

K-7 Science Content Expectations
GVSU-AWRI Outreach & Education Program
On the D.J. Angus and the W.G. Jackson
DRAFT February 2008

Welcome to the Grand Valley State University research and education vessels, *D.J. Angus* and *W.G. Jackson*. The vessels are well equipped floating laboratory-classrooms used to study the aquatic environment of Lake Michigan and adjoining waters. The vessels are operated by the GVSU Annis Water Resources Institute.

On our hands-on science cruises, the specific topics and depth of coverage vary with age level. In general, the biological, physical, and chemical dynamics and the interrelationships of rivers, inland lakes, and the Great Lakes are illustrated. Eutrophic-mesotrophic (inland lakes) and oligotrophic-mesotrophic (Lake Michigan) systems are compared and contrasted. Human impacts on ecosystems are explored such as shoreline development, impacts of land use, and the invasions by non-native species (lampreys, zebra mussels, spiny water fleas, etc.). For grades four through twelve, attention is paid to activities and concepts that align with local and state science standards and benchmarks. Advanced groups may request customized cruise experiences.

Alignment for Fourth - Seventh Grades

Items covered by the AWRI program

Grade Four

Discipline 1: Science processes

Inquiry Process

K-7 Standard S.IP: Develop an understanding that scientific inquiry and reasoning involves observing, questioning, investigating, recording, and developing solutions to problems.

S.IP.E.1 Inquiry involves generating questions, conducting investigations, and developing solutions to problems through reasoning and observation.

S.IP.04.11 Make purposeful observation of the natural world using the appropriate senses. Students observe water color, clarity, bottom sediments, plankton, and benthic organisms.

S.IP.04.12 Generate questions based on observations. Students generate questions about the differences in the water quality of the two lakes, how water quality affects the living things in the lakes, how do invasive species change an ecosystem, etc.

S.IP.04.13 Plan and conduct simple and fair investigations. Students have an opportunity to analyze various water quality parameters in an investigation that leads to an understanding of the trophic status of two freshwater testing sites.

S.IP.04.14 Manipulate simple tools that aid observation and data collection (for example: hand lens, balance, ruler, meter stick, measuring cup, thermometer, spring scale, stop watch/timer, graduated cylinder/beaker). Students on the boat have the opportunity to use many tools, most of which are not available for teachers in the classroom.

S.IP.04.15 Make accurate measurements with appropriate units (millimeters, centimeters, meters, milliliters, liters, Celsius, grams, seconds, minutes) for the measurement tool. Students use measuring units in the Secchi disk, turbidity tube, plankton density, water temperature, dissolved oxygen, alkalinity, etc.

S.IP.04.16 Construct simple charts and graphs from data and observations. Students create a data table from their observations, as well as a water temperature graph.

Inquiry Analysis and Communication

K-7 Standard S.IA: Develop an understanding that scientific inquiry and investigations require analysis and communication of findings, using appropriate technology.

S.IA.E.1 Inquiry includes an analysis and presentation of findings that lead to future questions, research, and investigations.

S.IA.04.11 Summarize information from charts and graphs to answer scientific questions. Students use the data table to answer questions about water quality and trophic status of the lakes.

S.IA.04.13 Communicate and present findings of observations and investigations.

S.IA.04.14 Develop research strategies and skills for information gathering and problem solving. Students gather and organize information and use the information to answer questions about water quality.

S.IA.04.15 Compare and contrast sets of data from multiple trials of a science investigation to explain reasons for differences. Students conduct their tests multiple times for accuracy.

Reflection and Social Implications

K-7 Standard S.RS: *Develop an understanding that claims and evidence for their scientific merit should be analyzed. Understand how scientists decide what constitutes scientific knowledge. Develop an understanding of the importance of reflection on scientific knowledge and its application to new situations to better understand the role of science in society and technology.*

S.RS.E.1 Reflecting on knowledge is the application of scientific knowledge to new and different situations. Reflecting on knowledge requires careful analysis of evidence that guides decision-making and the application of science throughout history and within society.

S.RS.04.14 Use data/samples as evidence to separate fact from opinion. Students learn how the data they gather forms a more reliable picture of the type of lake they are observing and the health of the lake than what they might form without the tools used on the trip.

S.RS.04.15 Use evidence when communicating scientific ideas. Students gather evidence about water quality, the presence of certain organisms in the bottom sample, etc. to help them understand and be able to communicate ideas about the lakes.

S.RS.04.18 Describe the effect humans and other organisms have on the balance of the natural world. Students learn about how water quality is affected by humans and by other organisms, particularly invasive species.

Discipline 3: Life Sciences

Organization of Living Things

L.OL.E.1 Life Requirements- Organisms have basic needs. Animals and plants need air, water, and food. Plants also require light. Plants and animals use food as a source of energy and as a source of building material for growth and repair.

L.OL.04.16 Determine that animals require air, water, and a source of energy and building material for growth and repair. Students learn about sources of energy for organisms that live in the lakes.

Evolution

L.EV.E.2 Survival- Individuals of the same kind differ in their characteristics, and sometimes the differences give individuals an advantage in surviving and reproducing.

L.EV.04.22 Identify how variations in physical characteristics of individual organisms give them an advantage for survival and reproduction. Students learn about why certain organisms thrive in certain conditions in the lakes (bloodworms, invasive species, etc.)

Ecosystems

K-7 Standard L.EC: *Develop an understanding of the interdependence of the variety of populations, communities and ecosystems, including those in the Great Lakes region. Develop an understanding of different types of interdependence and that biotic (living) and abiotic (non-living) factors affect the balance of an ecosystem. Understand that all organisms cause changes, some detrimental and others beneficial, in the environment where they live.* **L.EC.E.1 Interactions-** Organisms interact in various ways including providing food and shelter to one another. Some interactions are helpful: others are harmful to the organism and other organisms.

L.EC.04.11 Identify organisms as part of a food chain or food web. Students learn about food chains and webs of the great lakes and how they can differ according to habitat conditions (bloodworms, fish that require oxygen).

L.EC.E.2 Changed Environment Effects- When the environment changes, some plants and animals

survive to reproduce; others die or move to new locations.

LEC.04.21 Explain how environmental changes can produce a change in the food web. Students learn about how changes in water quality can affect the makeup of a food web (bloodworms), and how invasive species affect food webs by encouraging the growth in number of some organisms while competing for resources with others.

Grade Five

Discipline 1: Science Processes

Inquiry Process

S.IP.M.1 Inquiry involves generating questions, conducting investigations, and developing solutions to problems through reasoning and observation.

S.IP.05.11 Generate scientific questions based on observations, investigations, and research. See 4th grade expectation S.IP.04.12

S.IP.05.12 Design and conduct scientific investigations. See 4th grade expectation S.IP.04.13

S.IP.05.13 Use tools and equipment (spring scales, stop watches, meter sticks and tapes, models, hand lens) appropriate to scientific investigations. See 4th grade expectation S.IP.04.14

S.IP.05.14 Use metric measurement devices in an investigation. See 4th grade expectation S.IP.04.15

S.IP.05.15 Construct charts and graphs from data and observations. See 4th grade expectation S.IP.04.16

S.IP.05.16 Identify patterns in data. Students learn how water quality data allows us to describe the trophic status of a lake.

Inquiry Analysis and Communication

S.IA.M.1 Inquiry includes an analysis and presentation of findings that lead to future questions, research, and investigations.

S.IA.05.11 Analyze information from data tables and graphs to answer scientific questions. See 4th grade expectation S.IA.04.11

Reflection and Social Implications

S.RS.M.1 Reflecting on knowledge is the application of scientific knowledge to new and different situations. Reflecting on knowledge requires careful analysis of evidence that guides decision-making and the application of science throughout history and within society.

S.RS.05.13 Identify the need for evidence in making scientific decisions.

S.RS.05.17 Describe the effect humans and other organisms have on the balance in the natural world. See 4th grade expectation S.RS.04.18

Discipline 3: Life Sciences

Organization of Living Things

Evolution

L.EV.M.1 Species Adaptation and Survival- Species with certain traits are more likely than others to survive and have offspring in particular environments. When an environment changes, the advantage or disadvantage of the species' characteristics can change. Extinction of a species occurs when the environment changes and the characteristics of a species are insufficient to allow survival.

L.EV.05.12 Describe the physical characteristics (traits) of organisms that help them survive in their environment. Students learn about how certain fish can survive in high/low oxygen environments, and how quagga mussels' ability to migrate has allowed them to colonize the great lakes more than zebra mussels.

Grade Six

Discipline 1: Science Processes

Inquiry Process **See 5th Grade**

Inquiry Analysis and Communication **See 5th Grade**

Reflection and Social Implications **See 5th Grade**

Discipline 3: Life Science

Organization of Living Things

L.OL.M.5 Producers, Consumers, and Decomposers- All animals, including humans, are consumers that meet their energy by eating other organisms or their products. Consumers break down the structures of the organisms they eat to make the materials they need to grow and function. Decomposers, including bacteria and fungi, use dead organisms or their products to meet their energy needs.

L.OL.06.51 Classify organisms (producers, consumers, and decomposers) based on their source of energy for growth and development. *As organisms are found, they are classified by their niche.*

L.OL.06.52 Distinguish between the ways in which consumers and decomposers obtain energy. *Phytoplankton and zooplankton are compared and contrasted.*

Ecosystems

K-7 Standard L.EC: *Develop an understanding of the interdependence of the variety of populations, communities and ecosystems, including those in the Great Lakes region. Develop an understanding of different types of interdependence and that biotic (living) and abiotic (non-living) factors affect the balance of an ecosystem. Understand that all organisms cause changes, some detrimental and others beneficial, in the environment where they live.*

L.EC.M.1 Interactions of Organisms- **Organisms of one species form a population. Populations of different organisms interact and form communities. Living communities and nonliving factors that interact with them form ecosystems.**

L.EC.06.11 List examples of populations, communities, and ecosystems including the Great Lakes region. *Students are introduced to aquatic populations, communities, and ecosystems.*

L.EC.M.2 Relationships of Organisms- **Two types of organisms may interact with one another in several ways: They may be in a producer/consumer, predator/prey, or parasite/host relationship. Some organisms may scavenge or decompose another. Relationships may be competitive or mutually beneficial. Some species have become so adapted to each other that neither could survive without the other.**

L.EC.06.21 Describe common patterns of relationships between and among populations (competition, parasitism, symbiosis, predator/prey). *Students learn about competition for food in the Great Lakes and how invasive species change the populations of predator and prey organisms. Students also learn about sea lampreys, which are parasitic.*

L.EC.06.23 Predict how changes in one population might affect other populations based upon their relationships in the food web. *Students learn about the changes invasive species have had on other organisms.*

L.EC.M.3 Biotic and Abiotic Factors- **The number of organisms and populations an ecosystem can support depends on the biotic (living) resources available and abiotic (nonliving) factors, such as quality of light and water, range of temperatures and soil composition.**

L.EC.06.31 Identify the living (biotic) and nonliving (abiotic) components of an ecosystem. *Students learn about plankton, invertebrates and fish, as well as abiotic components such as oxygen and pH.*

L.EC.06.32 Identify the factors in an ecosystem that influence changes in population size. *Students learn about how certain water quality parameters affect populations, as well as the effects of invasive species.*

L.EC.M.4 Environmental Impact of Organisms- **All organisms (including humans) cause change in the environment where they live. Some of the changes are harmful to the organism or other organisms, whereas others are helpful.**

L.EC.06.41 Describe how human beings are part of the ecosystem of the Earth and that human activity can purposefully, or accidentally, alter the balance in ecosystems. *Students learn about pollution, invasive species, etc.*

L.EC.06.42 Predict possible consequences of overpopulation of organisms, including humans, (for example: species extinction, resource depletion, climate change, pollution). *Students learn about the*

effects of an overpopulation of zebra and quagga mussels, sea lampreys, alewives, etc.

Discipline 4: Earth Sciences

Solid Earth

E.S.E.M.1 Soil- Soils consist of weathered rocks and decomposed organic materials from dead plants, animals, and bacteria. Soils are often found in layers with each having a different chemical composition and texture.

E.S.E.06.14 Compare different soil samples based on particle size and texture. Students examine bottom sediments from two different lakes, one consisting primarily of organic matter, the other of sand.

Grade Seven

Discipline 1: Science Processes

Inquiry Process **See 5th Grade**

Inquiry Analysis and Communication **See 5th Grade**

Reflection and Social Implications **See 5th Grade**

Discipline 4: Earth Science

E.E.S.M.4 Human Consequences- Human activities have changed the land, oceans, and atmosphere of the Earth resulting in the reduction of the number and variety of wild plants and animals sometimes causing extinction of species.

E.E.S.07.41 Explain how human activities (surface mining, deforestation, overpopulation, construction and urban development, farming, dams, landfills, and restoring natural areas) change the surface of the Earth and affect the survival of organisms. **Students learn about human effects on the aquatic environment.**

E.E.S.07.42 Describe the origins of pollution in the atmosphere, geosphere, and hydrosphere, (car exhaust, industrial emissions, acid rain, and natural sources), and how pollution impacts habitats, climatic change, threatens or endangers species. **Students learn about sources of pollution in the Great Lakes.**

E.E.S.M.8 Water Cycle- Water circulates through the four spheres of the Earth in what is known as the “water cycle.”

E.E.S.07.81 Explain the water cycle and describe how evaporation, transpiration, condensation, cloud formation, precipitation, infiltration, surface runoff, ground water, and absorption occur within the cycle.

E.E.S.07.82 Analyze the flow of water between the components of a watershed, including surface features (lakes, streams, rivers, wetlands) and groundwater. **Students learn about their local watershed and the Great Lakes watershed.**