COURSE OF STUDY GUIDE

LOWER CAPE MAY REGIONAL SCHOOL DISTRICT

TITLE OF COURSE: _____Marine Biology and Oceanography_____

DEPARTMENT: _____Science____ DATE REVISED: _____23 June 2016_____

GRADE: _____11th or 12th_____

I. COURSE ORGANIZATION

Length: _____Full Year Credits: _____5_____

Periods Per Week: _____4_____ Weighted: _____5%_____

Prerequisite: _____Physical Science, Biology and Algebra I_____

II. COURSE DESCRIPTION

Marine Biology and Oceanography class is intended for students interested in a career in the marine field or related science or for students interested about being more informed about the marine ecosystem. It includes the study of the physical and biological aspects of the world ocean and the near-shore environments. The class structure is such that students often work in cooperative groups and spend considerable time in the field. Particular emphasis will be placed on learning the life cycles of various local marine fauna and flora through an extensive system of marine aquariums maintained in the classroom. Academic topics within the realm of physical oceanography include: water chemistry; wave physics; plate tectonics; Tele-connections (El Nino); tides; morphology of ocean basins; coastal processes and human alterations. Academic topics within the realm of marine biology include: microbial life and plankton; marine fungi; multi-cellular primary producers; marine invertebrate zoology; marine fishes; marine mammals; marine reptiles and birds; marine ecology; intertidal zone life; coral reef systems; estuaries; and human impacts on fisheries. Laboratory investigations, with several formal reports, will supplement most topics. Several DVD and video collections will be shown as well.

III. COURSE MISSION

The mission of Marine Biology and Oceanography is to provide an overview of the world ocean and an appreciation of the rich biological diversity that exists within our marine ecosystem. It is believed that through an understanding of the ecology of our marine environment, students will be better prepared to make informed decisions in their careers or lives as citizens.

IV. DEPARTMENT MISSION

The primary goal of the Science Department of Lower Cape May Regional High School is to support the school's mission statement of preparing students to lead successful lives by helping them to: communicate effectively, think critically and creatively, solve problems resourcefully, use technology effectively, work cooperatively, and develop as self-directed learners.

VI. COURSE LEVEL ASSESSMENTS & BENCH MARKS

A) Benchmark I: Marine Aquarium Group Project
1. Apply correct terminology when referring to a marine aquarium
2. Know the Nitrogen cycle and its end product
3. Utilizing resources from the classroom, be able to establish mechanical, biological and chemical filtration
4. Know how to calculate rates of flow
5. Be able to measure, document and understand the physical parameters within the aquarium that support life, such as Ammonia, Nitrite, Nitrate, D.O., pH, Salinity and temperature
6. Maintain a weekly journal that summarizes the activity of the project
7. Collect all marine organisms via various capture methods during field excursions
8. Provide life-sustaining maintenance such as, partial water changes, filter cleaning, feeding and mechanical support
9. Create an educational display that correctly identifies the fauna and flora of the marine aquarium and lists the natural history of each organism. Educate fellow classmates about the display in an oral and visual presentation.

B) Benchmark II: Students will understand the physical aspects of the marine environment.
1. Understand the basic history of marine science including key explorers and expiditions
2. Recognize that major advances in marine science have been tied to advances in technology
3. Marine scientists utilize the scientific method, observation skills, inductive and deductive reasoning.
4. Students will know the interior structure of the earth relative size of the ocean basins
5. Students be able to explain the reason for tectonic plate movements and its impact on the oceans
6. Compare and contrast active plate margins versus passive plate margins, as well as mid-ocean ridges versus trenches
7. Explain why water is considered a polar molecule and the impacts upon its properties
8. Investigate the salinity of seawater samples and explain the composition of its ions
9. Relate the visible light spectrum with the depth of seawater
10. Relate wave height, speed and periodicity mathematically
11. Utilizing terms such as thermocline, explain why tropical water are often clear while temperate water are often opaque
12. Describe the ocean to atmosphere interaction and relate in terms of its impacts upon global climate and weather patterns
13. Create a model of the world's oceans and label all major ocean surface currents and indicate whether it is a cold or warm current
14. Choose a tidal cycle that would be least destructive to humans should a major coastal storm strike and defend your position citing the interaction of major celestial bodies
15. Explain why most tsunamis and earthquakes occur in the Pacific basin

C) Benchmark III: Microbial marine life and primary producers of the sea

1. Perform a qualitative and quanitative analysis lab of local sea water
2. Describe what causes red tides and what organisms are responsible for bioluminescence
3. Create a chart that lists the chemical components of major photosynthetic and light-capturing organisms

4. Collect samples of local seaweeds and organize them in a presentation that is phylogenetically accurate and represents all key groups and their structural components
5. Create a field guide of several members of the primary producers and seaweeds of the Mill Creek estuary and watershed area.

D) Benchmark IV: Multicellular Animal Life In the Marine Environment

1. Decipher between deposit feeding and suspension feeding with specific examples.
2. List and describe several medusa and polyp animals found locally in our bioregion.
3. Dissect one or more mollusks and describe the external and internal anatomy and function.
4. Illustrate the major marine invertebrate phyla and their most important characteristics.
5. Create a diagram that features the key differences between bilateral and radial symmetry.
6. Describe the key aspects of the three classes of marine fishes.
7. Dissect a local cartilaginous species and illustrate the external and internal anatomy with a description of the function.
8. Be able to identify 30 local species of both cartilaginous and bony fishes along with the common and scientific names.
9. Describe fish behavior including feeding, migration, reproduction, schooling and territoriality.
10. What are some advantages and disadvantages of fish that change sex?
11. What are the characteristics of the class Mammalia and what are the key marine Orders within the class.
12. What are the key characteristics of the class Aves and what are the key marine Orders within the class. List several members.
13. Perform a field lab that observes, identifies, and lists behaviors of all birds within the marsh area.
14. List the three marine member orders of the class Reptilia and describe the general geographical distribution and conservation status.

E) Benchmark V: Marine Ecology

1. Create a flow chart that illustrates at least six trophic levels for the Delaware Bay ecosystem.
2. Examine the various rates of primary production based upon different ecosystems found globally.
3. Study a rocky intertidal zone and illustrate the physical changes that occur during changes in tides and the behaviors observed by organisms in response to those physical changes.
4. Create a diagram that represents the role of the Delaware Bay estuary or a smaller salt marsh system, such as Mill Creek, in the migration of shorebirds. Include range maps, diets, and conservation status.
5. View a current DVD or online documentary on coral reef ecosystems. List 10 or more threats humans have caused upon this dynamic environment. What efforts are being done to mitigate this? What groups are actively working toward this mitigation?

VII. POSSIBLE ASSESSMENT TASKS

Written *Oral* *Visual*

VIII. CONTENT/SUGGESTED INSTRUCTIONAL TIME

Content Pacing Guide & Standards

Unit Title: The Marine Aquarium				
Content: Group assignments and specific roles within the group The basic setup of a proper aquarium Mechanical, biological and chemical filtration, Salinity and ions pH Dissolved oxygen The nitrogen cycle Temperature. Students will perform analysis of all parameters throughout the year. Test and vocabulary terms to support several labs.	**Standards** HS-PS1-1 HS-PS1-3 HS-LS1-2 HS-LS1-3 HS-LS2-3	**Disciplinary Core Ideas** PS1-A PS2-B LS1-A	**Crosscutting Concepts** PS2-6 LS1-3	**Time Frame** 2 Weeks, with ongoing projects throughout the year.

		Unit Title: The Science of Marine Biology and Oceanography		
Content: History of Marine Science Career Options Technology and the study of the ocean The Scientific Method Inductive and Deductive reasoning	**Standards** HS-ESS3-1	**Disciplinary Core Ideas** ESS3-A	**Crosscutting Concepts** ESS3-3 ESS3-2	**Time Frame** 2 Weeks

		Unit Title: Physical Oceanography		
Content: The Earth's interior Plate Tectonics The Sea Floor Chemistry of Water Composition of Seawater Tides Surface Currents and Gyres Teleconnections Wave Science Tsunamis	**Standards** HS-ESS2-3 HS-ESS1-5 HS-ESS1-6 HS-ESS2-5 HS-PS2-4 HS-ESS2-4 HS-ESS3-4 HS-PS4-1 HS-ESS3-1	**Disciplinary Core Ideas** ESS2-A ESS2-B ESS2-C ESS2-B ESS1-C PS1-A PS2-B PS2-B ESS2-D PS4-A	**Crosscutting Concepts** ESS3-5 ESS2-7 ESS2-1 PS2-6 ESS2-4 ESS3-5 PS4-4 PS4-5	**Time Frame** 6 Weeks

		Unit Title: Marine Biology			
Content: Marine Microbes- bacteria and plankton Multicellular Seaweeds Halophytic Plants	**Standards** HS-LS1-1 HS-LS1-2	**Disciplinary Core Ideas** LS1-A	**Crosscutting Concepts** LS1-2 LS1-3	**Time Frame** 6 weeks

CHK/smb

Sponges Cnidarians Worms (round, flat and segmented) Mollusks Arthropods Echinoderms Tunicates Jawless fishes Cartilaginous fishes Bony fishes Marine Mammals Marine Reptiles Sea Birds	HS-LS1-3 HS-LS3-1 HS-LS3-3 HS-LS4-1 HS-LS4-2 HS-LS4-4 HS-LS4-5	 LS3-A LS3-B LS4-A LS4-B LS4-C	 LS3-3 LS4-1 LS4-3	

		Unit Title: Marine Ecosystems and Ecology		
Content:	**Standards**	**Disciplinary Core Ideas**	**Crosscutting Concepts**	**Time Frame**
Organization of Communities Energy flow and productivity Ecological Zonation of the Oceans Intertidal Zones Littoral Zones Ecology of Estuaries Coral Reefs Humans use of Marine Resources	HS-LS2-2 HS-LS2-6 HS-LS2-7 HS-LS4-6 HS-ESS3-3	LS2-A LS2-C LS2-D LS4-D ETS1-B	LS2-8 LS4-6 LS2-2	4 weeks

IX. MODIFICATIONS: INCLUSION TECHNIQUES/ENRICHMENTS

Possible instructional techniques may include but may not be limited to the following:

Resource Center – A course of study will be modified t accommodate the specific needs of a special education student as outlined in his/her IEP.
Inclusion – Peer tutoring, computer software, oral tests, visual organizers, study guides, and cooperative learning activities
Enrichments – Field trips, guest speakers, brochure design, simulations, drama, and poetry

Students are provided with a basic text and/or supplemental curricular materials that are used for assigned readings, discussion, and information gathering. Through teacher-directed instructional activities, students are asked to acquire knowledge, develop an understanding of content, apply information to their own lives, analyze data, synthesize material, and make evaluative judgments.

When planning each lesion, teachers select specific objectives, organize material to achieve maximum understanding, make associations, and check for understanding at frequent intervals. Technology materials are used when appropriate. Suggestions for specific assignments and student activities are found in the teacher's resource guide of the approved textbook series.

X. INTERDISCIPLINARY CONNECTIONS/MULTICULTURAL MATERIALS

Videos: *Illustrations:* *Art*

A) Video/ DVDs
1. BBC Blue Planet Series

2. NOVA Series Tsunami and Hurricane DVDs
3. National Geographic Hurricane DVDs
4. PBS Nature "Blue Whale" DVD
5. PBS Nature "Crash: A Tale of Two Species"
6. "Aliens of the Deep" DVD
7. Animal Planet "Ocean's Deadliest" Video

B) Illustrations
1. Chart or spreadsheet that documents chemical parameters of marine aquarium
2. The Sea Floor map project
3. Global Sea Currents and Gyres map project
4. Characteristics of Surface Waves illustration
5. Overhead/ Powerpoint of Active vs. Passive plate margins
6. Chart of major marine invertebrate phyla
7. Illustrated map of local estuary and food webs
8. Illustration of various commercial fishing methods

C) Art
1. Students will compose an educational display that features correct common and scientific names of their marine aquarium inhabitants along with detailed information on the organism's natural history. This can be an artfully designed poster, 3D mobile, display board, etc. Students will then present this project with an informative powerpoint lesson on their marine aquarium.
2. Students have lease to design their marine aquariums in any fashion they would like as long as it represents a general theme about the ecosystem (microcosm) they wish to re-create.

XI. MATERIALS/TECHNOLOGY

A) Text Book and References:
1. Marine Biology, by Castro and Huber, 5th Edition, McGraw Hill Higher Education, Copyright 2005.
2. The Marine Biology Coloring Book, by Thomas M. Niesen, Harper Resource, Copyright 2000.
3. Various field guides and books on natural history. Most are in the media center or the marine science lab shelves.

B) Video/ DVD: as stated above, videos and DVD's relevant to the units and chapter will be shown.

C) LCD Projector/ Laptop Computer:
1. An LCD Projector, along with a laptop computer will be utilized to show notes and illustrations that cannot be drawn on the chalkboard
2. An LCD projector and laptop computer will be used to show short online videos that pertain to chapter information (ie: TED talks).

D) Marine Aquaria

1. 20-30 glass, fiberglass or acrylic aquariums, along with proper filtration will be needed to provide sufficient projects for students enrolled in the program
2. Nets and other collection devices to gather live specimens for the aquariums
3. School Bus and driver to take students to and from collection sites
4. Chemical Testing kits (ie: Marine Lab) and probes to measure physical parameters to sustain life support conditions in the aquariums (ie: dissolved oxygen levels).

E) Dissection Kits
1. Sets of dissection kits for 8 groups of 4 students
2. Dissection pans for small invertebrate animals and larger pans for bony fishes or sharks

F) Microscopes
1. Compound Light Microscope- for microbes chapter
2. Dissecting Microscope- for invertebrate zoology labs