a-g Biology

Basic Course Information

Title: a-g Biology

Transcript abbreviations: a-g Biology A / 6E1002 , a-g Biology B / 6E1009

Length of course: Full Year

Subject area: Laboratory Science ("d") / Biology / Life Sciences

UC honors designation? No

Prerequisites: None

Co-requisites: Algebra 1 or equivalent (Required)

Integrated (Academics / CTE)? No

Grade levels: 9th, 10th

Course learning environment: Classroom Based

Course Description

Course overview

This is an NGSS-aligned biology course where students use science inquiry and lab processes to explore biological and earth science concepts from a phenomena-based perspective. The course is arranged around six areas: Interactions in Ecosystems; Interactions in Ecosystems: Matter and Energy; Structure, Function and Growth; Earth’s Atmosphere; Inheritance of Traits; Evidence of Evolution; and Human Impact. Students will apply their knowledge of Disciplinary Cored Ideas (DCIs) to a variety of real-world phenomena such as seasonal greening and ecospheres, superbugs, and ocean acidification and local invasive species, through a “storyline” approach. Throughout the course, earth and space science concepts will be incorporated at logical points in the curriculum to enrich student learning. Students will view these phenomena through the lenses of crosscutting concepts such as energy and matter (relationships in ecosystems, earth’s atmosphere) or structure and function (cells, mitosis and cancer, or evidence for evolution). This course emphasizes the use of evidence-based reasoning for scientific explanations and engineering solutions in order to communicate recommendations to address real-world problems. Students will discuss and evaluate a variety of scientific information and data from different sources; they will analyze and interpret their own data and compare them with those used by the scientific community. Students will demonstrate their knowledge through the engagement in the Science and Engineering Practices, during-hands on activities, and inquiry labs. Additionally, students will create laboratory reports, build models, and create projects integrating technology to form content skills.

Course content:

The shaded background of the following field indicates this course was approved by UC for the 2014-15 school year or earlier. Please refer to the current "a-g" course criteria and guidelines when completing your course submission form.

Unit 1 – Interactions in Ecosystems

Description

In this unit, students will develop an understanding of the complexity of the interactions that exist in various ecosystems in the biosphere, including interactions between biotic and abiotic factors. Students examine the organizational and interaction of populations with in an environment, and the interdependence that occurs amount organisms. Students begin looking for examples of interactions firsthand by going outdoors and connecting what they examine locally with concepts such as biodiversity, ecosystem regulation, (direct vs indirect, bottom up vs top down) and scenarios such as tropic cascades and other ecosystem disruptions.

NGSS Core Performance expectations emphasized:

HS-LS2-2 Use mathematical representations to support and revise explanations based on evidence about factors affecting biodiversity and populations in ecosystems of different scales.

HS-LS2-8 Evaluate the evidence for the role of group behavior flocking, schooling, migrating, swarming, and hunting) on individual and species chances to survive and reproduce.

Disciplinary Core Ideas in this Segment:

LS2.A Interdependent Relationships in Ecosystems

LS2.B Cycles of Matter and Energy Transfer in Ecosystems LS2.C Ecosystem Dynamics, Functioning, and Resilience LS2.D Social Interactions and Group Behavior

LS4.D Biodiversity and Humans

Unit Assignment(s): Unit Assignment:
Summary of sample assignment – **Exploring Trophic Cascade Activity**

In this activity students use cards of habitats and animals and plant species to model trophic cascades. Students are to identify and arrange the species into the appropriate habitat and trophic level in a food chain. They then indicate how each species affects the species in the trophic level below it in order to illustrate a trophic cascade. Students learn which trophic level limits the population size, biomass and energy in the other trophic levels. Additionally, students learn the direct and indirect relationships that occur in an ecosystem and apply it to trophic cascades. Finally, students must then justify their reasons for these answers focusing on the NGSS model of making a claim that is supported by evidence and reasoning.

Unit Lab Activities:

Unit Lab Activity:

Summary of sample lab – **Ecosystem Assessment Lab**

The purpose of this lab is to have students collect different details of an ecosystem using various

measurement techniques and tools of a plant ecologist, animal biologist, and geologist. Data collection includes: sketching, taking samples/measurements of biotic and abiotic factors (i.e., soil composition and temperature, wind speed, relative abundance of flora and fauna), classification of organisms, and making qualitative and quantitative observations. Data analysis includes communicating information about their habitat to the rest of the class by building a scaled representation of their area. Data can include sketches, samples, measurements and observations. Students are assessed on naming and describing the distribution of the different types of plants and animals that live in a particular habitat as well as describing how climate, soil, and water contribute to the differences and similarities of plant and animal populations.

Unit 2 – Interactions in Ecosystems: Matter and Energy

Description

In this unit, students explore the cycling of matter within ecosystems and the flow of energy through ecosystems. At the macroscopic level, students investigate the cycling of matter and flow of energy in ecosystems by examining different local ecosystems. They generate ideas about how matter and energy move through different communities, like the ecosystems they examined in the previous unit. Students examine the role of abiotic and biotic factors in the cycling of matter and the flow of energy through an ecosystem.

NGSS Core performance expectations emphasized:

HS-LS2-1 Use mathematical and/or computational representations to support explanations of factors that affect carrying capacity of ecosystems at different scales.

HS-LS2-4 Use mathematical representations to support claims for the cycling of matter and flow of energy among organisms in an ecosystem.

Disciplinary Core Ideas in this Segment:
LS2.A Interdependent Relationships in Ecosystems

LS2.B Cycles of Matter and Energy Transfer in Ecosystems LS2.C Ecosystem Dynamics, Functioning, and Resilience

Unit Assignment(s):

Unit Assignment:

Summary of sample assignment- **California Bioregion Activity**

Students compare and analyze precipitation and productivity data from different California bioregions in order to identify the effects of specific limiting factors in those bioregions. Students create and revise a system model detailing the way in which fresh water cycles in and affects the carrying capacity of various ecosystems.

Unit Lab Activities:

Unit Lab Activity:

Summary of lab assignment- **Soil Testing Lab**

Students will explore the nutrients found in different types of soils from four samples – coastal sand, potting soil, brackish lake soil, and local soil. Students use a Soil Nutrient Test Kit to specifically test soil composition focusing on nitrogen, phosphorus, and potassium. Students are organized into teams to collect and record data for their assigned soil sample and communicate their data to the rest of the lab groups. Students engage in arguing from evidence to explain why certain flora occur in certain ecosystems of specific soil compositions. They will use the evidence to develop a model of how nutrients cycle through ecosystems and write a lab report to communicate their findings and conclusions.

Unit 3 – Structure, Function and Growth

Description

In this unit, students work to answer the guiding question, “How do organisms live and grow.” Students begin by learning about cell structure and function, the role of proteins in cells and living systems and how DNA affects how cells look and behave. Students learn the basic concepts of the hierarchal organization of organisms, basic cell structure, DNA structure, and genes. Next, the students focus on photosynthesis and respiration, cell division, chromosomes, genetic information, and mitotic cell division. Students will demonstrate that they can use investigations and gather evidence by which they can construct explanations and models that describe structures and processes of organism.

NGSS core performance expectations emphasized:

HS-LS1-1 Construct an explanation based on evidence for how the structure of DNA determines the structure of proteins which carry out the essential functions of life through systems of specialized cells.

HS-LS1-2 Develop and use a model to illustrate the hierarchal organization of interacting systems that provide specific functions within multicellular organisms.

HS-PS1-8 Use a model to illustrate the role of cellular division (mitosis) and differentiation in producing and maintaining complex organisms.

Disciplinary Core Ideas in this segment:

LS1.A: Structure and Function

LS1.B: Growth and Development

LS1.C: Organization form Matter and Energy Flow in Organism.

Unit Assignment(s):

Unit Assignment:

Summary of sample assignment- **Cell Membrane – Bubble Model**

Students spend time researching the cell membrane using books to learn about the structure and function of the cell membrane. Students make up a bubble solution and construct a drinking straw bubble frame as directed. Using the bubble solution and frame, students follow specific directions to demonstrate features and characteristics of the cell membrane including: they are dynamic and adapt

to changing conditions, they are capable of self-repair, cell organelles are surrounded by membranes, and cell membranes have specialized proteins embedded in the membrane, such as channel proteins, that give the membrane its unique properties. Students complete a Student Analysis sheet and produce a short video or a collection of photos show the features of the cell membrane model.

Unit Lab Activities:

Summary of a sample lab: **Proteins Under Construction**

Students use pipe stem cleaner and different colors of beads to make a series of models that show the four levels of protein structure. Starting with one section of pipe stem cleaner and 5-8 beads, students make a model of an amino acid sequence in a polypeptide that was coded by DNA by treading the beads on to the pipe stem cleaner. The two free ends of the pipe stem cleaner should be twisted around each end bead to keep it from slipping off the end. Students draw a diagram of this primary structure of the protein. Next students make the secondary structure of the protein by folding it an accordion fashion or twisting it around a pencil. Students make a diagram of this secondary structure of the protein. To make the tertiary structure of the protein, students fold the accordion folded or spiraled molecule back on itself and join the two free ends of the pipe stem cleaner. Students draw a diagram of this molecule. Once one protein molecule, students follow the procedure they just completed to make two more proteins. To make the quaternary structure, students join the three tertiary molecules to make one molecule. Students draw a diagram of this structure, labeling the amino acids that make it up. Finally, students answer questions included in the lab and write a lab report summarizing the lab.

Unit 4 – Earth's Atmosphere: Photosynthesis and Respiration

Description

In this unit, students investigate and learn the interconnected processes of photosynthesis and cellular respiration, then apply that knowledge to their understanding of how living things acquire energy and matter for life. They will spend the unit explaining the phenomena of ecospheres and seasonal greening of the Earth. Students will learn about how organisms store and utilize the raw materials and gases they take in from the environment. Students will participate in inquiry labs to measure the rates of photosynthesis and cell respiration. Using the understanding they gain from these investigations they will apply their knowledge of these two processes to come to an understanding about how the cycling of energy and matter has changed over Earth's history. Emphasis is on the dynamic causes, effects, and feedbacks between the biosphere and Earth's other systems.

NGSS core performance expectations emphasized:

HS-LSl-5 Use a model to illustrate how photosynthesis transforms light energy into stored chemical energy.

H5-LS1-6 Construct and revise an explanation based on evidence for how carbon, hydrogen, and oxygen from sugar molecules may combine with other elements to form amino acids and/or other large carbon-based molecules.

H5-LS1·7 Use a model to illustrate that cellular respiration is a chemical process whereby the bonds of food molecules and oxygen molecules are broken and the bonds the bonds in new compounds are formed resulting in net transfer of energy.

HS-LS2-3 Construct and revise an explanation based on evidence for the cycling of matter and flow

of energy in aerobic and anaerobic conditions.

HS-LS2-5 Develop a model to illustrate the role of photosynthesis and cellular respiration in the cycling of carbon among the biosphere, atmosphere, hydrosphere, and geosphere.

HS-EES1-6 Apply scientific reasoning and evidence from ancient Earth materials, meteorites, other planetary surfaces to construct an account of Earth's formation and early history

HS-EES3-6 Use a computational representation to illustrate the relationship among Earth systems and how those relationships are being modified due to human activity.

Disciplinary Core Ideas In this segment:

LS1.C: Organization for Matter and Energy Flow in Organisms.

LS2.B: Cycles of Matter and Energy Transfer in Ecosystems.

LS2.C: Ecosystem Dynamics, Functioning, and Resilience.

LS4.D: Biodiversity and Humans

PS3.D: Energy in Chemical Processes

Unit Assignment(s):

Unit Assignment:

Summary of sample assignment- Modeling the Interconnectedness of Photosynthesis and Cell Respiration

Students will develop a model of the interconnectedness of photosynthesis and cell respiration that show how the products of photosynthesis become the reactants of cell respiration and how the products of cell respiration become the reactants of photosynthesis. Their model must show how the atoms are moving and recombining, as well as the conservation of matter. By the end of the activity, students will be able to explain the balanced equation for photosynthesis and cell respiration, and how glucose and water are made from water and carbon dioxide and how sugar is broken down to form carbon dioxide and water.

Unit Lab Activities:

Unit Lab Activity:

Summary of a sample lab: Comparing Photosynthesis and Cell Respiration

In this lab, students investigate rate of gas exchange in photosynthesis and cellular respiration to provide evidence of the role of carbon dioxide and sugar in the two processes. In the first part of the lab, students will use Anacharis as a model organism to form conclusions about how carbon dioxide affects the photosynthetic rate by measuring the amount of oxygen produced with and without carbon dioxide present in a water sample. Students analyze the data graphically to compare the amounts of oxygen produced to provide evidence that carbon dioxide is essential to photosynthesis.

In the second part, students use yeast as a model organism to form conclusions about how glucose affects the rate of respiration by measuring the amount of carbon dioxide produced with and without

carbon dioxide present in a water sample. Students analyze the data graphically to compare the amounts of carbon dioxide produced to provide evidence that carbon dioxide is essential to photosynthesis. By the end of the lab, students will be able to discuss the difference between aerobic and anaerobic respiration, construct a model of the gas exchange occurring during photosynthesis and cellular respiration, and analyze the data from both procedures to provide evidence for the importance of carbon dioxide during photosynthesis and the importance of glucose during cellular respiration.

Unit 5 – Inheritance of Traits

Description

In this unit, students explore inheritance of traits by explaining how offspring do not look exactly like their parents. Students explore the dynamics of gene expression and replication at the molecular level. This exploration provides them with a basis for examining some of the fundamental techniques that underlie genetic engineering, including cell division, DNA replication, and protein synthesis. Students then begin their study of genetics and explore the transmission of information, genetic variation, and inheritance patterns. Students will see how genetic information is passed between generations and how this provides for the biological continuity for species. They study the relationship between genotype and phenotype and explore how the environment plays an important role in phenotypic expression. Finally, students focus on patterns by which multicellular organisms develop.

NGSS core performance expectations emphasized:

HS-LS1-1 Construct and explanation based on evidence for how the structure of DNA determines the structure of proteins which carry out essential functions of life through systems of specialize cells.

HS-LS1-4 Use a model to illustrate the role of cellular division (mitosis) and differentiation in producing and maintaining complex organisms.

HS-LS3-1 Ask questions to clarify relationships about the role of DNA and chromosomes in coding the instructions for characteristics traits passed from parents to offspring..

H5-LS3-2 Make and defend a claim based on evidence that inheritable genetic variations may result from: (1) new genetic combinations through meiosis, (2) viable errors occurring during replication and/or (3) mutations caused by environmental factors.

HS-LS3-3 Apply concepts of statistics and probability to explain the variation and distribution of expressed traits in a population.

HS-LS3-3 Apply concepts of statistics and probability to explain the variation and distribution of expressed traits in a population.

HS-LS4-2 Construct an explanation based on evidence that the process of evolution primarily results from four factors: (1) the potential for a species to increase in number, (2) the heritable genetic variation of individuals in a species due to mutations and sexual reproduction.

HS-LS4-3 Apply concepts of statistics and probability to support explanations that organisms with an advantageous heritable trait tend to increase in proportion to organisms lacking this trait.

Disciplinary Core Ideas In this segment:

LS1A: Structure and Function

LS1.B: Growth and Development of Organisms

LS3.A: Inheritance of Traits

LS3.B: Variation of Traits

ESS4.B: Natural Selection

ESS4.C: Adaptation

Unit Assignment(s):

Unit Assignment:

Summary of sample assignment- Passing It On activity

Students will investigate the story of the fictitious Flipnob family and gather information about the expression of the trait for freckles or no freckles. Students will use information contained in the story of the family to discover the names of the family members, their relationships to other members of the family and extended family, and the expression of freckles or no freckles in each family member. Students will use the evidence they collect to complete a pedigree showing the occurrence and appearance (phenotype) of freckles or no freckles in each family members. From this information, and an understanding of inheritance, the genotypes of individuals can be determined. Students will extend their understanding of inheritance by repeating the process, this time focusing on the presence or absence of the color blind trait. Students again use the information collected, and their understanding of genetics and heredity, to complete a pedigree to show how color blindness is inherited in the family.

Unit Lab Activities:

Unit Lab

Summary of a sample lab- **Toothpick Fish**

In this inquiry lab, students will investigate a model of a changing population due to environmental change, experimenting with and environment for a population of “toothpick” fish. Students will learn about the relationships among genes, traits, variations, survival, and reproduction. Three colors of toothpicks, eight of each (green, red, and yellow), represent different alleles present in the “fish” population. Students are told that the green allele is dominant to the other alleles, but that the red and yellow alleles are co-dominant. Students place the 24 toothpicks in a dish and randomly select pairs of toothpicks, setting the toothpicks aside so that they stay in pairs. This simulates the way offspring are formed by the sperm of the male randomly combining with the eggs of the female. Once all the pairs (12) have been drawn, the phenotype (color) and genotype of each fish is recorded in a data table. Students count the number of each color of fish and record this in a second data table; this data represents the beginning population of fish.

Students are then told that the stream environment (heavy bank vegetation and abundant aquatic plants) is favorable to green, red, and orange fish, and that all these fish successfully reproduce, but none of the yellow fish survive and reproduce because they are easily spotted in the predominantly green environment. Students are instructed to set aside all yellow fish (both toothpicks are yellow). Students place the alleles of surviving fish back into the dish and again randomly select pairs of toothpicks to represent a 2nd generation of fish, recording the needed information, setting aside any

yellow fish, and returning the surviving fish back into the dish. This process is repeated once again to select a 3rd generation of fish. Students return the surviving 3rd generation fish back into the dish.

Students will make one final selection of fish, setting out the pairs of alleles to represent a 4th generation of fish. However, a catastrophic disaster occurs that radically changes the stream environment: a toxic waste, harmful to aquatic plants, is dumped into the stream. The plants rapidly die, leaving the stream bottom covered by only rock and sand. This new environment favors yellow, red, and orange fish, but the green fish are now easily spotted and can't survive or reproduce. Because the green fish don't survive, they are set aside. Students record the data for the surviving 4th generation fish. They then construct graphs of their data to show the change in the fish population over time, analyzing data and using the evidence to develop an explanation of how change (evolution) occurs in populations.

Unit 6 – Evidence of Evolution

Description

In this unit, students will work to answer the guiding question: "How and why is Earth constantly changing?" They will study the evolution of life on Earth, the fossil record, and biogeography. Students will be asked to evaluate pieces of evidence for evolution and use genetic information to determine if a population is evolving. Students will use basic geologic principles (the law of superposition in sedimentary rock and plate tectonics) to determine the relative age of fossils. Students will review additional evidence that supports natural selection and evolution, including DNA, comparative anatomy, and relationships between trait occurrence within a population; and environmental factors such as mutation, reproductive and geographic isolation, coevolution, and symbiotic relationships. Students will use their knowledge of natural selection to predict the effect of an environmental change on a particular population, using evidence to explain how human populations have been affected by the environment. Students will be asked to analyze cladograms and other evidence to make claims about evolution.

NGSS core performance expectations emphasized:

HS-LS2-8 Evaluate the evidence for the role of group behavior on individual and species' chances to survive and reproduce.

HS-LS3.2 Make and defend a claim based on evidence that inheritable genetic variations may results from: (1) new genetic combinations through meiosis, (2) viable errors occurring during replication, and/or (3) mutations caused by environmental factors.

HS-LS4-1 Communicate scientific information that common ancestry and biological evolution are supported by multiple lines of empirical evidence.

HS-LS4-2 Construct an explanation based on evidence that the process of evolution primarily results from four factors: (1) the potential for a species to increase in number, (2) the heritable genetic variation of individuals in a species due to mutation and sexual reproduction, (3) competition for limited resources, and (4) proliferation of those organisms that are better able to survive and reproduce in the environment.

HS-LS4-4 Construct an explanation based on evidence for how natural selection leads to adaptation of populations.

HS-LS 4-5 Evaluate the evidence supporting claims that changes in environmental conditions may result in: (1) increases in the number of individuals of some species, (2) the emergence of new

species over time, and (3) the extinction of other species.

HS-ESS1-5 Evaluate evidence of the past and current movements of continental and oceanic crust and theory of plate tectonics to explain ages of crustal rock.

HS-ESS3-1 Construct an explanation based on evidence for how the availability of natural resources, occurrence of natural hazards, and changes in climate have influenced human activity.

HS-ESS3-4 Evaluate or refine a technological solution that reduces impacts of human activities on natural systems.

Disciplinary Core Ideas In this segment:

LS2.A: Interdependent Relationships in Ecosystems

LS2.C: Ecosystem Dynamics, Functioning, and Resilience

LS2.D: Social Interactions and Group Behavior LS3.A: Inheritance of Traits.

LS3.B: Variation of Traits

LS4.A: Evidence of Common Ancestry and Diversity LS4.B: Natural Selection

LS4.C: Adaptation

LS4.D: Biodiversity and Humans

ETS1.B: Developing Possible Solutions.

ESS1.C: The History of Planet Earth

ESS3.C: Human Impacts on Earth Systems

Unit Assignment(s):
Unit Assignment:

Summary of sample assignment- **Finch Descent**

Students begin this unit by developing a model of finch descent with modification. Students will create a "museum style" graphical model to show how one species of ancestral finch diversified into 13 different finches on the Galapagos islands. They will include how the different environments selected for different traits, and therefore led to speciation of finches. Students will be able to use their model to predict additional changes that might happen in the finch populations, and what could happen with organisms other than finches in similar situations. Students will use Darwin's finches as an example of how to construct a cladogram. They will then analyze and interpret additional cladograms, as well as use evidence (such as homologous structures) to build their own cladograms based on data.

Unit Lab Activity:

Summary of a sample lab – **Stickleback Lab**

Stickleback Evolution Virtual Lab
The Making of the Fittest:Evolving Switches, Evolving Bodies

In this lab students will practice the science and techniques used to analyze the forms and structures of organisms – in particular, the pelvic morphology of the three-spined stickleback fish (Gasterosteus aculeatus). Students learn skills of data collection and analysis to study evolutionary processes. The lab includes three experiments in which students will collect and analyze data using photographs of living fish specimens and fossils. The lab also includes several short videos explaining research methods and relating the evolutionary history of the stickleback fish.

Unit 7 – Human Impact

Description

This culminating unit will ask students to apply their previous learning to explain how the environment and human populations are inextricably intertwined. Students will examine and evaluate climate change evidence and models to predict future impacts to Earth systems. Students will add to their understanding of matter cycling by examining more closely how human activity influences these cycles. Students will examine examples of changes in ecosystem conditions which could include biological or physical changes, such as volcanic eruption or sea level rise. Examples of human activities that will be studied can include chemical dumping in the Bay, air pollution, urbanization, and dissemination of invasive species. Students will be asked to determine cause and affect relationships for how changes to the environment such as fire, drought, climate change, and the rate of change of the environment affect distribution or disappearance of traits in species.

NGSS core performance expectations emphasized:

HS-LS2-6 Evaluate the claims, evidence, and reasoning that the complex interactions in ecosystems maintain relatively consistent numbers and types of organisms in stable conditions, but changing conditions may result in a new ecosystem.

H5-LS2-7 Design, evaluate, and refine a solution for reducing impacts of human activities on the environment and biodiversity

H5-LS4-5 Evaluate the evidence supporting claims that changes in environmental conditions may result in: (1) increases in the number of individuals of some species. (2) the emergence of new species over time, and (3) the extinction of other species.

H5-LS4-6 Create or revise a simulation to test a solution to mitigate adverse impacts of human activity on biodiversity.

H5-ESS3-5 Analyze geoscience data and the results of global climate models to make and evidence-based forecast of the current rate of global or regional climate change and associated future impacts to Earth systems.

H5-ESS3-6 Use computational representation to illustrate the relationship among Earth systems and how those relationships are being modified due to human activity.

Disciplinary Core Ideas In this segment:

LS2.A: Interdependent Relationships in Ecosystems

LS2.C: Ecosystem Dynamics, Functioning, and Resilience

LS4.C: Adaptation

LS4.D: Biodiversity and Humans

ESS2.D: Weather and Climate

ESS3.A: Natural Resources

ESS3.C: Human Impacts on Earth Systems

ESS3.D: Global Climate Change

ETS1.B: Developing Possible Solutions

Unit Assignment(s):

Unit Assignment:

Summary of sample assignment- **Research Project – Human Impact on a Local Population**

Students generate a research question related to a local population that has been or could be impacted by human activity. Students analyze data, explore mitigation efforts, work with local science community based organizations and scientists, and make recommendations about what could be done to minimize human impact. The student research process includes peer evaluation and a revision component.

Unit Lab Activities:

Unit Lab Activity:

Summary of a sample lab – **Coral Reef**

In this computer-based activity, students download, graph, and analyze authentic satellite temperature data for coral reef sites around the world. After observing global trends in the data, students evaluate the threat to coral reefs from heat stress, which has been occurring with increased intensity and frequency in recent years. The activity requires that each student have access to a computer for one 50-minute period. If computers are unavailable or students are unfamiliar with the use of spreadsheet software, students can be provided with handouts of prepared graphs for analysis and evaluation.

The activity includes a mapping component so the students work individually on one particular coral reef location and then the findings for the whole class are summarized on a set of world maps. After observing global trends in the data, students evaluate the threat to coral reefs from heat stress, which has been occurring with increased intensity and frequency in recent years. Students complete the related student worksheet and write a summary lab report.

Course Materials

Textbooks

Title	Author	Publisher	Edition	Website	Primary
CA Standards-based textbook (This course is aligned to the 2005 edition of Glencoe McGraw Hill Biology: The Dynamics of Life textbook but it is specifically designed to work with any CA standards aligned	Alten Biggs, Whitney Crispen Hagins, Chris Kapicka, Linda Lundgren, Peter	Glecoe-McGraw Hill	2005	www.mheducation.com	Yes

textbook)	Rillero, Kathleen G. Tallman, Dinah Zike				

Manuals

Title	Author	Publisher	Edition	Website	Read in Entirety
Argument-Driven Inquiry in Biology: Lab Investigations for Grades 9-12		NSTA Press-National Science Teachers Association	2015		No

Websites

Title	Author(s)/Editor(s)/Compiler(s)	Affiliated Institution or Organization	URL
NASA – Global Climate Change, Earth Observations and Earth Observatory		National Aeronautic and Space Administration	www.nasa.gov/ames
NOAA – Resource Collections		National Oceanic and Atmospheric Administration	www.noaa.gov/education
USGS Educational Resources for Secondary Grades		United States Geological Survey	
BioInteractive		Howard Hughes Medical Institute	www.hhmi.org/biointeractive