MARINELAB AP ENVIRONMENTAL SCIENCE COURSE

Astronomy/Plankton Tow

Summary: Astronomy will discussed aboard the boat. Discussion will include location of Polaris and how it is used for navigation, idenitificaiton of visible constellations and identification of visible planets. Definition of plankton and types of plankton will also be reviewed aboard the boat and plankton net will be towed. Collected samples will be projected under a microscope in the FCC where species will be identified.

Outline Level 1	**AP.ES.**	Environmental Science Topic Outline
Outline Level 2	**II.**	The Living World
Outline Level 3	**II.A.**	Ecosystem Structure
Outline Level 4	**II.A.1.**	(Biological populations and communities; ecological niches; interactions among species; keystone species; species diversity and edge effects; major terrestrial and aquatic biomes)
Outline Level 1	**AP.ES.**	Environmental Science Topic Outline
Outline Level 2	**II.**	The Living World
Outline Level 3	**II.B.**	Energy Flow
Outline Level 4	**II.B.1.**	(Photosynthesis and cellular respiration; food webs and trophic levels; ecological pyramids)
Outline Level 1	**AP.ES.**	Environmental Science Topic Outline
Outline Level 2	**II.**	The Living World
Outline Level 3	**II.C.**	Ecosystem Diversity
Outline Level 4	**II.C.1.**	(Biodiversity; natural selection; evolution; ecosystem services)
Outline Level 1	**AP.ES.**	Environmental Science Topic Outline
Outline Level 2	**II.**	The Living World
Outline Level 3	**II.E.**	Natural Biogeochemical Cycles
Outline Level 4	**II.E.1.**	(Carbon, nitrogen, phosphorus, sulfur, water, conservation of matter)

Cassiopeia

Summary: This lab begins with an introduction to Cassiopeia spp.and its life cycle as well as methods and issues surrounding mariculture. Students work in groups to collect embyos from Cassiopeia and place in vials. Students monitor vials throughout the week, looking for developing planula and polyps. All data from this lab will be discussed during the Summary.

Outline Level 1	**AP.ES.**	Environmental Science Topic Outline
Outline Level 2	**II.**	The Living World
Outline Level 3	**II.A.**	Ecosystem Structure

Cassiopeia continued		
Outline Level 4	**II.A.1.**	(Biological populations and communities; ecological niches; interactions among species; keystone species; species diversity and edge effects; major terrestrial and aquatic biomes)
Outline Level 1	**AP.ES.**	Environmental Science Topic Outline
Outline Level 2	**II.**	The Living World
Outline Level 3	**II.C.**	Ecosystem Diversity
Outline Level 4	**II.C.1.**	(Biodiversity; natural selection; evolution; ecosystem services)
Outline Level 1	**AP.ES.**	Environmental Science Topic Outline
Outline Level 2	**III.**	Population
Outline Level 3	**III.A.**	Population Biology Concepts
Outline Level 4	**III.A.1.**	(Population ecology; carrying capacity; reproductive strategies; survivorship)
Outline Level 1	**AP.ES.**	Environmental Science Topic Outline
Outline Level 2	**IV.**	Land and Water Use
Outline Level 3	**IV.F.**	Fishing
Outline Level 4	**IV.F.1.**	(Fishing techniques; overfishing; aquaculture; relevant laws and treaties)

Coral Reef Ecology

Summary: Power point discussion outlines types of coral, coral reproduction, importance of the coral reef, disturbances to the coral reef and coral management/restoration projects. Students will then go out to two coral reef sites to snorkel.

Outline Level 1	**AP.ES.**	Environmental Science Topic Outline
Outline Level 2	**I.**	Earth Systems and Resources
Outline Level 3	**I.C.**	Global Water Resources and Use
Outline Level 4	**I.C.1.**	(Freshwater/saltwater; ocean circulation; agricultural, industrial, and domestic use; surface and groundwater issues; global problems; conservation)
Outline Level 1	**AP.ES.**	Environmental Science Topic Outline
Outline Level 2	**II.**	The Living World
Outline Level 3	**II.A.**	Ecosystem Structure
Outline Level 4	**II.A.1.**	(Biological populations and communities; ecological niches; interactions among species; keystone species; species diversity and edge effects; major terrestrial and aquatic biomes)

MARINELAB AP ENVIRONMENTAL SCIENCE COURSE

Coral Reef Ecology Continued		
Outline Level 1	**AP.ES.**	Environmental Science Topic Outline
Outline Level 2	**II.**	The Living World
Outline Level 3	**II.B.**	Energy Flow
Outline Level 4	**II.B.1.**	(Photosynthesis and cellular respiration; food webs and trophic levels; ecological pyramids)
Outline Level 1	**AP.ES.**	Environmental Science Topic Outline
Outline Level 2	**II.**	The Living World
Outline Level 3	**II.C.**	Ecosystem Diversity
Outline Level 4	**II.C.1.**	(Biodiversity; natural selection; evolution; ecosystem services)
Outline Level 1	**AP.ES.**	Environmental Science Topic Outline
Outline Level 2	**III.**	Population
Outline Level 3	**III.A.**	Population Biology Concepts
Outline Level 4	**III.A.1.**	(Population ecology; carrying capacity; reproductive strategies; survivorship)
Outline Level 1	**AP.ES.**	Environmental Science Topic Outline
Outline Level 2	**III.**	Population
Outline Level 3	**III.B.**	Human Population
Outline Level 4	**III.B.3.**	Impacts of population growth
Outline Level 5	**III.B.3.a.**	(Hunger; disease; economic effects; resource use; habitat destruction)
Outline Level 1	**AP.ES.**	Environmental Science Topic Outline
Outline Level 2	**IV.**	Land and Water Use
Outline Level 3	**IV.D.**	Other Land Use
Outline Level 4	**IV.D.4.**	Land conservation options
Outline Level 5	**IV.D.4.a.**	(Preservation; remediation; mitigation; restoration)
Outline Level 1	**AP.ES.**	Environmental Science Topic Outline
Outline Level 2	**VI.**	Pollution
Outline Level 3	**VI.A.**	Pollution Types
Outline Level 4	**VI.A.3.**	Water pollution
Outline Level 5	**VI.A.3.a.**	(Types; sources, causes, and effects; cultural eutrophication; ground-water pollution; maintaining water quality; water purification; sewage treatment/septic systems; Clean Water Act and other relevant laws)

Coral Reef Ecology Continued		
Outline Level 1	**AP.ES.**	Environmental Science Topic Outline
Outline Level 2	**VI.**	Pollution
Outline Level 3	**VI.C.**	Economic Impacts
Outline Level 4	**VI.C.1.**	(Cost-benefit analysis; externalities; marginal costs; sustainability)
Outline Level 1	**AP.ES.**	Environmental Science Topic Outline
Outline Level 2	**VII.**	Global Change
Outline Level 3	**VII.C.**	Loss of Biodiversity
Outline Level 4	**VII.C.1.**	Habitat loss; overuse; pollution; introduced species; endangered and extinct species
Outline Level 4	**VII.C.2.**	Maintenance through conservation
Outline Level 4	**VII.C.3.**	Relevant laws and treaties

Everglades Hydrology

Summary: The field trip to Everglades National Park is preceded by an Everglades Hydrology Discussion which focuses on importance of the Everglades, flow of water thru FL pre 1900s versus post 1900s, and restoration efforts. Field trip involves walking along paved trails to identify trees, flowers, birds and other organisms. Additional stops are offered.

Outline Level 1	**AP.ES.**	Environmental Science Topic Outline
Outline Level 2	**I.**	Earth Systems and Resources
Outline Level 3	**I.C.**	Global Water Resources and Use
Outline Level 4	**I.C.1.**	(Freshwater/saltwater; ocean circulation; agricultural, industrial, and domestic use; surface and groundwater issues; global problems; conservation)
Outline Level 1	**AP.ES.**	Environmental Science Topic Outline
Outline Level 2	**II.**	The Living World
Outline Level 3	**II.A.**	Ecosystem Structure
Outline Level 4	**II.A.1.**	(Biological populations and communities; ecological niches; interactions among species; keystone species; species diversity and edge effects; major terrestrial and aquatic biomes)
Outline Level 1	**AP.ES.**	Environmental Science Topic Outline
Outline Level 2	**II.**	The Living World
Outline Level 3	**II.B.**	Energy Flow
Outline Level 4	**II.B.1.**	(Photosynthesis and cellular respiration; food webs and trophic levels; ecological pyramids)

Everglades Hydrology continued		
Outline Level 1	**AP.ES.**	Environmental Science Topic Outline
Outline Level 2	**II.**	The Living World
Outline Level 3	**II.C.**	Ecosystem Diversity
Outline Level 4	**II.C.1.**	(Biodiversity; natural selection; evolution; ecosystem services)
Outline Level 1	**AP.ES.**	Environmental Science Topic Outline
Outline Level 2	**III.**	Population
Outline Level 3	**III.B.**	Human Population
Outline Level 4	**III.B.3.**	Impacts of population growth
Outline Level 5	**III.B.3.a.**	(Hunger; disease; economic effects; resource use; habitat destruction)
Outline Level 1	**AP.ES.**	Environmental Science Topic Outline
Outline Level 2	**IV.**	Land and Water Use
Outline Level 3	**IV.D.**	Other Land Use
Outline Level 4	**IV.D.3.**	Public and federal lands
Outline Level 5	**IV.D.3.a.**	(Management; wilderness areas; national parks; wildlife refuges; forests; wetlands)
Outline Level 1	**AP.ES.**	Environmental Science Topic Outline
Outline Level 2	**VII.**	Global Change
Outline Level 3	**VII.C.**	Loss of Biodiversity
Outline Level 4	**VII.C.1.**	Habitat loss; overuse; pollution; introduced species; endangered and extinct species
Outline Level 4	**VII.C.3.**	Relevant laws and treaties

Field Identification of Reef Fish

Summary: Field trip to the coral reef is preceded by a discussion on how to identify coral reef fish and a slideshow with commonly seen fish.

Outline Level 1	**AP.ES.**	Environmental Science Topic Outline
Outline Level 2	**II.**	The Living World
Outline Level 3	**II.A.**	Ecosystem Structure
Outline Level 4	**II.A.1.**	(Biological populations and communities; ecological niches; interactions among species; keystone species; species diversity and edge effects; major terrestrial and aquatic biomes)
Outline Level 1	**AP.ES.**	Environmental Science Topic Outline
Outline Level 2	**II.**	The Living World
Outline Level 3	**II.B.**	Energy Flow
Outline Level 4	**II.B.1.**	(Photosynthesis and cellular respiration; food webs and trophic levels; ecological pyramids)

Field Identification of Reef Fish continued		
Outline Level 1	**AP.ES.**	Environmental Science Topic Outline
Outline Level 2	**II.**	The Living World
Outline Level 3	**II.C.**	Ecosystem Diversity
Outline Level 4	**II.C.1.**	(Biodiversity; natural selection; evolution; ecosystem services)
Outline Level 1	**AP.ES.**	Environmental Science Topic Outline
Outline Level 2	**III.**	Population
Outline Level 3	**III.A.**	Population Biology Concepts
Outline Level 4	**III.A.1.**	(Population ecology; carrying capacity; reproductive strategies; survivorship)
Outline Level 1	**AP.ES.**	Environmental Science Topic Outline
Outline Level 2	**VII.**	Global Change
Outline Level 3	**VII.C.**	Loss of Biodiversity
Outline Level 4	**VII.C.1.**	Habitat loss; overuse; pollution; introduced species; endangered and extinct species
Outline Level 4	**VII.C.3.**	Relevant laws and treaties

Invertebrate Diversity

Summary: This lab gives students a hands on opportunity to understand the concept of diversity and its association with a healthy, stable environment. Students will "shake" invertebrates off of live rock collected from Largo Sound. Students will identify each organism found using an ID key and instructors will collect a sample of every species found. These critters will then be projected onto the TV for all to see using a microscope and a flexcam. Each species will be identified, described and classified into its phylum.

Outline Level 1	**AP.ES.**	Environmental Science Topic Outline
Outline Level 2	**II.**	The Living World
Outline Level 3	**II.A.**	Ecosystem Structure
Outline Level 4	**II.A.1.**	(Biological populations and communities; ecological niches; interactions among species; keystone species; species diversity and edge effects; major terrestrial and aquatic biomes)
Outline Level 1	**AP.ES.**	Environmental Science Topic Outline
Outline Level 2	**II.**	The Living World
Outline Level 3	**II.C.**	Ecosystem Diversity
Outline Level 4	**II.C.1.**	(Biodiversity; natural selection; evolution; ecosystem services)

Invertebrate Diversity continued		
Outline Level 1	**AP.ES.**	Environmental Science Topic Outline
Outline Level 2	**VII.**	Global Change
Outline Level 3	**VII.C.**	Loss of Biodiversity
Outline Level 4	**VII.C.1.**	Habitat loss; overuse; pollution; introduced species; endangered and extinct species
Outline Level 4	**VII.C.3.**	Relevant laws and treaties

Keys Habitats - Introduction and Summary

Summary: Two separate powerpoint discussions. The Keys Habitats discussion is at the beginning of the program outlining the main habitats that make up the Keys, where these habitats are located and how the abiotic components of each habitat influence the abiotic components. The Summary Power Point will be presented at the end of the trip to review any data collected during the stay (water quality and/or Cassiopeia lab), dicuss the ecology of habitats visited and why diversity varied at these locations. Required field trips include Seagrass, Mangrove and Coral Reef Ecology, while supplementary trips are Rodriguez Key Zonation, Hardbottom Shoal Ecology, Keys Survey and Backcountry. Required labs are Invertebrate diversity and Astronomy/Plankton Tow while optional supplementary labs include Water Quality, Sponge Spicule, Sea Turtle Lab, Shark Lab and Cassiopeia Lab.

Outline Level 1	**AP.ES.**	Environmental Science Topic Outline
Outline Level 2	**I.**	Earth Systems and Resources
Outline Level 3	**I.C.**	Global Water Resources and Use
Outline Level 4	**I.C.1.**	(Freshwater/saltwater; ocean circulation; agricultural, industrial, and domestic use; surface and groundwater issues; global problems; conservation)
Outline Level 1	**AP.ES.**	Environmental Science Topic Outline
Outline Level 2	**II.**	The Living World
Outline Level 3	**II.A.**	Ecosystem Structure
Outline Level 4	**II.A.1.**	(Biological populations and communities; ecological niches; interactions among species; keystone species; species diversity and edge effects; major terrestrial and aquatic biomes)
Outline Level 1	**AP.ES.**	Environmental Science Topic Outline
Outline Level 2	**II.**	The Living World
Outline Level 3	**II.C.**	Ecosystem Diversity
Outline Level 4	**II.C.1.**	(Biodiversity; natural selection; evolution; ecosystem services)

MARINELAB AP ENVIRONMENTAL SCIENCE COURSE

Keys Habitats - Introduction and Summary continued		
Outline Level 1	**AP.ES.**	Environmental Science Topic Outline
Outline Level 2	**III.**	Population
Outline Level 3	**III.B.**	Human Population
Outline Level 4	**III.B.2.**	Population size
Outline Level 5	**III.B.2.a.**	(Strategies for sustainability; case studies; national policies)
Outline Level 1	**AP.ES.**	Environmental Science Topic Outline
Outline Level 2	**III.**	Population
Outline Level 3	**III.B.**	Human Population
Outline Level 4	**III.B.3.**	Impacts of population growth
Outline Level 5	**III.B.3.a.**	(Hunger; disease; economic effects; resource use; habitat destruction)
Outline Level 1	**AP.ES.**	Environmental Science Topic Outline
Outline Level 2	**IV.**	Land and Water Use
Outline Level 3	**IV.D.**	Other Land Use
Outline Level 4	**IV.D.3.**	Public and federal lands
Outline Level 5	**IV.D.3.a.**	(Management; wilderness areas; national parks; wildlife refuges; forests; wetlands)
Outline Level 1	**AP.ES.**	Environmental Science Topic Outline
Outline Level 2	**IV.**	Land and Water Use
Outline Level 3	**IV.E.**	Mining
Outline Level 4	**IV.E.1.**	(Mineral formation; extraction; global reserves; relevant laws and treaties)
Outline Level 1	**AP.ES.**	Environmental Science Topic Outline
Outline Level 2	**IV.**	Land and Water Use
Outline Level 3	**IV.G.**	Global Economics
Outline Level 4	**IV.G.1.**	(Globalization; World Bank; Tragedy of the Commons; relevant laws and treaties)
Outline Level 1	**AP.ES.**	Environmental Science Topic Outline
Outline Level 2	**VI.**	Pollution
Outline Level 3	**VI.A.**	Pollution Types
Outline Level 4	**VI.A.1.**	Air pollution
Outline Level 5	**VI.A.1.a.**	(Sources--primary and secondary; major air pollutants; measurement units; smog; acid deposition--causes and effects; heat islands and temperature inversions; indoor air pollution; remediation and reduction strategies; Clean Air Act and other relevant laws)

MARINELAB AP ENVIRONMENTAL SCIENCE COURSE

Keys Habitats - Introduction and Summary continued		
Outline Level 1	**AP.ES.**	Environmental Science Topic Outline
Outline Level 2	**VI.**	Pollution
Outline Level 3	**VI.A.**	Pollution Types
Outline Level 4	**VI.A.3.**	Water pollution
Outline Level 5	**VI.A.3.a.**	(Types; sources, causes, and effects; cultural eutrophication; ground-water pollution; maintaining water quality; water purification; sewage treatment/septic systems; Clean Water Act and other relevant laws)
Outline Level 1	**AP.ES.**	Environmental Science Topic Outline
Outline Level 2	**VI.**	Pollution
Outline Level 3	**VI.B.**	Impacts on the Environment and Human Health
Outline Level 4	**VI.B.2.**	Hazardous chemicals in the environment
Outline Level 5	**VI.B.2.a.**	(Types of hazardous waste; treatment/disposal of hazardous waste; cleanup of contaminated sites; biomagnification; relevant laws)
Outline Level 1	**AP.ES.**	Environmental Science Topic Outline
Outline Level 2	**VI.**	Pollution
Outline Level 3	**VI.C.**	Economic Impacts
Outline Level 4	**VI.C.1.**	(Cost-benefit analysis; externalities; marginal costs; sustainability)
Outline Level 1	**AP.ES.**	Environmental Science Topic Outline
Outline Level 2	**VII.**	Global Change
Outline Level 3	**VII.A.**	Stratospheric Ozone
Outline Level 4	**VII.A.1.**	(Formation of stratospheric ozone; ultraviolet radiation; causes of ozone depletion; effects of ozone depletion; strategies for reducing ozone depletion; relevant laws and treaties)
Outline Level 1	**AP.ES.**	Environmental Science Topic Outline
Outline Level 2	**VII.**	Global Change
Outline Level 3	**VII.B.**	Global Warming
Outline Level 4	**VII.B.1.**	(Greenhouse gases and the greenhouse effect; impacts and consequences of global warming; reducing climate change; relevant laws and treaties)
Outline Level 1	**AP.ES.**	Environmental Science Topic Outline
Outline Level 2	**VII.**	Global Change
Outline Level 3	**VII.C.**	Loss of Biodiversity
Outline Level 4	**VII.C.1.**	Habitat loss; overuse; pollution; introduced species; endangered and extinct species
Outline Level 4	**VII.C.3.**	Relevant laws and treaties

Mangrove ecology

Summary: The mangrove lesson is taught aboard the boat en route to the mangrove snorkeling site. Lesson inludes the types of mangroves found in FL, identification of the mangroves, and the ecological importance of the mangrove habitat. Stops will be made along the way to point out various features of the mangroves and the surrounding land, as well as birds and iguanas, in Adam's Cut, Blackwater Sound, and in the Grotto or Hidden Lake. Students will snorkel amongst the mangroves while the instructor snorkels and collects critters. Students will get a hands on lesson about the various organisms.

Outline Level 1	**AP.ES.**	Environmental Science Topic Outline
Outline Level 2	**I.**	Earth Systems and Resources
Outline Level 3	**I.B.**	The Atmosphere
Outline Level 4	**I.B.1.**	(Composition; structure; weather and climate; atmospheric circulation and the Coriolis Effect; atmosphere-ocean interactions; ENSO)
Outline Level 1	**AP.ES.**	Environmental Science Topic Outline
Outline Level 2	**I.**	Earth Systems and Resources
Outline Level 3	**I.C.**	Global Water Resources and Use
Outline Level 4	**I.C.1.**	(Freshwater/saltwater; ocean circulation; agricultural, industrial, and domestic use; surface and groundwater issues; global problems; conservation)
Outline Level 1	**AP.ES.**	Environmental Science Topic Outline
Outline Level 2	**II.**	The Living World
Outline Level 3	**II.A.**	Ecosystem Structure
Outline Level 4	**II.A.1.**	(Biological populations and communities; ecological niches; interactions among species; keystone species; species diversity and edge effects; major terrestrial and aquatic biomes)
Outline Level 1	**AP.ES.**	Environmental Science Topic Outline
Outline Level 2	**II.**	The Living World
Outline Level 3	**II.B.**	Energy Flow
Outline Level 4	**II.B.1.**	(Photosynthesis and cellular respiration; food webs and trophic levels; ecological pyramids)
Outline Level 1	**AP.ES.**	Environmental Science Topic Outline
Outline Level 2	**II.**	The Living World
Outline Level 3	**II.C.**	Ecosystem Diversity
Outline Level 4	**II.C.1.**	(Biodiversity; natural selection; evolution; ecosystem services)

MARINELAB AP ENVIRONMENTAL SCIENCE COURSE

Mangrove ecology continued		
Outline Level 1	**AP.ES.**	Environmental Science Topic Outline
Outline Level 2	**II.**	The Living World
Outline Level 3	**II.E.**	Natural Biogeochemical Cycles
Outline Level 4	**II.E.1.**	(Carbon, nitrogen, phosphorus, sulfur, water, conservation of matter)
Outline Level 1	**AP.ES.**	Environmental Science Topic Outline
Outline Level 2	**III.**	Population
Outline Level 3	**III.A.**	Population Biology Concepts
Outline Level 4	**III.A.1.**	(Population ecology; carrying capacity; reproductive strategies; survivorship)
Outline Level 1	**AP.ES.**	Environmental Science Topic Outline
Outline Level 2	**III.**	Population
Outline Level 3	**III.B.**	Human Population
Outline Level 4	**III.B.3.**	Impacts of population growth
Outline Level 5	**III.B.3.a.**	(Hunger; disease; economic effects; resource use; habitat destruction)
Outline Level 1	**AP.ES.**	Environmental Science Topic Outline
Outline Level 2	**IV.**	Land and Water Use
Outline Level 3	**IV.D.**	Other Land Use
Outline Level 4	**IV.D.3.**	Public and federal lands
Outline Level 5	**IV.D.3.a.**	(Management; wilderness areas; national parks; wildlife refuges; forests; wetlands)
Outline Level 1	**AP.ES.**	Environmental Science Topic Outline
Outline Level 2	**IV.**	Land and Water Use
Outline Level 3	**IV.D.**	Other Land Use
Outline Level 4	**IV.D.4.**	Land conservation options
Outline Level 5	**IV.D.4.a.**	(Preservation; remediation; mitigation; restoration)
Outline Level 1	**AP.ES.**	Environmental Science Topic Outline
Outline Level 2	**VI.**	Pollution
Outline Level 3	**VI.A.**	Pollution Types
Outline Level 4	**VI.A.3.**	Water pollution
Outline Level 5	**VI.A.3.a.**	(Types; sources, causes, and effects; cultural eutrophication; ground-water pollution; maintaining water quality; water purification; sewage treatment/septic systems; Clean Water Act and other relevant laws)

Mangrove ecology continued		
Outline Level 1	**AP.ES.**	Environmental Science Topic Outline
Outline Level 2	**VI.**	Pollution
Outline Level 3	**VI.C.**	Economic Impacts
Outline Level 4	**VI.C.1.**	(Cost-benefit analysis; externalities; marginal costs; sustainability)
Outline Level 1	**AP.ES.**	Environmental Science Topic Outline
Outline Level 2	**VII.**	Global Change
Outline Level 3	**VII.C.**	Loss of Biodiversity
Outline Level 4	**VII.C.1.**	Habitat loss; overuse; pollution; introduced species; endangered and extinct species
Outline Level 4	**VII.C.2.**	Maintenance through conservation

Rodriguez Key zonation

Summary: Students will be introduced to the idea of an ecotone and the organisms commonly found at Rodriguez Key. Students will snorkel the algae shoal while instructors collect Goniolithonalgae. Lab will be conducted on boat where students break apart Gonioalgae, collect and identify resident species. If time allows, a second snorkel site will be visited.

Outline Level 1	**AP.ES.**	Environmental Science Topic Outline
Outline Level 2	**II.**	The Living World
Outline Level 3	**II.A.**	Ecosystem Structure
Outline Level 4	**II.A.1.**	(Biological populations and communities; ecological niches; interactions among species; keystone species; species diversity and edge effects; major terrestrial and aquatic biomes)
Outline Level 1	**AP.ES.**	Environmental Science Topic Outline
Outline Level 2	**II.**	The Living World
Outline Level 3	**II.B.**	Energy Flow
Outline Level 4	**II.B.1.**	(Photosynthesis and cellular respiration; food webs and trophic levels; ecological pyramids)
Outline Level 1	**AP.ES.**	Environmental Science Topic Outline
Outline Level 2	**II.**	The Living World
Outline Level 3	**II.C.**	Ecosystem Diversity
Outline Level 4	**II.C.1.**	(Biodiversity; natural selection; evolution; ecosystem services)

MARINELAB AP ENVIRONMENTAL SCIENCE COURSE

Rodriguez Key zonation

Outline Level 1	**AP.ES.**	Environmental Science Topic Outline
Outline Level 2	**III.**	Population
Outline Level 3	**III.A.**	Population Biology Concepts
Outline Level 4	**III.A.1.**	(Population ecology; carrying capacity; reproductive strategies; survivorship)
Outline Level 1	**AP.ES.**	Environmental Science Topic Outline
Outline Level 2	**VII.**	Global Change
Outline Level 3	**VII.C.**	Loss of Biodiversity
Outline Level 4	**VII.C.1.**	Habitat loss; overuse; pollution; introduced species; endangered and extinct species
Outline Level 4	**VII.C.3.**	Relevant laws and treaties

Sea Turtle Stranding Activity

Summary: Activity is preceded by an introduction to sea turtles in Florida, as well as their life history and threats. Students will work in groups acting as members of the Sea Turtle Stranding and Salvage Network. A worksheet used by the STSSN is filled out and groups present their findings to the rest of the students.

Outline Level 1	**AP.ES.**	Environmental Science Topic Outline
Outline Level 2	**II.**	The Living World
Outline Level 3	**II.A.**	Ecosystem Structure
Outline Level 4	**II.A.1.**	(Biological populations and communities; ecological niches; interactions among species; keystone species; species diversity and edge effects; major terrestrial and aquatic biomes)
Outline Level 1	**AP.ES.**	Environmental Science Topic Outline
Outline Level 2	**II.**	The Living World
Outline Level 3	**II.C.**	Ecosystem Diversity
Outline Level 4	**II.C.1.**	(Biodiversity; natural selection; evolution; ecosystem services)
Outline Level 1	**AP.ES.**	Environmental Science Topic Outline
Outline Level 2	**III.**	Population
Outline Level 3	**III.A.**	Population Biology Concepts
Outline Level 4	**III.A.1.**	(Population ecology; carrying capacity; reproductive strategies; survivorship)
Outline Level 1	**AP.ES.**	Environmental Science Topic Outline
Outline Level 2	**III.**	Population
Outline Level 3	**III.B.**	Human Population

Sea Turtle Stranding Activity continued		
Outline Level 4	**III.B.3.**	Impacts of population growth
Outline Level 5	**III.B.3.a.**	(Hunger; disease; economic effects; resource use; habitat destruction)
Outline Level 1	**AP.ES.**	Environmental Science Topic Outline
Outline Level 2	**IV.**	Land and Water Use
Outline Level 3	**IV.A.**	Agriculture
Outline Level 4	**IV.A.1.**	Feeding a growing population
Outline Level 5	**IV.A.1.a.**	(Human nutritional requirements; types of agriculture; Green Revolution; genetic engineering and crop production; deforestation; irrigation; sustainable agriculture)
Outline Level 1	**AP.ES.**	Environmental Science Topic Outline
Outline Level 2	**IV.**	Land and Water Use
Outline Level 3	**IV.C.**	Rangelands
Outline Level 4	**IV.C.1.**	(Overgrazing; deforestation; desertification; rangeland management; federal rangelands)
Outline Level 1	**AP.ES.**	Environmental Science Topic Outline
Outline Level 2	**IV.**	Land and Water Use
Outline Level 3	**IV.D.**	Other Land Use
Outline Level 4	**IV.D.4.**	Land conservation options
Outline Level 5	**IV.D.4.a.**	(Preservation; remediation; mitigation; restoration)
Outline Level 1	**AP.ES.**	Environmental Science Topic Outline
Outline Level 2	**VI.**	Pollution
Outline Level 3	**VI.C.**	Economic Impacts
Outline Level 4	**VI.C.1.**	(Cost-benefit analysis; externalities; marginal costs; sustainability)
Outline Level 1	**AP.ES.**	Environmental Science Topic Outline
Outline Level 2	**VII.**	Global Change
Outline Level 3	**VII.C.**	Loss of Biodiversity
Outline Level 4	**VII.C.1.**	Habitat loss; overuse; pollution; introduced species; endangered and extinct species
Outline Level 4	**VII.C.2.**	Maintenance through conservation

MARINELAB AP ENVIRONMENTAL SCIENCE COURSE

Seagrass ecology

Summary: Power point discussion outlines importance of seagrass, types of seagrass and algae commonly found in the Florida Keys and common marine phyla with examples of species found in seagrass from each phylum. Field trip to a seagrass bed follows. Students will snorkel while instructor gathers seagrass and algae species to present on the boat.

Outline Level 1	**AP.ES.**	Environmental Science Topic Outline
Outline Level 2	**I.**	Earth Systems and Resources
Outline Level 3	**I.D.**	Soil and Soil Dynamics
Outline Level 4	**I.D.1.**	(Rock cycle; formation; composition; physical and chemical properties; main soil types; erosion and other soil problems; soil conservation)
Outline Level 1	**AP.ES.**	Environmental Science Topic Outline
Outline Level 2	**II.**	The Living World
Outline Level 3	**II.A.**	Ecosystem Structure
Outline Level 4	**II.A.1.**	(Biological populations and communities; ecological niches; interactions among species; keystone species; species diversity and edge effects; major terrestrial and aquatic biomes)
Outline Level 1	**AP.ES.**	Environmental Science Topic Outline
Outline Level 2	**II.**	The Living World
Outline Level 3	**II.B.**	Energy Flow
Outline Level 4	**II.B.1.**	(Photosynthesis and cellular respiration; food webs and trophic levels; ecological pyramids)
Outline Level 1	**AP.ES.**	Environmental Science Topic Outline
Outline Level 2	**II.**	The Living World
Outline Level 3	**II.C.**	Ecosystem Diversity
Outline Level 4	**II.C.1.**	(Biodiversity; natural selection; evolution; ecosystem services)
Outline Level 1	**AP.ES.**	Environmental Science Topic Outline
Outline Level 2	**II.**	The Living World
Outline Level 3	**II.D.**	Natural Ecosystem Change
Outline Level 4	**II.D.1.**	(Climate shifts; species movement; ecological succession)
Outline Level 1	**AP.ES.**	Environmental Science Topic Outline
Outline Level 2	**II.**	The Living World
Outline Level 3	**II.E.**	Natural Biogeochemical Cycles
Outline Level 4	**II.E.1.**	(Carbon, nitrogen, phosphorus, sulfur, water, conservation of matter)

MARINELAB AP ENVIRONMENTAL SCIENCE COURSE

Seagrass ecology continued		
Outline Level 1	**AP.ES.**	Environmental Science Topic Outline
Outline Level 2	**III.**	Population
Outline Level 3	**III.B.**	Human Population
Outline Level 4	**III.B.3.**	Impacts of population growth
Outline Level 5	**III.B.3.a.**	(Hunger; disease; economic effects; resource use; habitat destruction)
Outline Level 1	**AP.ES.**	Environmental Science Topic Outline
Outline Level 2	**IV.**	Land and Water Use
Outline Level 3	**IV.D.**	Other Land Use
Outline Level 4	**IV.D.4.**	Land conservation options
Outline Level 5	**IV.D.4.a.**	(Preservation; remediation; mitigation; restoration)
Outline Level 1	**AP.ES.**	Environmental Science Topic Outline
Outline Level 2	**VI.**	Pollution
Outline Level 3	**VI.A.**	Pollution Types
Outline Level 4	**VI.A.3.**	Water pollution
Outline Level 5	**VI.A.3.a.**	(Types; sources, causes, and effects; cultural eutrophication; ground-water pollution; maintaining water quality; water purification; sewage treatment/septic systems; Clean Water Act and other relevant laws)
Outline Level 1	**AP.ES.**	Environmental Science Topic Outline
Outline Level 2	**VI.**	Pollution
Outline Level 3	**VI.C.**	Economic Impacts
Outline Level 4	**VI.C.1.**	(Cost-benefit analysis; externalities; marginal costs; sustainability)
Outline Level 1	**AP.ES.**	Environmental Science Topic Outline
Outline Level 2	**VII.**	Global Change
Outline Level 3	**VII.C.**	Loss of Biodiversity
Outline Level 4	**VII.C.1.**	Habitat loss; overuse; pollution; introduced species; endangered and extinct species
Outline Level 4	**VII.C.2.**	Maintenance through conservation

MARINELAB AP ENVIRONMENTAL SCIENCE COURSE

Sponge Spicule Identification

Summary: Instructor will begin by reviewing marine invertebrate phyla and associated common characteristics and defense mechanisms. Types of sponge spicules and functions of spicules are explained. Students will work in pairs to isolate spicules from various species of local sponges that have been dried. Spicule shapes are identified for each sponge species.

Outline Level 1	**AP.ES.**	Environmental Science Topic Outline
Outline Level 2	**II.**	The Living World
Outline Level 3	**II.A.**	Ecosystem Structure
Outline Level 4	**II.A.1.**	(Biological populations and communities; ecological niches; interactions among species; keystone species; species diversity and edge effects; major terrestrial and aquatic biomes)
Outline Level 1	**AP.ES.**	Environmental Science Topic Outline
Outline Level 2	**II.**	The Living World
Outline Level 3	**II.C.**	Ecosystem Diversity
Outline Level 4	**II.C.1.**	(Biodiversity; natural selection; evolution; ecosystem services)
Outline Level 1	**AP.ES.**	Environmental Science Topic Outline
Outline Level 2	**III.**	Population
Outline Level 3	**III.A.**	Population Biology Concepts
Outline Level 4	**III.A.1.**	(Population ecology; carrying capacity; reproductive strategies; survivorship)

Water Quality Lab

Summary: During this lab, students will be taught about the importance of abiotic conditions such as water quality parameters (salinity, temperature, pH, dissolved oxygen, ammonia, and clarity), the healthy levels for water quality parameters, and techniques for measuring water quality parameters. Students will then get the opportunity to use the instruments to test water quality of four different samples of water, representing four different bodies of water (North Sea, South Sea, Key Largo drinking water, MarineLab fish tank). The measurements from the water samples will then be compared and explained.

Outline Level 1	**AP.ES.**	Environmental Science Topic Outline
Outline Level 2	**I.**	Earth Systems and Resources
Outline Level 3	**I.C.**	Global Water Resources and Use
Outline Level 4	**I.C.1.**	(Freshwater/saltwater; ocean circulation; agricultural, industrial, and domestic use; surface and groundwater issues; global problems; conservation)

MARINELAB AP ENVIRONMENTAL SCIENCE COURSE

Water Quality Lab continued		
Outline Level 1	**AP.ES.**	Environmental Science Topic Outline
Outline Level 2	**II.**	The Living World
Outline Level 3	**II.A.**	Ecosystem Structure
Outline Level 4	**II.A.1.**	(Biological populations and communities; ecological niches; interactions among species; keystone species; species diversity and edge effects; major terrestrial and aquatic biomes)
Outline Level 1	**AP.ES.**	Environmental Science Topic Outline
Outline Level 2	**II.**	The Living World
Outline Level 3	**II.C.**	Ecosystem Diversity
Outline Level 4	**II.C.1.**	(Biodiversity; natural selection; evolution; ecosystem services)
Outline Level 1	**AP.ES.**	Environmental Science Topic Outline
Outline Level 2	**II.**	The Living World
Outline Level 3	**II.E.**	Natural Biogeochemical Cycles
Outline Level 4	**II.E.1.**	(Carbon, nitrogen, phosphorus, sulfur, water, conservation of matter)
Outline Level 1	**AP.ES.**	Environmental Science Topic Outline
Outline Level 2	**III.**	Population
Outline Level 3	**III.B.**	Human Population
Outline Level 4	**III.B.3.**	Impacts of population growth
Outline Level 5	**III.B.3.a.**	(Hunger; disease; economic effects; resource use; habitat destruction)
Outline Level 1	**AP.ES.**	Environmental Science Topic Outline
Outline Level 2	**IV.**	Land and Water Use
Outline Level 3	**IV.D.**	Other Land Use
Outline Level 4	**IV.D.3.**	Public and federal lands
Outline Level 5	**IV.D.3.a.**	(Management; wilderness areas; national parks; wildlife refuges; forests; wetlands)
Outline Level 1	**AP.ES.**	Environmental Science Topic Outline
Outline Level 2	**V.**	Energy Resources and Consumption
Outline Level 3	**V.B.**	Energy Consumption
Outline Level 4	**V.B.1.**	History
Outline Level 5	**V.B.1.a.**	(Industrial Revolution; exponential growth; energy crisis)

MARINELAB AP ENVIRONMENTAL SCIENCE COURSE

Water Quality Lab continued		
Outline Level 1	**AP.ES.**	Environmental Science Topic Outline
Outline Level 2	**VI.**	Pollution
Outline Level 3	**VI.A.**	Pollution Types
Outline Level 4	**VI.A.1.**	Air pollution
Outline Level 5	**VI.A.1.a.**	(Sources--primary and secondary; major air pollutants; measurement units; smog; acid deposition--causes and effects; heat islands and temperature inversions; indoor air pollution; remediation and reduction strategies; Clean Air Act and other relevant laws)
Outline Level 1	**AP.ES.**	Environmental Science Topic Outline
Outline Level 2	**VI.**	Pollution
Outline Level 3	**VI.A.**	Pollution Types
Outline Level 4	**VI.A.3.**	Water pollution
Outline Level 5	**VI.A.3.a.**	(Types; sources, causes, and effects; cultural eutrophication; ground-water pollution; maintaining water quality; water purification; sewage treatment/septic systems; Clean Water Act and other relevant laws)
Outline Level 1	**AP.ES.**	Environmental Science Topic Outline
Outline Level 2	**VI.**	Pollution
Outline Level 3	**VI.B.**	Impacts on the Environment and Human Health
Outline Level 4	**VI.B.1.**	Hazards to human health
Outline Level 5	**VI.B.1.a.**	(Environmental risk analysis; acute and chronic effects; dose-response relationships; air pollutants; smoking and other risks)
Outline Level 1	**AP.ES.**	Environmental Science Topic Outline
Outline Level 2	**VII.**	Global Change
Outline Level 3	**VII.C.**	Loss of Biodiversity
Outline Level 4	**VII.C.1.**	Habitat loss; overuse; pollution; introduced species; endangered and extinct species