**COURSE OUTCOME:**

* **Course Description**

Marine Ecology is a course that enables students to develop a balanced understanding and appreciation of the marine environment and of the need to manage this vast resource in a sustainable fashion. Students will investigate the following major topics:

* The Ocean Environment and Ecological Principles – Physical, Chemical, and

Biological Factors

* Marine Organisms – Plankton, Invertebrates, Vertebrates
* Marine Ecosystems and Human Impacts
* Marine Resources
* **Hyperlink to local curriculum, state standards, and/or competencies**

**Http://knoxschools.org/cms/lib7/TN01917079/Centricity/Domain/1012/Marine%20Ecology%202013-2014.pdf**

**INSTRUCTION:**

* **Course Topics**

**Unit 1 - Principles of Marine Ecology and the Marine Habitat**

* Define fundamental ecological terms: habitat, niche, ecological levels of organization, abiotic & biotic factors, limiting factors, range of tolerance.
* Identify and describe marine life zones based on light and depth.
* Explain how physical properties (light, sound, temperature pressure) of ocean water vary with depth.
* Relate physical characteristics of the ocean such salinity, temperature, pressure and light absorption to marine life distribution.
* Describe how the Coriolis effect influences ocean currents and marine habitats.
* Identify major ocean currents on a world map.
* Compare and contrast compare abiotic factors of eastern boundary and western boundary currents.
* Identify factors affecting distribution of marine nutrients and gases (upwelling, downwelling) throughout the water column.
* Describe the impact of thermohaline circulation on marine and terrestrial ecosystems.
* Distinguish between the terms pycnocline, thermocline and halocline.

**Unit 2 - The Ocean Floor and Ocean Depths**

* Explain how the theories of continental drift and seafloor spreading support the theory of plate tectonics.
* Compare and contrast plate boundaries: convergent, divergent and transverse and ocean floor features associated with each.
* Describe how satellite altimetry is used to map the ocean floor.
* Explain the ecological significance of seamounts and associated communities.
* Describe the origin and importance of marine sediments to marine studies.
* Distinguish among lithogenous, cosmogenous, biogenous and hydrogenous sediment
* and the distribution of each in the marine environment.
* Compare and contrast hydrothermal vents with cold seep communities.
* Describe the chemical, biological and ecological function of bioluminescence among marine organisms in the ocean depths & bioluminescent adaptations.

**Unit 3 - Marine Organisms and Energy Flow**

* Examine representative organisms from major marine phyla & identify/describe structural adaptations that aid survival in their habitat.
* Distinguish between marine prokaryotes and eukaryotes and examples of each.
* Identify major groups of unicellular phytoplankton and distinguishing characteristics of each: diatoms, dinoflagellates, silicoflagellates, coccolithophores.
* Identify major groups of marine zooplankton and distinguishing characteristics of each (protozoans): foraminiferans, radiolarians, ciliates.
* Explain the differences between meroplankton and holoplankton and adaptive strategies of each.
* Identify and describe major groups of multicellular algae (seaweeds /macrophytes): Chlorophyta, Heterokontophyta (Phaeophyta), & Rhodophyta and the photosynthetic pigments associated with each.
* Distinguish between the light and dark reactions in photosynthesis and the function of accessory pigments in photosystems II & I that contribute to the distribution of marine algae at various depths.
* Identify the general structure and function of seaweeds.
* Describe the general reproductive strategy of seaweeds, and process of alternation of generations.
* Trace and describe how energy flows through marine ecosystems via food chains and food webs and pyramids.
* Describe the significance of chemosynthesis to the marine habitat.

**Unit 4 - Coral Reefs and Community Interactions**

* Identify the characteristics of organisms of the Phylum Porifera and explain the basis for separating sponge classes; identify the composition of supporting structures for each class.
* Describe the major types of body plans of sponges: asconoid, syconoid and leuconoid.
* Identify the cells types and functions of each that are found in sponge organisms (choanocytes, amoebocytes, porocytes, pinacocytes.)
* Describe feeding and reproductive strategies of sponges.
* Explain the ecological and economical importance of sponges.
* Identify the characteristics of organisms of the Phylum Cnidaria and distinguish between the major classes of cnidarians/examples of each.
* Describe the life cycles and reproductive strategies of cnidarian classes.
* Describe the theory of coral reef formation and distinguish between barrier reef, fringing reef and atolls.
* Describe the zones along the coral reef and differences in abiotic factors that affect the distribution of organisms found in each.
* Describe the conditions (abiotic) required for reef formation.
* Evaluate the significance of symbiotic relationships in the structure and function of the coral reef ecosystem (especially between zooxanthellae and cnidarians.)
* Identify common coral reef fish given a picture or diagram.
* Identify and describe the symbiotic relationships of commensalism, parasitism and mutualism.
* Define the role of: keystone species, indicator species, nonnative species, native species.
* Explain the process of resource partitioning in marine communities and its importance in promoting diversity.
* Identify examples of nonpoint source pollution and its impact on the coral reef ecosystem.
* Describe examples of human interference with coral reef function.

**Unit 5 - Rocky Shores**

* Identify the general characteristics of organisms from the Phylum Mollusca and common classes Bivalvia, Gastropoda and Cephalopoda.
* Compare and contrast structures and adaptations of a clam (Bilvalvia) and squid (Cephalopoda.)
* Describe factors that create tides and the types of tides these factors produce.
* Explain how tides impact the communities that develop along rocky shores and adaptations organisms have to cope with variations in abiotic conditions.
* Identify and describe the zones of a rocky shore ecosystem and the variations in abiotic factors and biotic factors of each zone.
* Describe the importance of tidepool communities among the rocky shore ecosystem and conditions within that organisms must be able to tolerate.
* Identify and describe adaptations rocky shore inhabitants have in order to tolerate issues of desiccation, wave shock, temperature change and competition for space.
* Identify community interactions affecting populations along the rocky shore zones (ex. Starfish/mollusks.)
* Recognize the general characteristics of the Phylum Echinodermata and distinguish among major classes.
* Identify the structure and function of a starfish anatomy.

**Unit 6 – Estuaries**

* Distinguish between four basic types of estuaries based on geology as well as mixing patterns of fresh and salt water.
* Identify the variations in abiotic factors that impact organisms adapted to estuarine habitats, comparing and contrasting adaptations to fluctuations in salinity.
* Explain why estuaries are among the most productive marine ecosystems and their importance as a nursery to most marine organism.
* Identify the significance of the Chesapeake Bay as the United States largest estuary and its ecological and economical importance.
* Identify distinct communities associated with estuaries: mudflats, saltmarsh, sea grass, mangroves, oyster reefs.
* Describe why estuaries, of all marine ecosystems, are most affected by humans.
* Describe how oxygen demanding waste impact water quality in a marine habitat using an oxygen-sag curve.
* Describe how bays are impacted by dead zones created from nonpoint source pollution.
* Identify the characteristics of organisms of the Phylum Arthropoda; subphylum Crustacea.
* Describe the life cycle of the Blue Crab.
* Identify the abiotic conditions and preferences of the various stages of Blue Crab and habitat preferences using data from the Chesapeake Bay.
* Identify the general characteristics of chordates/vertebrates and distinguish among the major groups of fishes in terms of structure/function.
* Describe how fish form and tail shape adaptations reflect the niche of a particular fish.
* Describe the general characteristics of fish biology that enables them to successfully inhabit the marine habitat (nervous, digestive, circulatory & respiratory systems.)
* Distinguish between anadromous and catadromous fish.
* Identify behaviors and strategies (coloration) common to fish groups.
* Describe the reproductive strategies of fish groups.

**Unit 7 - Sandy Beaches**

* Identify characteristics of sandy beach ecosystem and impacts of sediment infauna, meiofauna and epifauna.
* Explain how wave action and longshore currents impact shoreline distribution.
* Describe human impacts on sandy beach ecosystems relative to sand erosion, pollution and community structure.
* Describe examples of armoring including pros and cons of each in preventing sand erosion.
* Describe general characteristics of marine reptiles.
* Classify marine turtles: class-order-family and identify common marine turtles given a description or diagram.
* Distinguish between endangered, threatened and extinct organisms.
* Describe the impacts human have on marine turtle populations.
* Describe the general characteristics of class Aves – Marine Birds and unique adaptations to the marine habitat.
* Distinguish between the four major groups of marine birds: tubenoses, penguins, pelicans and gulls and the taxonomic order of each.
* Describe the four major feeding modes of marine birds and examples of marine birds in each category.
* Identify the ecological significance of marine seabirds.
* Explain how resource partitioning among seabirds leads to increased diversity.

**Unit 8 - Polar Regions**

* Compare and contrast the abiotic and biotic factors of the Arctic and Antarctic polar regions.
* Identify the components of a typical polar marine ecosystem food web.
* Explain how stable isotopes in polar ice cores are used to monitor earth’s climate.
* Distinguish between the greenhouse effect and global warming and evidence for and possible impacts of global warming on the marine environment.
* Describe the general characteristics of members of the class Mammalia.
* Identify characteristics of organisms in the orders: Pinnipedia (true and eared seals) Carniovra, Sirenia, Cetacea.
* Compare and contrast the cetacean families: mysticieti and odondoceti.
* Describe the interactions and behaviors within a seal rookery and benefits to the seal population.
* Explain the ecological significance of sea otters as keystone species.
* Describe how some marine mammals are uniquely adapted to dive to extreme depths.
* Identify some of the unique adaptations of marine mammal circulatory, digestive and respiratory systems and the importance of counter-current exchange with marine mammal metabolism.
* Describe the physiology of echolocation used by some cetaceans and how cetaceans interact with their environment through its use.
* Name and identify major marine cetaceans given pictures.
* Explain how human activity impacts marine mammals.
* Identify the impacts of the Marine Mammal Act and the IWC on marine mammal populations.

**Unit 9 - Marine Resources**

* Distinguish between the terms “renewable” and “nonrenewable” resource and examples of each from the marine environment.
* Determine how biodiversity is estimated using species richness and abundance data and why biodiversity is important for sustaining ecosystem structure and function.
* Describe how the concept of the “Tragedy of the Commons” is apparent with regards to current fish populations in the ocean realm.
* Explain how various types of fishing technology impact marine fish.
* Populations and why fishery management is necessary to sustain and improve current crisis in marine fish populations.
* Determine how personal choices impact marine fisheries.
* Identify national/international laws designed to protect fisheries.
* Describe the pros and cons of aquaculture.
* Identify mineral resources and pharmaceutical obtained from the marine environment.
* Identify sources of energy from the marine environment and the pros and cons of each.
* Explain the pros and cons of desalination plants as sources of freshwater.
* Describe the benefits of establishing marine sanctuaries.
* **General Pacing**

Units to be covered are listed in the course topics section of the syllabus. The order in which the material is covered may change slightly over the course of the year.

* **Materials Needed**

\*Spiral Notebook  
\*Folder  
\*Pencils  
\*Loose-leaf paper (no spiral bound)  
\*Colored Pencils

**ASSESSMENT:**

* **Expectations**

Marine ecology students will be expected to master all materials listed in the Tennessee State Standards. Mastery will be determined by chapter and/or unit tests.

* **Grading Policy**

Grades will be determined by accumulation of points.

Grade Scale:

A 93-100

B 85-92

C 75-84

D 70-74

F below 70

* + 85% of the student's grade will be determined by the following:

1. Tests and Quizzes

2. Laboratory Activities

3. Classroom Activities

4. Folders

5. Projects

* + 15% of the student's grade will be determined by the final course exam
* **Make-Up Work Policy/Late Work Policy**

See Student Handbook. All make-up work and late work will be handled on an individual basis by the teacher.

**GENERAL EXPECTATIONS:**

* **Students:**
* **Attendance Policy**

***Attendance policy will follow the Gibbs High School student handbook.***

* **Classroom Policy/Procedures**
* **Classroom Rules:**
  + - Be prepared with all materials daily
    - Follow directions
    - Use class time wisely
    - Be on time
    - Be respectful of teacher and classmates
    - Do your own work
    - Cell phones are not to be a distraction
* **Honor Code / Plagiarism**

Students are expected to do their own work. This includes class work, projects, tests, quizzes, etc. If students are found to be in violation of the Honor Code, a zero will be given on the assignment.

* **Teacher:**
* **Communication Strategy:**
* Students are encouraged to communicate with the instructor any problems they may be having with class content. Students are encouraged to check their grades on the portal frequently to maintain an understanding of what their grade is.
* Parents are encouraged to email the instructor with any questions or concerns at any time.
* **Intervention Strategy:**

Tutoring will be made available by the science department. A schedule will be posted on the school website and distributed to students upon completion.

* **Disclaimers**

This class does not and shall not discriminate on the basis of religion, creed or any other beliefs.

**Email Address: chris.bray@knoxschools.org**

**Phone Number: (865) 689-9130 Ext. 1208**

**If you have further questions concerning the details outlined in this syllabus, I will be glad to discuss them with you. In addition, if you do not approve of a specific resource listed on this syllabus, please make your request to me in writing and an alternative assignment and/or materials will be provided. The request should include your name, the student’s name, the specific activity/materials in which you do not want your student to participate or to which you do not want them exposed, and the nature of your objection.**

**Your signatures below indicate that you have read and understand the course syllabus provided on my school fusion page:**

**Student Signature \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**Parent Signature \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**Parent E-Mail \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**