Trading Books for Boats in Bonne Bay 2011

___Your Name Here___ 's Work Book

Proudly Funded by:

Bonne Bay marine station

MEMORIAL UNIVERSITY

CURRA

RED Ochre Regional Board Inc.

WESTERN SCHOOL DISTRICT

Integrated Coastal Zone Management Steering Committee

Proudly Supported by:

ACAP Humber Arm Environmental Association Inc.

Fisheries and Oceans Canada | Pêches et Océans Canada

INSTRUCTORS

Allison Eaton BSc. B.Ed.
Bonne Bay Marine Station, Memorial University
P0 Box 69,
Norris Point, NL
A0K 3V0

709 458-2550
www.bonnebay.ca

Rebecca Brushett BSc. B.Ed

BOAT OPERATOR

Bon Tours
PO Box 129
Rocky Harbour, NL
A0K 4N0

709 458-2016
www.bontours.ca

HOW TO USE THIS WORKBOOK

This workbook contains 5 major sections:

Boat Station
To be completed by students on-board the boat using the nautical chart.

Learning Stations
To be completed by students based on the activities and/or observations at the learning stations.

Presentation
To be completed by students based on the notes provided to you in this workbook and the powerpoint presentation. A copy of the presentation was supplied to your teacher.

Homework
To be completed by students at home or at school using materials supplied to your teacher.

Glossary
To assist students with terms that they may not be familiar with.

STUDENTS - where do I find the answers?

The information needed to answer the questions contained in this workbook can be obtained by:

- Listening to the power point presentation. The PowerPoint presentation has been supplied to your teacher.
- Studying the displays and posters.
- Participating in the activities during the boat trip.

TEACHER'S - learner outcomes / evaluation

This workbook and all supporting material have been developed to directly fulfill the prescribed curriculum as outlined in the table on the following pages.

The workbook is meant to be used by teachers as an evaluation tool.

Trading Books for Boats Topics	Science Grade 8 Curriculum
Water Cycle	1.2 Define water cycle
Ocean Currents	1.26 Carry out procedures in order to investigate how temperature differences cause deep water currents. (209-1)
Ocean Waves	1.32 Explain how waves and tides are generated. (311-10a) 1.33 Define wave 1.34 Identify that waves on the surface of water are the result of a transfer of energy from moving air to the water. 1.35 Define and illustrate the following wave features: (i) wave length (ii) wave height (iii) crest (iv) trough 1.37 Identify that as waves approach a shoreline the wave length **decreases and wave height increases**
Tides	1.39 Define tide 1.40 Explain and illustrate how tides are generated by the gravitational pull of the moon. 1.41 Define tidal range 1.42 Distinguish between spring tides and neap tides
Marine Species	1.60 Describe species found in saltwater environments. Include: (i) pelagic zone (ii) benthic zone 1.64 Identify the effects of abiotic factors on plant and animal distributions in marine and freshwater ecosystems. (208 2, 306-3) Include: (i) temperature (ii) dissolved oxygen (iii) phosphates (iv) pH (v) turbidity (vi) pollution (vii) upwelling (marine) (viii) salinity (marine)

	(ix) ocean currents (marine)
Humans and Oceans	1.66 Describe some positive and negative effects of marine technologies on ocean species. (113-2) 1.67 Discuss how new technologies have contributed to over-fishing 1.68 Discuss how the offshore oil industry impacts marine environments 1.69 Discuss potential impacts aquaculture technologies have on marine environments

PRESENTATION

To be completed by students based on the notes provided to you in this workbook and the powerpoint presentation. A copy of the presentation was supplied to your teacher.

1: pH

Each molecule of water is made up of one oxygen and two hydrogen atoms. It also contains some ions of free hydrogen atoms (H+) that have a positive charge, and some ions of oxygen and single hydrogen atoms (OH-) that have a negative charge. These ions are very unstable and will attempt to combine with other elements. The measure of the ratio that exists between these two ions in a sample of water is called its pH. The pH scale ranges from 0 to 14.

Pure water is neutral and has a pH of 7. It contains the same number of negative and positive ions. If water contains more H+ ions, it is considered acidic and will have a pH lower than 7. If it contains more OH- ions than H+ ions, it is basic and will have a pH value greater than 7.

Fish need water that is near the middle of the pH scale to survive. For example, salmon need water with a pH between 6.5 and 8.0 for full productivity.

Increased amounts of nitrogen oxides, carbon oxides, and sulfur oxides are being released into the atmosphere by automobile exhaust and by the burning of fossil fuels. These emissions are converted to acids in the atmosphere and fall as acid rain or acid snow. Periods of high water caused by melting acidic snow may rapidly decrease the pH in streams.

1. What pH range do you expect to sample today during the boat station and why?

____

____

2. What are some causes of low pH in aquatic ecosystems?

____

____

____

2: Temperature

Temperature is important for growth in any ecosystem. Oxygen gas is less soluble in water at higher temperatures than at lower temperatures. An increase in water temperature can encourage biological and chemical activity, affecting oxygen levels in the system.

The source of water in a stream can determine its temperature. For example, water coming from a glacier or from a spring will be cold. Many factors along a stream's course can affect its temperature. Natural warming occurs when air temperatures are high from direct sunlight. Human activities such as the removal or the destruction of shading vegetation along the stream's edge can also raise water temperature by exposing the stream to the heat of direct sunlight. As well, water slowed by dams or other obstructions will warm near the surface, though deeper water may remain very cold.

Ponds, being generally small and shallow, will warm uniformly throughout. In contrast, the larger lake systems show characteristic temperature patterns as the seasons change: during spring, temperature patterns, water density, and the level of dissolved oxygen within a lake are fairly consistent. As summer approaches, the sun heats the lake system, causing internal changes. The less dense top layers of the lake warm first, and stay at the surface. Thus, two distinct layers form: a warmer, upper layer and a cooler, lower layer. This layering is called thermal stratification. By midsummer there will be three layers: the warm upper layer, a transition layer from warm to cold called the thermocline, and the cool deeper layer. These layers generally form in lakes of depth of more than 12 meters, while shallow water bodies are usually warmed uniformly and completely.

This layering has consequences for dissolved oxygen levels. The warmer upper layer at the surface circulates, thus maintaining contact with the air, whereas, the deeper, cooler layer is cut off from the surface by the thermocline. This reduces oxygen in deeper waters, and limits productivity in this layer.

When winter arrives, the water cools. The layering disappears and temperatures become uniform again. As air temperatures continue to fall, the surface waters of the lake cool further, become denser and sink to the bottom. This pattern continues until the water temperature reaches 4°C, the temperature of maximum density for water. Water colder than 4°C is lighter, remains near the surface, and freezes, forming ice at the lake surface, while the temperature remains 4°C at depth.

While plants are adapted to these temperature variations, many animals prefer more stable temperatures and generally move to stay within a certain range. These temperature preferences are critical for feeding, reproduction, and migration. In particular, temperatures are critical for the survival of young.

1. What is the average surface seawater temperature in March and July/August for Bonne Bay?

____

3: Dissolved Oxygen

Aquatic organisms depend on the level of oxygen dissolved in water. Even if water is saturated with oxygen, (containing as much O2 as it is capable of holding), it may contain less than 5% oxygen. The air we breathe contains 21% oxygen. Many factors can affect the oxygen content of water. Turbulence, temperature, organic matter and plant growth all influence daily and seasonal oxygen levels.

Turbulence - Dissolved oxygen content is increased by water movement. Generally, standing or stagnant water contains less dissolved oxygen than turbulent (moving) water. Moving water (water flowing over a waterfall or through shallow riffles), mixes with air thus increasing the opportunity for oxygen to become absorbed.

Temperature - Temperature also influences oxygen concentrations. Generally cold water contains more dissolved oxygen than warm water. Water running through a cool shaded area can increase its capacity to hold oxygen, but as water slows and gets heated in an open area, this oxygen holding capacity again decreases.

Organic Matter - The quantity of organic matter in water also affects the amount of dissolved oxygen in the system. In a natural environment that has not been disturbed by humans, the organic matter present in a stream will originate from dead aquatic plants, leaves shed by stream-side vegetation, or from animals that have died in or near the water. Other sources of organic matter in water are the result of human activity. These include logging debris and effluent (waste) from homes and industries.

Decomposition of organic matter by micro-organisms such as bacteria and fungi requires oxygen. Therefore, water with a high organic content will use up available oxygen quickly. High biological oxygen demand (BOD) can cause oxygen levels to become too low to sustain most aquatic organisms.

Plant Growth - Plant growth also affects dissolved oxygen levels. During summer months, when plants receive light from the sun, they can produce large amounts of oxygen during the day through photosynthesis. At night, their respiration uses up some of that oxygen. In locations where aquatic vegetation is dense, dissolved oxygen levels can fluctuate considerably from day to night. Dead aquatic vegetation can cause serious problems in winter as it decomposes under a layer of ice. This decomposition increases the BOD, but there is little chance to restore oxygen levels as they are depleted. The ice barrier separates the water from the air, preventing atmospheric oxygen from reaching and dissolving into the water. The barrier created by ice and snow also blocks or diffuses what little light there is, preventing replenishment of dissolved oxygen by photosynthesis. This oxygen depletion often results in a winter kill of aquatic organisms including fish.

1. What human activities affect dissolved oxygen levels in water?

____

____

2. What is the effect of reduced dissolved oxygen levels on aquatic organisms?

____

____

4: Phosphates

Phosphates contain the element phosphorus which is important in many organic chemicals, especially those involved in energy storage. Much of the excess phosphorous enters the water through detergents that are being flushed down our drains. Too much phosphorus contributes to algal blooms which leads to choked water systems.

1. What are some possible sources of excess phosphates in our waters?

____

____

____

5: Turbidity

The sun is the source of light and heat energy in freshwater ecosystems. All plant life (plankton, algae, and macro-plants) need light for photosynthesis, the basis for all energy flow in the environment. Water must be clear if light is to reach organisms lower down in the water column, thereby still allowing photosynthesis to take place.

The depth of light penetration in water is determined by the nature of light and water's ability to filter out specific wavelengths. Light is made up of different wavelengths that we perceive as different colors. Not all colors are equally transmitted through water. Red wavelengths are filtered out in the upper layers while the blues reach farthest into the depths.

Dissolved and suspended material such as tannins and sediments color water and affect the clarity, and thus the penetration of light through the depths. If water is cloudy, it will reduce light penetration and is said to be turbid. Clarity is determined using a Secchi Disc, which indicates the depth to which light can penetrate. This measurement by itself, however, does not indicate water quality even though the clarity of water can give an indication of the health of an aquatic system. Clear water may be good for light penetration, but the water ay be clear due to a high level of acidity (low pH), and water organisms may have been killed by this acidity. While turbid (cloudy) water may prevent light penetration, the turbidity may be caused by plankton, which indicate the presence of abundant nutrients. A Secchi disc reading alone should not be the only indicator of water quality.

1. What factors might affect turbidity in Bonne Bay?

____

____

____

6: Salinity

The salt in the ocean was initially derived from gases expelled from volcanoes when the earth's crust was being formed; now rivers, streams and groundwater flowing over land, pick up minerals and deposit them into the ocean. These break down or dissolve, contributing to the salinity of the seas. The average of total amount of salt dissolved in the ocean is approximately 35ppt. This means that there is roughly 35 grams of salt in every 1000 grams of seawater.

Salinity is not constant throughout the water column. Salinity of the top layer of the ocean is closely linked with precipitation and evaporation. Evaporation leaves behind dissolved salts increasing salinity, while precipitation "freshens" the top ocean layers (reducing salinity). Salinity levels are high in mid-latitudes where evaporation is high and precipitation is low, whereas salinity is low near the equator because precipitation is so high. Very high latitudes can also see decreases in salinity where sea ice melts and "freshens" the water.

The oceans are naturally salty. This saline environment has quite an effect on life in the oceans-- most creatures that live in the ocean could not live in fresh water. However, when the highly saline waters of the ocean meet fresh water, an estuary is formed. This is a special environment where some creatures have adapted to a mixture of fresh and salt water. The alteration of fresh water systems, ground waters, or soils by human actions that cause an increase in the salinity of these areas, can have a devastating effect on the organisms within the affected ecosystems. Changes in salinity brought about by human residential, commercial and industrial activity can kill plant life, aquatic life, and animal life in a given area.

1. Explain what would happen to the average salinity measurement if several icebergs began to melt in Bonne Bay (note: icebergs are made of freshwater)?

____

____

BOAT STATION

To be completed by students on-board the boat using the nautical chart.

Bonne Bay Fact Hunt

1. What are the 2 arms of Bonne Bay (East Arm and South Arm) described as?

____

____

2. How long and wide is the East Arm?

____

____

4. What is the maximum depth measured in the East Arm?

____

____

6. What is the surface temperature ranges for Bonne Bay in the winter and summer?

	Bonne Bay Surface Water Temperature
Winter	
Summer	

7. How many tidal cycles occur in Bonne Bay everyday?

____

____

LEARNING STATIONS

To be completed by students based on the activities and/or observations at the learning stations.

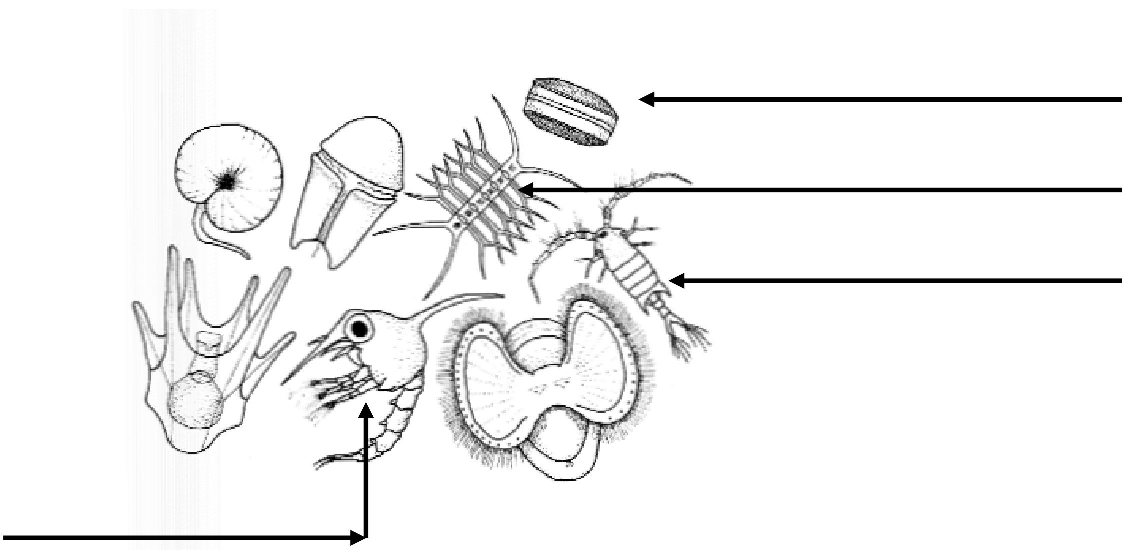
Station 1: Plankton

Fill in the blanks!

Plants or ________________________ use sunlight to manufacture sugars from chemicals in seawater and release _____________________.

Animal plankton or _____________________ include tiny shrimplike crustaceans such as copepods, jelly fish, fish eggs and baby fish.

Label each organism as phytoplankton or zooplankton.



2. Describe the role that plankton plays in the environment.

____

____

____

3. On the boat you conducted (or will conduct) plankton tows and collected a sample from the tow. Look at some of the specimens under the microscope and sketch 2 different things that you see.

4. What type of plankton did you just sketch?

5. Identify, and list below, 3 organisms in our touch tank that feed directly on plankton.

6. What effect do you think new marine technologies would have on plankton?

Station 2: Oil Spill Prevention and Remediation

1. Using the display, list 5 potential sources of oil pollution in the Bonne Bay.

____

____

____

____

____

2. Name two marine creatures that might be affected by oil pollution.

____

____

3. List 3 ways of cleaning up a small oil spill.

____

____

4. Which two use peat as a natural absorbant?

____

____

____

5. OIL SPILL IN BONNE BAY! Reporting the case.

Where in Bonne Bay? ____________________________________

When did it happen? _____________________________________

How much fuel?____

What kind of fuel? _______________________________________

What was the immediate repsonse?____

What was the long term response?____

What did they use to restore the habitat? _______________________________________

Give 2 reasons why Eel grass was used.

____

____

____

____

____

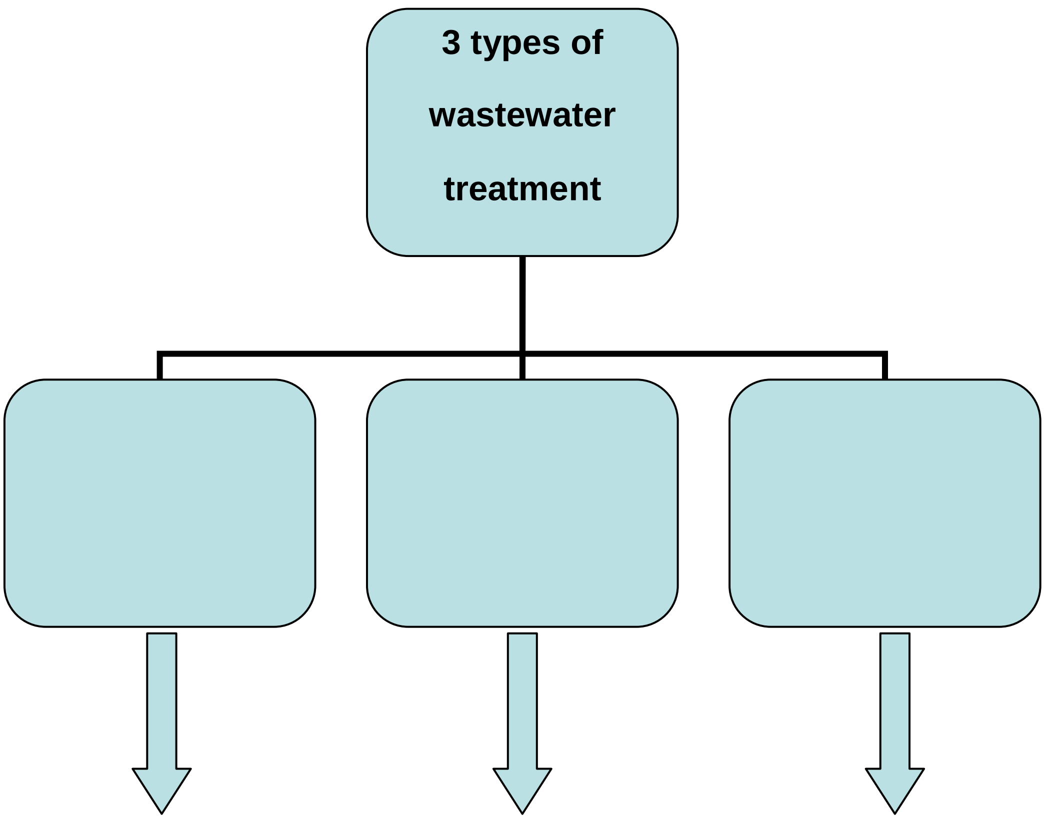
____

Station 3: Municipal Wastewater Treatment

1. What is another name for municipal wastewater?

____

Fill in the blanks.



Removes ___________ and ____________ material.

Adds ___________ so bacteria can______________.

Is a ______________ process. Wastewater is most often treated by adding ______________.

2. Look at the book provided. Does your community treat it’s wastewater?

____

____

3. Where does wastewater go if it is not treated?

____

4. What are 2 things in detergents that are harmful to the environment?

____

5. Why are they harmful?

____

____

____

____

6. What kind of things can you do to reduce the amount of nitrates and phosphates in our wastewater?

____

____

____

____

Station 4: Coastal Activities in Bonne Bay and the Gulf of St. Lawrence

1. List 5 coastal activities taking place in the Bonne Bay:

____

____

____

____

____

2. Choose 1 coastal activity and list the possible harmful effects this activity may have on our marine environment.

Coastal Activity #1 :

____

____

____

____

3. List the 2 major aquaculture areas in Newfoundland.

____

____

4. List the 4 most common species harvested through aquaculture in Newfoundland.

5. What kind of impacts can aquaculture technologies have on our marine environments?

HOMEWORK

To be completed by students at home or at school using materials supplied by your teacher.

1. What is Marine Debris?

____

____

____

2. List 4 examples of marine debris.

____

____

____

____

3. Give two examples of how marine debris can be harmful to marine life.

____

____

4. What is the most common type of marine debris?

____

____

____

5. List the 3 types of marine debris that take the longest to decompose.

____

____

____

6. Explain a possible scenario of how small pieces of garbage from around your school could end up in Bonne Bay.

____

____

____

____

____

GLOSSARY

BIOLOGICIAL OXYGEN: oxygen that is dissolved in water.

BIOLOGICAL OXYGEN DEMAND: amount of oxygen required by organisms to decompose organic matter in water.

ESTUARY: the point at which the mouth of a river/stream enters the sea, causing the freshwater and seawater to be mixed.

HOLOPLANKTON: an organism that remains a zooplankton for their entire life (i.e. copepods).

KRILL: (known as euphausiids); are small shrimp-like crustaceans, which are a major food source for a variety of marine life.

MEROPLANKTON: an organism that is a zooplankton only when it is young/juvenile (i.e. starfish).

PHOSPHORUS: An important nutrient for algae; responsible for primary production.

PHOTIC ZONE: the top layer of the ocean that sunlight is able to reach/penetrate.

PHOTOSYNTHESIS: process by which plants produce their own food and release oxygen as a byproduct. Carbon dioxide is combined with hydrogen from the water using solar energy.

PHYTOPLANKTON: plant plankton, they conduct photosynthesis.

PLANKTON: organisms that drift in the sea, they can not actively swimagainst it.

TANNINS: phenolic compound from plants that dyes or colors.

THERMAL STRATIFICATION (THERMOCLINE): formation of layer(s) based on temperature.

TURBIDITY: clarity of water caused by presence of suspended matter.

TURBULENCE: the unstable flow of a liquid or gas.

UPWELLING: upward motion of cold nutrient-rich ocean waters.

ZOOPLANKTON: animal plankton

Trading Books for Boats in Bonne Bay
Data Sheet – Fall 2011

School Name: ____

Student Name: ____

Sampling Site # _____________

GPS Location: ___________________________N ______________________________W

Date: _______________________ Time:________________________

DATA COLLECTION
Cloud Cover (check one): clear___ scattered___ broken___ overcast___

Sea State (using Beaufort's Wind Scale 0 – 12): ____________________

Tide Information Time of High Tide:____________________(hours & mins)
Time of Low Tide:_____________________(hours & mins)

Turbidity a = length of rope where disk disappears ____________cm
b = length of rope where disk is at surface___________cm
Turbidity depth (a-b)____________cm

Water Sample #	**1**
Water Sampler:	
Depth of Sample:	
Salinity of Sample:	
D Oxygen of Sample:	
Temperature of Sample:	
Ph of Sample :	

Plankton Tow Yes_________ No_________

Beaufort Wind Scale

In 1806, Admiral Sir Francis Beaufort devised a simple scale that coastal observers could use to report the state of the sea to the Admiralty. It was officially adopted in 1838.

Beaufort Number	**Speed**			**Name**	**Conditions at Sea**
	knots	**km/h**	**mi/h**		
0	< 1	< 2	< 1	Calm	Sea like a mirror.
1	1-3	1-5	1-4	Light air	Ripples only.
2	4-6	6-11	5-7	Light breeze	Small wavelets (0.2 m). Crests have a glassy appearance.
3	7-10	12-19	8-11	Gentle breeze	Large wavelets (0.6 m), crests begin to break.
4	11-16	20-29	12-18	Moderate breeze	Small waves (1 m), some whitecaps.
5	17-21	30-39	19-24	Fresh breeze	Moderate waves (1.8 m), many whitecaps.
6	22-27	40-50	25-31	Strong breeze	Large waves (3 m), probably some spray.
7	28-33	51-61	32-38	Near gale	Mounting sea (4 m) with foam blown in streaks downwind.
8	34-40	62-74	39-46	Gale	Moderately high waves (5.5 m), crests break into spindrift.
9	41-47	76-87	47-54	Strong gale	High waves (7 m), dense foam, visibility affected.
10	48-55	88-102	55-63	Storm	Very high waves (9 m), heavy sea roll, visibility impaired. Surface generally white.
11	56-63	103-118	64-73	Violent storm	Exceptionally high waves (11 m), visibility poor.
12	64+	119+	74+	Hurricane	14 m waves, air filled with foam and spray, visibility bad.

THANK YOU

FOR TAKING PART IN

TRADING BOOKS FOR BOATS IN BONNE BAY 2011