ocean_floor)
12. extreme weather introduction <https://youtu.be/QVZExLO0MWA>
13. gases in the ocean <https://youtu.be/se99OhtzxNE>
14. These robots come to the rescue after a disaster  
[https://www.ted.com/talks/robin\\_murphy\\_these\\_robots\\_come\\_to\\_the\\_rescue\\_after\\_a\\_disaster/up-next](https://www.ted.com/talks/robin_murphy_these_robots_come_to_the_rescue_after_a_disaster/up-next)
15. Jeremy Jackson: How we wrecked the oceans. [https://www.ted.com/talks/jeremy\\_jackson/up-next](https://www.ted.com/talks/jeremy_jackson/up-next)
16. How the biggest waves in the world form <https://youtu.be/ZmBNcVvBUNs>
17. Raymond Wang: How germs travel on planes - and how we can stop them.  
[https://www.ted.com/talks/raymond\\_wang\\_how\\_germs\\_travel\\_on\\_planes\\_and\\_how\\_we\\_can\\_stop\\_them/up-next](https://www.ted.com/talks/raymond_wang_how_germs_travel_on_planes_and_how_we_can_stop_them/up-next)
18. Guillaume Nery - The exhilarating peace of freediving. [https://www.ted.com/talks/guillaume\\_nery\\_the\\_exhilarating\\_peace\\_of\\_freediving/up-next](https://www.ted.com/talks/guillaume_nery_the_exhilarating_peace_of_freediving/up-next)
19. Layers of the Ocean <https://youtu.be/UEh9cx-b8Og>
20. Edith Widder: Glowing life in an underwater world. [https://www.ted.com/talks/edith\\_widder\\_glowing\\_life\\_in\\_an\\_underwater\\_world/up-next](https://www.ted.com/talks/edith_widder_glowing_life_in_an_underwater_world/up-next)
21. David Gallo: Underwater astonishments [https://www.ted.com/talks/david\\_gallo\\_shows\\_underwater\\_astonishments/up-next](https://www.ted.com/talks/david_gallo_shows_underwater_astonishments/up-next)
22. Marine Food Webs. <https://www.sciencelearn.org.nz/resources/143-marine-food-webs>
23. Symbiosis: Mutualism, Commensalism and Parasitism <https://youtu.be/zSmL2F1t81Q>
24. Stephen Palumbi: Hidden toxins in the fish we eat. [https://www.ted.com/talks/stephen\\_palumbi\\_following\\_the\\_mercury\\_trail/up-next](https://www.ted.com/talks/stephen_palumbi_following_the_mercury_trail/up-next)
25. Solutions to human impacts/healthy oceans.  
<https://gpb.pbslearningmedia.org/resource/solutions-to-human-impacts/flipside-science-healthy-oceans-video/#.WhhuYkqnE2w>
26. PBS Newshour: Turning down the volume on the noise pollution for marine life.  
<http://www.pbs.org/video/turning-down-the-volume-on-noise-pollution-for-marine-life-1481070200/>
27. Gulf Coast Oil Spill - 5 years later <https://www.cnn.com/videos/us/2015/04/10/bp-gulf-oil-spill-five-year-anniversary-orig.cnn>
28. Kristina Gjerde: Making law on the high seas. [https://www.ted.com/talks/kristina\\_gjerde\\_making\\_law\\_on\\_the\\_high\\_seas/up-next](https://www.ted.com/talks/kristina_gjerde_making_law_on_the_high_seas/up-next)
29. Sylvia Earle: My wish: Protect our oceans [https://www.ted.com/talks/sylvia\\_earle\\_s\\_ted\\_prize\\_wish\\_to\\_protect\\_our\\_oceans/up-next](https://www.ted.com/talks/sylvia_earle_s_ted_prize_wish_to_protect_our_oceans/up-next)
30. Zheng He - The Great Voyager <https://youtu.be/UPxUZOUUML>
31. Paul Greenberg: The four fish we're overeating and what to eat instead.  
[https://www.ted.com/talks/paul\\_greenberg\\_the\\_four\\_fish\\_we\\_re\\_overeating\\_and\\_what\\_to\\_eat\\_instead/up-next](https://www.ted.com/talks/paul_greenberg_the_four_fish_we_re_overeating_and_what_to_eat_instead/up-next)
32. Mike Velings: The case for fish farming. [https://www.ted.com/talks/mike\\_velings\\_the\\_case\\_for\\_fish\\_farming/up-next](https://www.ted.com/talks/mike_velings_the_case_for_fish_farming/up-next)
33. Career - Marine Biologists <https://youtu.be/DA-xAFOLGpw>

34. October 2013: Mote Marine Aquarium <http://www.pbs.org/video/close-october-2013-mote-marine-aquarium/>

**Additional Information:**

*Sample questions/opportunities to support inquiry with students:*

1. What role do water currents and wind play in shaping climate?
2. How do tides and currents affect ocean and freshwater processes?
3. How do water, carbon and nutrient cycles affect aquatic environments?
4. How does the law of conservation of energy work in a marine environment?
5. What are the measurable properties of waves and what is the impact of wave interactions?
6. How do environmental shifts affect ecosystem?
7. How do the characteristics of a populations change within the layers of the ocean?
8. How is adaptation important for survival in a marine environment?
9. How do the indigenous peoples to identify and monitor marine populations?
10. What role do trophic levels play in how species interact with each other in an marine ecosystem?
11. What are the the factors impacting the aquatic population cycle the most?
12. How does human activity impact/influence marine environments?
13. How does the marine environment impact personal health?
14. How has indigenous knowledge aided in the preservation of marine environments?
15. What role does marine science play in helping society understand human impact on marine environments (currently and historically)?
16. What are the career options found within the field of marine science?
17. How do marine scientists employ systems of thinking and a variety of approaches and contributions to solve scientific and ethical questions in marine science?
18. What is the role of technology in marine science?
19. What is the biodiversity level within a local marine ecosystem?
20. What type of human activities has a marine ecosystem in your local area sustained over the years?
21. How have decisions affected a marine ecosystem in your local area?
22. How can we measure the biodiversity within a local marine ecosystem?
23. What stories describe the human activities that have shaped local marine ecosystems over the years?
24. What tools and technology can you use to determine the health of your local marine environment?
25. What is the relationship between water quality and biodiversity within a local marine ecosystem?
26. Who can you collaborate with to provide additional perspectives that will deepen your understanding of your findings?
27. How can gross and net productivity within an ecosystem be calculated?
28. What other factors can be considered to determine the overall health of a local marine ecosystem?
29. How does traditional marine science knowledge compare and align with your findings/research?
30. How has a community's ecological footprint affected productivity within a marine ecosystem in a local area?
31. What kind of changes can be made to improve the biodiversity of a local marine ecosystem?

32. How can traditional ecological practices inform possible future sustainable practices within a marine ecosystem in your local area?
33. How can you engage in a local marine ecosystem restoration project?
34. How can your findings be used to advocate for the importance of a local marine ecosystem?
35. How can you share the findings with local community groups?
36. How can you share with others what you have learned from your experience with a local marine ecosystem restoration project?