Water Quality Module - Standards

All NOAA Data in the Classroom modules follow guiding principles found in the Next Generation Science Standards (NGSS)[*] and Common Core State Standards[**]. They are based on the notion of learning as a developmental progression. The Water Quality Module activity levels are designed to address the NGSS and Common Core in the following ways:

Monitoring Estuarine Water Quality
Performance Expectations **NGSS MS-LS2 Ecosystems: Interactions, Energy, and Dynamics** ***MS-LS2-1: Analyze and interpret data to provide evidence for the effects of resource availability on organisms and populations of organisms in an ecosystem.*** ***MS-LS2-2: Construct an explanation that predicts patterns of interactions among organisms across multiple ecosystems.*** **Common Core ELA-Literacy: Science and Technical Subjects** ***RST.6-8.7: Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually (e.g., in a flowchart, diagram, model, graph, or table).*** Suggestion: Encourage students to synthesize information from data products generated online into their own representations (e.g. time series, charts comparing two locations, etc.). **Common Core ELA-Literacy: Writing** ***WHST.6-8.2 Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.*** Suggestion: Encourage students to document the research process in their own words. ***WHST.6-8.7 Conduct short research projects to answer a question (including a self-generated question), drawing on several sources and generating additional related, focused questions that allow for multiple avenues of exploration.*** Suggestion: If students are having trouble formulating their own research questions, refer them to model questions used in earlier activities.

[*] NGSS Lead States. 2013. Next Generation Science Standards: For States, By States. Washington, DC: The National Academies Press. Next Generation Science Standards is a registered trademark of Achieve. Neither Achieve nor the lead states and partners that developed the Next Generation Science Standards was involved in the production of, and does not endorse, this product.

[**] National Governors Association Center for Best Practices, Council of Chief State School Officers Title: Common Core State Standards. Publisher: National Governors Association Center for Best Practices, Council of Chief State School Officers, Washington D.C. Copyright Date: 2010.

Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
Analyzing and interpreting data: students graph and read water quality data (Levels 1-5); students examine the relationship between two or more parameters (Level 2 - 5); students interpret data products generated to investigate a research question (Levels 4 & 5). **Asking Questions and Defining Problems:** students ask their own questions to clarify the premise of their argument and clarify their hypothesis (Level 4-5) **Developing and using models:** students apply their skills in accessing and reading online data to explain how an estuary system works and interacts with other systems, and how those changes influence life in an estuary (Level 4 & 5). **Using mathematics and computational thinking:** students develop a working definition of temperature, dissolved oxygen and salinity (Level 1, 2 & 3); use a graphing application to examine the temporal relationship between variables (Level 2 - 5). **Constructing explanations and designing solutions:** students develop presentations to communicate findings from their data gathering (Levels 4 & 5). **Engaging in argument from evidence:** students present data in support of a research question (Levels 4 & 5). **Obtaining, evaluating, and communicating information:** students, working in teams, generate their own graphs, record, evaluate, and generate a brief report that supports or disapproves their hypothesis (Level 3 - 5); students develop presentations to communicate findings from their data gathering (Levels 3 - 5). **Planning and carrying out investigations:** students design their own investigation using real data to try to answer a research question of their choosing (Level 5).	**LS1.B: Use argument based on empirical evidence and scientific reasoning to support an explanation for how characteristic animal behaviors and specialized plant structures affect the probability of successful reproduction of animals and plants respectively:** students gather their own data, develop their own explanations that help them argument when and why fish engage in specific behaviors that increase the odds of reproduction. (Level 4 & 5) **LS2.A: Interdependent Relationships in Ecosystems:** students examine fish dependencies on specific water conditions for survival which could constrain their growth and reproduction (Level 4 & 5). **LS2.C: Ecosystem Dynamics, Functioning, and Resilience:** students examine three parameters in the context of a changing estuary system and use data to examine the interrelationship between these variables that shape the physical, chemical and biological components of the system (Level 1-3); students examine how DO, temperature and salinity changes contribute to generate the “ideal” water quality conditions for survival (Level 3); students generate data products to investigate whether ecosystem changes produce “ideal” water conditions for fish to survive at specific locations (Level 4); students design their own investigation using real data to develop their own research question and hypothesis to examine effects of changes in water quality parameters on a species. (Level 5).	**Patterns:** Observed patterns of forms and events guide organization and classification, and prompt questions about relationships and the factors that influence them (Levels 1 & 2). **Systems and System Models:** Defining the system under study - specifying its boundaries and making explicit a model of that system - provides tools for understanding and testing ideas that are applicable throughout science and engineering (Level 3). **Scale, Proportion, and Quantity:** In considering phenomena, it is critical to recognize what is relevant at different measures of size, time, and energy and to recognize how changes in scale, proportion, or quantity affect a system's structure or performance (Level 4). **Stability and Change:** For natural and built systems alike, conditions of stability and determinants of rates of change or evolution of a system are critical elements of study (Level 5).