Next Generation Science Standards (NGSS) links to OPIHI

Scientific and Engineering Practices

OPIHI addresses all of these; specific examples are highlighted below.

- **Asking Questions and Defining Problems**—all activities
- **Planning and Carrying Out Investigations**—OPIHI biological data follows citizen science protocols, water sampling procedures allow students to be creative in their sampling plans
- **Analyzing and Interpreting Data**—sampling activities, data interpretation after field trip
- **Developing and Using Models**—sampling activities
- **Constructing Explanations and Designing Solutions**—aspects in sampling and data interpretation activities
- **Engaging in Argument from Evidence**—all activities
- **Using Mathematics and Computational Thinking**—sampling activities, data interpretation after field trip
- **Obtaining, Evaluating, and Communicating Information**—all activities

Crosscutting Concepts

OPIHI touches on many of the crosscutting concepts; specific examples are highlighted below.

- **Patterns**—looking for zonation, comparing water quality to biological data, data analysis
- **Structure and Function**—when identifying species
- **Stability and Change**—OPIHI student data is contributing to a ten-year monitoring study to examine if and how species compositions have changed in the intertidal
- **Systems and System Models**—the sampling activities use models (e.g., the population of M&Ms, the index card species), and sampling designs are developed to describe systems and develop an accurate representation of an area

Disciplinary Core Ideas

The OPIHI project is an ecological monitoring program. Ecology is based on physical, chemical, and earth sciences (e.g., waves, water quality, humans, and climate change all affect the intertidal). However, the most direct connections are in the life sciences.

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Life Science (LS) 2: Ecosystems: Interactions, Energy, and Dynamics

- **LS2.A**: Interdependent Relationships in Ecosystems
- **LS2.C**: Ecosystem Dynamics, Functioning, and Resilience

Performance Expectations

OPIHI addresses content, practices, and concepts addressed in each of the following performance expectations.

- **MS-ESS3-3.** Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment.
- **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-LS2-4**. Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations.
- **HS-ESS2-5.** Plan and conduct an investigation of the properties of water and its effects on Earth materials and surface processes.
- **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-LS2-6**. 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.