KEY CONCEPTS (TRASH ISLAND: A GARBAGE PATCH JOURNEY)

- Research questions are a key component of research missions.
- A boat log is used to track voyages and maintain a permanent record of a vessel.
- Product design requires critical and creative thinking skills.
- The currents and wave action that create a gyre can transport trash into the gyre.
- Trash that makes its way into the ocean becomes part of the marine food web.
- Trawls are specialized fishing nets that are dragged through the water to collect samples.
- Product design requires critical and creative thinking skills.
- Field research requires the collection and analysis of samples and recording of data.
- A solution's pH number indicates its acidity and alkalinity.
- Many daily actions impact the environment.
- Objects can be reused for other purposes.
- Teamwork can help people accomplish a task.
- Scuba divers can move to different depths and stay safe by regulating buoyancy and their ascending and descending rates.
- Underwater environments can be explored using a wide variety of equipment.
- Ocean trash can pose challenges to the health and survival of marine life.
- Verbal and nonverbal communication is essential to teamwork.
- Some ocean trash can be cleaned up.
- Using fantasy is an essential creative thinking skill that can lead to innovative solutions to real problems.
- There are many ways to keep trash from entering oceans.
- It is important to communicate and share new knowledge with others.

OBJECTIVES

- Use research questions to guide their voyage.
- Explore the functions of a boat log by designing a log to record various aspects of a research voyage.
- Utilize critical and creative thinking skills to create and recreate waterproof boat log cases.
- Explore the transportation of trash into a gyre by making a gyre model.
- Discover how trash can become part of a food web.
- Utilize critical and creative thinking skills to create and modify trawls to collect samples.
- Explore the sample collection and analysis process by sifting through items they accumulate using their trawls and recording their sample data.
- Investigate water quality by adding ingredients to water and performing pH litmus tests on water.
- Identify and explore everyday actions and decisions that impact the environment by playing a game in which they are the game pieces.
- Examine how trash can be reused to make fishing poles.
- Work in crews to catch fish with their poles.
- Regulate buoyancy by making and testing model egg-marines.
- Investigate underwater research equipment options by designing their own ocean research models.
- Explore how ocean trash can entangle marine animals by playing a detanglement game in which the children are the net.
- Explore ways to clean up ocean trash by designing fantasy clean-up prototype machines.
- Investigate ways to reduce trash and stop Trash Island from growing.
- Deliver press conference presentations that address Trash Island research questions.

COMMON CORE STATE STANDARDS FOR MATHEMATICS ALIGNED TO TRASH ISLAND: A GARBAGE PATCH JOURNEY (TM) K-5

COUNTING AND CARDINALITY

- K.CC1 Count to 100 by ones and by tens.
- K.CC2 Count forward beginning from a given number within the known sequence (instead of having to begin at 1).
- K.CC6 Identify whether the number of objects in one group is greater than, less than, or equal to the number of objects in another group, e.g., by using matching and counting strategies.

OPERATIONS AND ALGEBRAIC THINKING

- 1.OA1 Use addition and subtraction within 20 to solve word problems involving situation of adding to, taking from, putting together, taking apart, and comparing, with unknowns in all positions, eg., by using objects, drawings, and equations with symbol for the unknown number to represent the problem.
- 1.OA6 Add and subtract within 20, demonstrating fluency for addition and subtraction within 10. Use strategies such as counting on: making ten (e.g., 8 + 6 = 8 + 2 + 4 = 10 + 4 + 14): decomposing a number leading to a ten (e.g., 13 - 4 = 13 - 3 - 1 = 10 - 1 = 9): using the relationship between addition and subtraction (e.g., knowing that 8 + 4 = 12, one knows 12 - 8 = 4): and creating equivalent but easier or known sums (e.g., adding 6 + 7 by creating the known equivalent 6 + 6 + 1 = 13).
- 2.OA1 Use addition and subtraction within 100 to solve one- and two-step word problems involving situations of adding to, taking from, putting together, taking apart, and comparing, with unknowns in all positions, e.g., by using drawings and equations with a symbol for the unknown number to represent the problem.
- 2.OA2 Fluently add and subtract within 20 using mental strategies.

NUMBER & OPERATIONS IN BASE TEN

- K.NBT1 Compose and decompose numbers from 11 to 19 into ten ones and some further ones, e.g., by using objects or drawings, and record each composition or decomposition by drawing or equation (e.g., 18 + 10 + 8): understand that these numbers are composed of ten ones and one two, three, four, five, six, seven, eight, ore nine ones.
- 1.NBT4 Add within 100, including adding a two-digit number and a one-digit number, and adding a two-digit number and a multiple of 10, using concrete models or drawings and strategies based on place value, properties of operations, and strategies based on place value, properties of operations, and/or the relationship between addition and subtraction; relate the strategy to a written method and explain the reasoning used. Understand that in adding two-digit numbers, one adds tens and tens, ones and ones: and sometimes it is necessary to compose a ten.
- 2.NBT5 Fluently add and subtract within 100 using strategies based on place value, properties of operations, and/or the relationship between addition and subtraction.

NUMBER & OPERATIONS-FRACTIONS

- 3.NF1 Understand a fraction 1/b as the quantity formed by 1 part when a whole number is partitioned into b equal parts: understand a fraction a/b as the quantity formed by a parts of size 1/b.

MEASUREMENT & DATA

- K.MD3 Classify objects into given categories; count the numbers of objects in each category and sort the categories by count.
- 1.MD4 Organize, represent, and interpret data with up to three categories: ask and answer questions about the total number of data points, how many in each category, and how many more or less are in one category than in another.
- 4.MD5 Recognize angles as geometric shapes that are formed wherever two rays share a common endpoint, and understand concepts of angle measurement:

  a. An angle is measured with reference to a circle with its center at the common endpoint of the rays, by considering the fraction of the circular arc between the points where the two rays intersect the circle. An angle that turns through 1/360 of a circle is called a “one -degree angle,” and can be used to measure angles.

GEOMETRY

- K.G1 Describe objects in the environment using names of shapes, and describe the relative positions of these objects using terms such as above, below, beside, in front of, behind, and next to.

- K.G2 Correctly name shapes regardless of their orientations or overall size.
- 3.G2 Partition shapes into parts with equal areas. Express the area of each part as a unit fraction of the whole.

COMMON CORE STATE STANDARDS FOR ENGLISH LANGUAGE ARTS & LITERACY IN HISTORY/SOCIAL STUDIES, SCIENCE, AND TECHNICAL SUBJECTS ALIGNED TO TRASH ISLAND: A GARBAGE PATCH JOURNEY (TM) K-5

WRITING STANDARDS

- Range of Writing

1. Write routinely over extended time frames (time for research, reflections, and revision) and shorter time frames (a single sitting or a day or two) for a range of tasks, purposes, and audiences.

SPEAKING AND LISTENING

- Comprehension and Collaboration

1. Prepare for and participate effectively in a range of conversations and collaborations with diverse partners, building on others' ideas and expressing their own clearly and persuasively.

2. Integrate and evaluate information presented in diverse media and formats, including visually, quantitatively, and orally.

3. Evaluate a speaker's point of view, reasoning, and use of evidence and rhetoric.

- Presentation of Knowledge and Ideas

4. Present information, findings, and supporting evidence such that listeners can follow the line of reasoning and the organization, development, and style are appropriate to task, purpose, and audience.

5. Make strategic use of digital media and visual displays of data to express information and enhance understanding of presentations.

6. Adapt speech to a variety of contexts and communicative tasks, demonstrating command of formal English when indicated or appropriate.

LANGUAGE

- Conventions of Standard English

1. Demonstrate command of the conventions of standard English grammar and usage when writing or speaking.

2. Demonstrate command of the conventions of standard English capitalization, punctuation, and spelling when writing.

- Knowledge of Language

3. Apply knowledge of language to understand how language functions in different contexts, to make effective choices for meaning or style, and to comprehend more fully when reading or listening.

NEXT GENERATION SCIENCE STANDARDS ALIGNED TO TRASH ISLAND: A GARBAGE PATCH JOURNEY (TM) K-5NEXT GENERATION SCIENCE STANDARDS ALIGNED TO BOLDER BUILDERS (TK-5

PHYSICAL SCIENCE

K-PS2 MOTION AND STABILITY: FORCES AND INTERACTIONS

- K-PS2-1. Plan and conduct an investigation to compare the effects of different strengths or different directions of pushes and pulls on the motion of an object.
- K-PS2-2. Analyze data to determine if a design solution works as intended to change the speed or direction of an object with a push or a pull.

K-PS3 ENERGY

- K-PS3-1. Make observations to determine the effect of sunlight on Earth's surface.
- K-PS3-2. Use tools and materials to design and build a structure that will reduce the warming effect of sunlight on an area.

1-PS4 WAVES AND THEIR APPLICATIONS IN TECHNOLOGIES FOR INFORMATION TRANSFER

- 1-PS4-4. Use tools and materials to design and build a device that uses light or sound to solve the problem of communicating over a distance.

2-PS1 MATTER AND ITS INTERACTIONS

- 2-PS1-1. Plan and conduct an investigation to describe and classify different kinds of materials by their observable properties.
- 2-PS1-2. Analyze data obtained from testing different materials to determine which materials have the properties that are best suited for an intended purpose.
- 2-PS1-3. Make observations to construct an evidence-based account of how an object made of a small set of pieces can be disassembled and made into a new object.
- 2-PS1-4. Construct an argument with evidence that some changes caused by heating or cooling can be reversed and some cannot.

3-PS2 MOTION AND STABILITY: FORCES AND INTERACTIONS

- 3-PS2-1. Plan and conduct an investigation to provide evidence of the effects of balanced and unbalanced forces on the motion of an object.
- 3-PS2-2. Make observations and/or measurements of an object's motion to provide evidence that a pattern can be used to predict future motion.
- 3-PS2-3. Ask questions to determine cause and effect relationships of electric or magnetic interactions between two objects not in contact with each other.
- 3-PS2-4. Define a simple design problem that can be solved by applying scientific ideas about magnets.

4-PS3 ENERGY

- 4-PS3-1. Use evidence to construct an explanation relating the speed of an object to the energy of that object.
- 4-PS3-3. Ask questions and predict outcomes about the changes in energy that occur when objects collide.
- 4-PS3-4. Apply scientific ideas to design, test, and refine a device that converts energy from one form to another.

4-PS4 WAVES AND THEIR APPLICATIONS IN TECHNOLOGIES FOR INFORMATION TRANSFER

- 4-PS4-3. Generate and compare multiple solutions that use patterns to transfer information.

5-PS1 MATTER AND ITS INTERACTIONS

- 5-PS1-3. Make observations and measurements to identify materials based on their properties.

5-PS2 MOTION AND STABILITY: FORCES AND INTERACTIONS

- 5-PS2-1. Support an argument that the gravitational force exerted by Earth on objects is directed down.
- 5-PS1-4. Conduct an investigation to determine whether the mixing of two or more substances results in new substances.

LIFE SCIENCE

K-LS1 FROM MOLECULES TO ORGANISMS: STRUCTURES AND PROCESSES

- K.LS.1 Use observations to describe patterns of what plants and animals (including humans) need to survive.

1-LS1 FROM MOLECULES TO ORGANISMS: STRUCTURES AND PROCESSES

- 1.LS.1 Use materials to design a solution to a human problem by mimicking how plants and/or animals use their external parts to help them survive, grow, and meet their needs.

2-LS2 ECOSYSTEMS: INTERACTIONS, ENERGY, AND DYNAMICS

- 2-LS2-1. Plan and conduct an investigation to determine if plants need sunlight and water to grow.

2-LS4 BIOLOGICAL EVOLUTION: UNITY AND DIVERSITY

- 2-LS4-1. Make observations of plants and animals to compare the diversity of life in different habitats.

3-LS3 HEREDITY: INHERITANCE AND VARIATION OF TRAITS

- 3-LS3-2. Use evidence to support the explanation that traits can be influenced by the environment.

3-LS4 BIOLOGICAL EVOLUTION: UNITY AND DIVERSITY

- 3-LS4-3. Construct an argument with evidence that in a particular habitat some organisms can survive well, some survivem less well, and some cannot survive at all.
- 3-LS4-4. Make a claim about the merit of a solution to a problem caused when the environment changes and the types of plants and animals that live there may change.

4-LS1 FROM MOLECULES TO ORGANISMS: STRUCTURES AND PROCESSES

- 4-LS1-1. Construct an argument that plants and animals have internal and external structures that function to support survival, growth, behavior, and reproduction.

EARTH AND SPACE SCIENCES

K-ESS2 EARTH'S SYSTEMS

- K-ESS2-1. Use and share observations of local weather conditions to describe patterns over time.
- K-ESS2-2. Construct an argument supported by evidence for how plants and animals (including humans) can change the environment to meet their needs.

K-ESS3 EARTH AND HUMAN ACTIVITY

- K-ESS3-2. Ask questions to obtain information about the purpose of weather forecasting to prepare for, and respond to, severe weather.
- K-ESS3-3. Communicate solutions that will reduce the impact of humans on the land, water, air, and/or other living things in the local environment.

2-ESS1 EARTH'S PLACE IN THE UNIVERSE

- 2-ESS1-1. Use information from several sources to provide evidence that Earth events can occur quickly or slowly.

3-ESS3 EARTH AND HUMAN ACTIVITY

- 3-ESS3-1. Make a claim about the merit of a design solution that reduces the impacts of a weather-related hazard.

4-ESS2 EARTH'S SYSTEMS

- 4-ESS2-1. Make observations and/or measurements to provide evidence of the effects of weathering or the rate of erosion by water, ice, wind, or vegetation.
- 4-ESS2-2. Analyze and interpret data from maps to describe patterns of Earth's features.

4-ESS3 EARTH AND HUMAN ACTIVITY

- 4-ESS3-1. Obtain and combine information to describe that energy and fuels are derived from natural resources and their uses affect the environment.
- 4-ESS3-2. Generate and compare multiple solutions to reduce the impacts of natural Earth processes on humans.

5-ESS3 EARTH AND HUMAN ACTIVITY

- 5-ESS3-1. Obtain and combine information about ways individual communities use science ideas to protect the Earth's resources and environment.

ENGINEERING DESIGN

K-2-ETS1 ENGINEERING DESIGN

- K-2-ETS1-1. Ask questions, make observations, and gather information about a situation people want to change to define a simple problem that can be solved through the development of a new or improved object or tool.
- K-2-ETS1-2. Develop a simple sketch, drawing, or physical model to illustrate how the shape of an object helps it function

as needed to solve a given problem.

- K-2-ETS1-3. Analyze data from tests of two objects designed to solve the same problem to compare the strengths and weaknesses of how each performs.

3-5 ETS1 ENGINEERING DESIGN

- 3-5-ETS1-1. Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.
- 3-5-ETS1-2. Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.
- 3-5-ETS1-3. Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved.