AN 'ADVENTURE' IN LEARNING

UNIT: **THE PLACE**

Related Massachusetts Curriculum Frameworks Content Strands and Performance Standards:

LESSON I: Where Are We?

A. Curriculum Frameworks: Content Strands and Performance Standards

HSCF: Strand 2 (Geography): LS 7, LS9

STCF: Strand 4 (Science, Technology & Human Affairs)

MCF: Patterns, Relations, and Algebra: 6P6

B. Concepts:

Reading Maps & Charts

Navigation on Land and Sea

Historical Methods of Navigation

Celestial Navigation

Technology of Navigation

Dead Reckoning

LESSON II: Fish Habitats

A. Curriculum Frameworks: Content Strands and Performance Standards

STCF: Strand 2 (Domains of Science): Life Sciences: Characteristics of organisms, Diversity and adaptation, Ecosystems & organisms.

STCF: Strand 4 (Science, Technology & Human Affairs)

B. Concepts:

Habitats and Ecosystems

Units of Measurement

Development of Fisheries Technology

LESSON III: Buoyancy

A. Curriculum Frameworks: Content Strands and Performance Standards

STCF: Strand 2 (Domains of Science): Physical Science: Motions, Transformations of Energy

STCF: Strand 4 (Science, Technology & Human Affairs)

B. Concepts:

Floatation

Maritime Design

Buoyancy

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A. Curriculum Frameworks: Content Strands and Performance Standards

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C. Materials:

Charts of Gloucester Harbor and Fishing Banks

Map of Gloucester

Sextant

GPS

Compass

Taffail Log

Stop Watch

D. Learning Activities:

1. What is navigation? (Gather student's definitions/suggestions—how to find your way around etc.) How do we navigate? (We need a form of place recognition, an understanding of spatial relationships, mental or physical map, landmarks, direction, a starting point and a destination, etc.) Ask students to give simple directions to a place they know (i.e. school, the store, their living room, their classroom). After a few examples, ask students to identify what their directions are actually imparting to the observer, direction, relationships, landmarks, etc. and write them on the whiteboard. Now ask students, Why is navigation important? (So that we can find places, so that we stay out of danger, so that we don't get lost, so we can find our way home, etc.)

2. Navigation at sea is very different from navigation on land. Have students hypothesize why this is so using the information that they produced in the first segment. (There are no landmarks at sea, there are no roads, there are dangers but they usually lie underwater and can't be seen, currents, wind and tides can

throw you off course, etc.) Ask students to hypothesize how navigation at sea is possible given these unique obstacles.

3. Display navigational tools one at a time, explain each, and let the students handle/try out the equipment.

a. maps and charts- have students examine a map of Gloucester and a chart of Gloucester and the harbor. Ask students to compile a list of the differences and similarities between the chart and the map (i.e. what information does the map impart that the chart does not, why they think that this is so and vice versa) Things to point out/explain: the legend, depth markings, physical representations, and longitude/latitude.

b. compass- the compass uses the Earth's magnetic field to display direction, the needle points to the magnetic north pole.

c. sextant- the sextant uses celestial (ask students to define) sightings to locate position/chart courses at sea. Celestial bodies like the sun and stars can be used as "landmarks" at sea. These bodies remain fixed as the Earth rotates and orbits the sun, by knowing the information that the sextant determines (the angle of the celestial body) and the time that the measurement was taken, we can determine where we are.

d. time piece- navigation became an exact science when clocks that could keep time at sea were developed. If we can measure time we can tell how long we have been moving in a certain direction, this information when multiplied by how fast we are moving will give us the distance we have traveled. As long as we know the direction we were moving, we can figure out where we are. (distance= rate x time) Have students calculate how far they have gone if they are traveling at 100 mph for 1 hour. Also, longitude and latitude are measured in degrees, minutes, and seconds.

e. taffail log- the taffail log was used to calculate speed. As it was dragged through the water, the propeller would spin. Sailors would then calculate the number of rotations the propeller mad in a given time and that would tell them the speed at which the boat was traveling.

f. GPS- stands for Global Positioning system. Satellites beam down coordinates to the device and tell the navigator his position.

g. ATON's- Aids to navigation—markers placed in bodies of water that impart information to sailors. Examples include light houses, bells, cans and nuns. Have students look around the harbor and point out the ATON's that they see.

4. Explain three types of navigation to the students, Celestial navigation (using celestial bodies in navigation), Dead Reckoning (using a known starting point, the direction and the speed to determine a course), and Modern Electronic navigation (relying on electronic devices to find position and stay on course). Have students hypothesize as to what tools would be used in each form of navigation. Finally, ask students what type of navigation they thought the captains of Adventure used and why. (Dead Reckoning).

LESSON II: Fish Habitats

A. <u>Curriculum Frameworks: Content Strands and Performance Standards</u>

STCF: Strand 2 (Domains of Science): Life Sciences: Characteristics of organisms, Diversity and Adaptation, Ecosystems & organisms.

STCF: Strand 4 (Science, Technology & Human Affairs)

B. <u>Concepts:</u>

Habitats and Ecosystems

Units of Measurement

Development of Fisheries Technology

C. <u>Materials:</u>

3 Lead lines

Poster explaining depth measurement

Poster showing fish and fish habitats

D. <u>Learning Activities:</u>

1. What do the fish that Adventure caught need to live? (food, salt water, habitat) What do the fish eat? (sea weed, plankton, other fish, pollutants, bait) And habitat, where do the fish live? (at the bottom of the water column, at the top, close to shore, out in open water, in the tropics, in the artic, in the rocks? On the sand?) Introduce the word "habitat." Different types of fish live in different types of habitats.

2. Show posters depicting the water-column and the fish habitats. Ask students to name what characteristics would best suit a fish living at different points in the water column or different types of habitat. (flat fish on sandy bottoms, fast swimming fish in open water, etc.)

3. If we were fishing, how could we tell what type of habitat and what type of fish are under our boat if we can't see through the water? (depth sounding, charts, experience, lead lining)

4. What is lead-lining? What did it tell the fishermen? (characteristics of the bottom, depth) How did the lead line measure depth? (Knots mark fathoms in line. Lard or other material at the end of the weight collects debris from the bottom or is marked by rocks or shells)

5. Divide into groups of 3 or 4 and try the lead lining experiment. Give each group of students a lead line. Explain the parts of the line (line, weight) and how it works. Instruct them to look at the knots in the line explain that each knot represents one fathom. Introduce the word fathom. (means six feet) Have students put tallow or lard on the bottom of the weight. Gently lower the line over the gunwale. Keep easing out the line slowly until the weight is resting on the bottom. Have students mark the nearest knot to their hand. Slowly reel in the line and weight. When the weight is retrieved, have students look at the debris and marking in the lard or tallow. Next have students count the number of knots that are wet. Have students multiply this number by six to calculate the number of fathoms.

Questions to answer:

a. How deep is the water under Adventure?

b. What type of bottom is under the dock?

c. What type of fish from the charts would we most likely find in the water here?

d. How do you know?

LESSON III: Buoyancy

A. <u>Curriculum Frameworks: Content Strands and Performance Standards</u>

STCF: Strand 2 (Domains of Science): Physical Science: Motions, Transformations of Energy

STCF: Strand 4 (Science, Technology & Human Affairs)

B. <u>Concepts:</u>

Flotation

Maritime Design

Buoyancy

C. <u>Materials:</u>

Poster showing forces at work

Poster with definition of buoyancy

5 small, clear, watertight receptacles

Clay (plasticine)

D. <u>Learning Activities:</u>

1. Why does Adventure float? Why does anything float? (weight, shape, density) Ask for, and collect ideas from the students and write them down on the white board.

2. Divide students into pairs and assign each pair to a container of water. Distribute a piece of clay to each student. Ask the students to shape their pieces of clay into the tightest possible balls. Then ask students to hold up their balls when they have finished. When all the students are ready, take a vote on how many think the clay will float and how many think that it will sink. Next, drop the clay into the water. (The ball of clay sinks) Ask those who thought it would sink why they thought so and vice versa.

3. Now ask the students to flatten the clay as flat as they can (don't use clothing, dock, or Adventure to do this, the clay can get messy) and then have them fold up the sides to make boats shaped from the clay. Check the boats for any holes. Have all the students wait until everyone has finished modeling their boats. Ask the students, "What do you think it will do now?" (take vote again) Have students gently place the clay boats in the water. (the boats should float and might need some adjustments if they don't)

4. Show the poster on the impact of the forces of gravity and buoyancy on an object in water. "The clay sank when it was shaped like a ball and floated when it was shaped like a boat. Why do you think that happened?" (shape of the object changed its volume and surface area)

5. Explain the force of gravity (drawing the object toward the center of the earth) and the buoyant force. Introduce the term "displacement" and ask the students to help define it. (Write definition on white board) Explain that an object will displace the same volume of water as it contains itself. If the object weighs more than the water that it displaces, then the object will sink. If the object weighs less than the water it

displaces, the object will float. “What does that tell us about the clay ball and the clay boat?” (The water the ball displaces weighs less than the ball. The water the boat displaces weighs more than the boat.)

6. “How does the shape of the boat help it float?” (Much of the volume of the boat is made up of air, which is light) How is the clay boat like Adventure?

7. How could we make the boat sink? (add weights or water) Add marbles or other objects to the boats until they sink. If we increase the load too much even, the shape of the boat won’t keep it from sinking. It will sink when it weighs more than the volume of water that it displaces.