This Lake Alive!

An Interdisciplinary Handbook for Teaching and Learning about the Lake Champlain Basin

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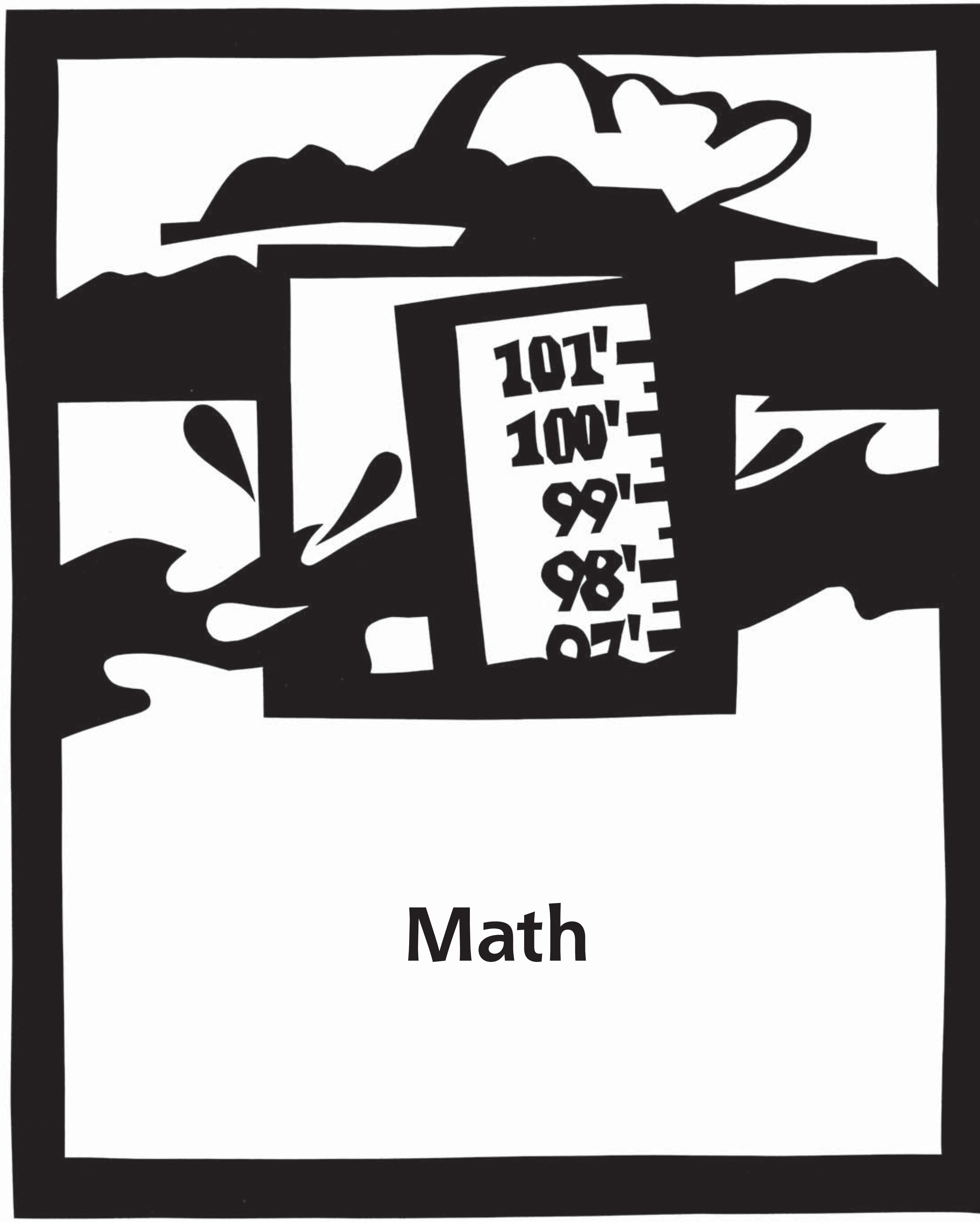


Math

This chapter was written by Kris Kenlan, a math teacher at the Frederick H. Tuttle Middle School in South Burlington, Vermont.

Her purpose was to provide the classroom teacher with a sampling of math activities to use in conjunction with an interdisciplinary study. Kris designed activities that employ a variety of math skills—basic computation as well as higher level problem solving—which of course will entice you to design more math activities. There is so much data now available about the Lake Champlain Basin and new standards invite teachers to use this “real world” data with students. The possibilities are endless!

In choosing these activities, Kris sought to:
• provide students the opportunity to use a variety of math skills,
• use math as a bridge to help students understand the many different features of the Lake Champlain Basin and to see these features in new ways,
• provide the practical application of math skills to the “real world” of the basin.

Activity: Count the Boats!

TEACHER NOTES *and* INFO

A survey of boat use and activity was undertaken during the summer of 1992. The data obtained were the result of aerial photographs taken on one clear weekend day in July, 1992. The photographs were then analyzed. Boats were divided into categories of type, size, distance from shore and activity. I wanted to use pictographs as a way of showing this data.

***Note:** The data for this activity was taken from the "Lake Champlain Boat Study," by Susan Bulmer, a report published by the Lake Champlain Basin Program in 1993.*

The pictographs included here represent the count for Shelburne Bay. Each boat represents 25 boats and is an approximation, to the nearest 25, of the actual data. I left out data on commercial vessels and boats larger than 54 feet; their low numbers would have been hard to represent. Categories are organized according to type, size and activity.

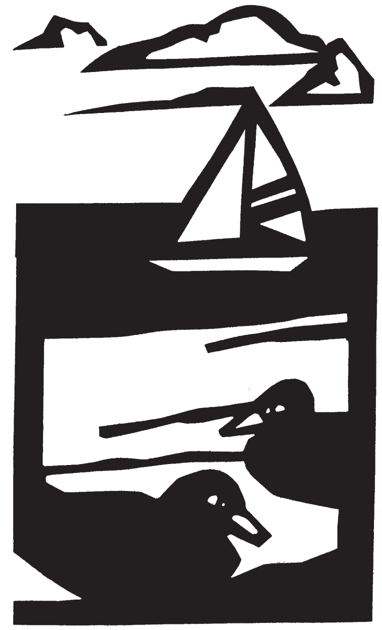
STUDENT ACTIVITY

First have students study the pictographs, then have them interpret the data.

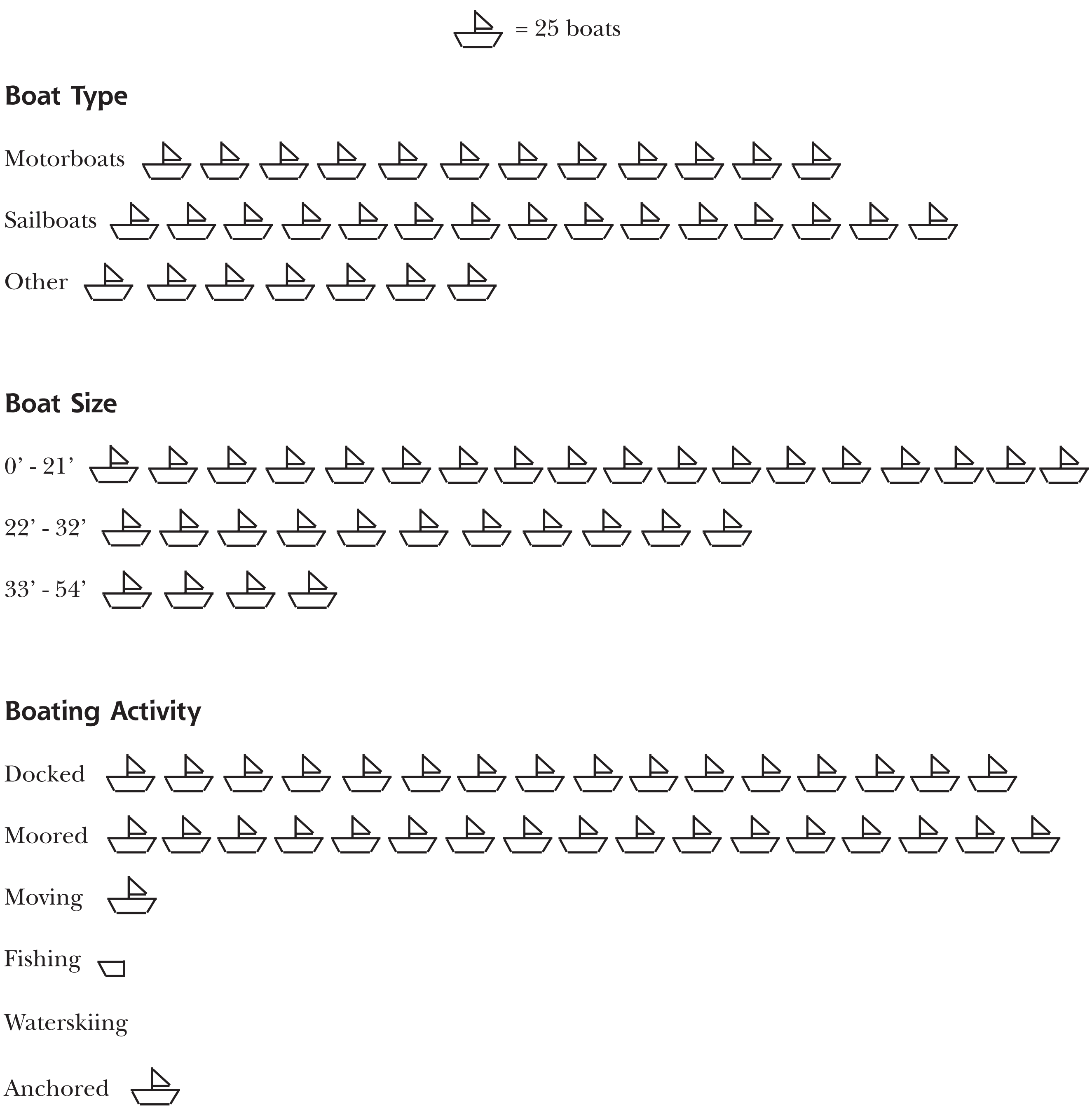
QUESTIONS *for* STUDENTS

1. Estimate the number of boats in each category.
2. How many more sailboats were there than motorboats?
3. What was the most common boat size in Shelburne Bay?
4. What was the most common activity?
5. How many more boats between 0 feet and 21 feet were there than between 33 feet and 54 feet?
6. How many boats of all types were in Shelburne Bay at the time of the count?

STUDENT HANDOUT - "Boat Count Data for Shelburne Bay (July, 1992)"



Boat Count Data for Shelburne Bay
(July,1992)



Activity: **Let's Dive!**

TEACHER NOTES *and* INFO
The following activity is designed to look at one of the ways that money is spent on recreation and to review some basic math skills.

STUDENT ACTIVITY
Hand out the worksheet "Take a Dive!" to your students. Let them determine how much it would cost them to "suit up" for scuba diving in Lake Champlain. The list of equipment and costs can be used in various ways for more complicated math problems.

SCUBA stands for "self-contained, underwater, diving apparatus."

STUDENT HANDOUT - "Take a Dive!"

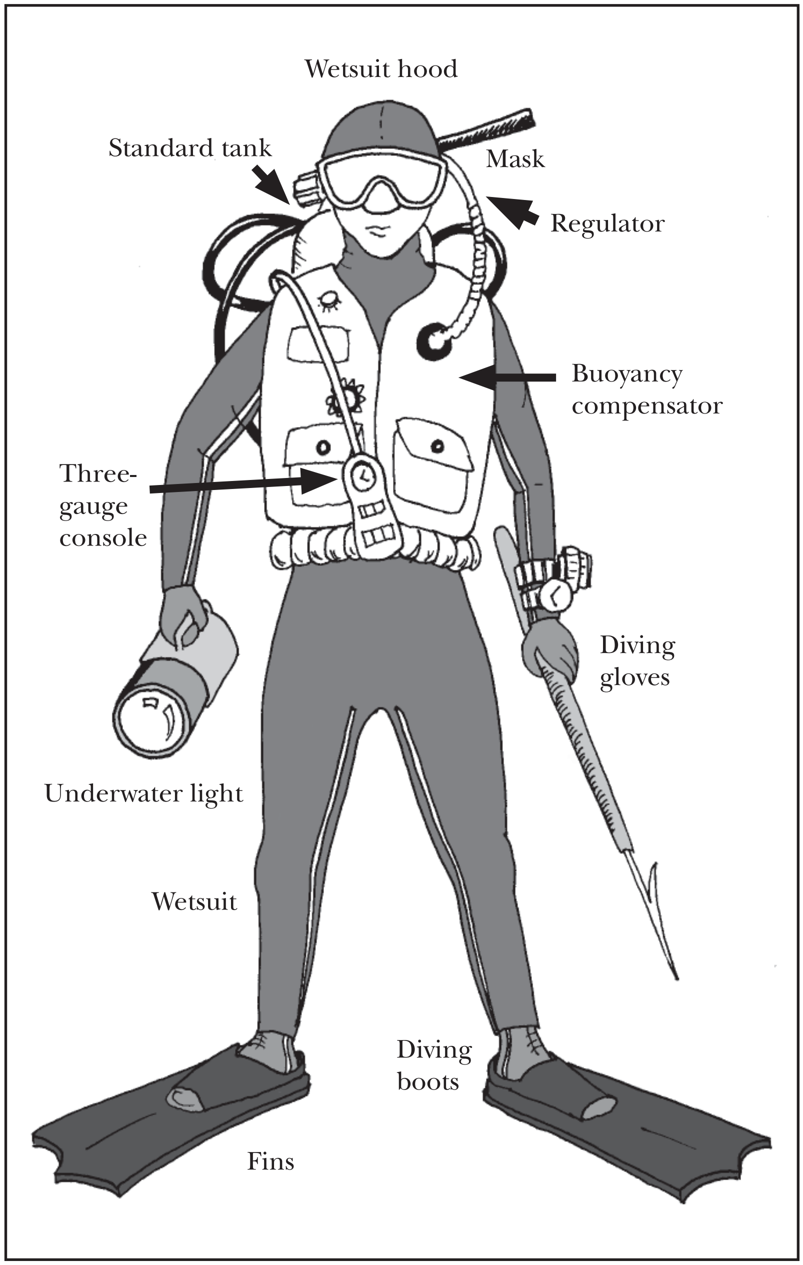
Jon Eddy of the Waterfront Diving Center often visits classrooms and shares slides and artifacts. Sometimes students have a chance to put on scuba equipment—as you see in this photo.

Take a Dive!

Scuba divers need many pieces of equipment in order to dive safely and comfortably. They need equipment to provide warmth, a source of air, a way to control their buoyancy and a way to measure their depth and direction, among other things. How much would it cost to "suit up" for a summer dive in Lake Champlain?

EQUIPMENT *and* COSTS

1. Wetsuit	$289.00
2. Standard tank	$119.95
3. Regulator	$249.50
4. Buoyancy compensator	$269.00
5. Mask	$ 62.95
6. Fins	$ 69.95
7. Diving boots	$ 34.45
8. Wetsuit hood	$ 32.95
9. Diving gloves	$ 28.95
10. Three-gauge console	$209.95
11. Underwater light	$ 49.95



Activity: **Lake-Level Learning**

TEACHER NOTES *and* INFO

The level of Lake Champlain (above sea level) is published daily in the *Burlington Free Press* weather section. It is expressed in decimal notation (i.e. 96.2 feet). During spring runoff, the lake level often shows dramatic daily increases. Students can create a bar graph showing the daily lake level and then use it to calculate daily and/or weekly increases or decreases.

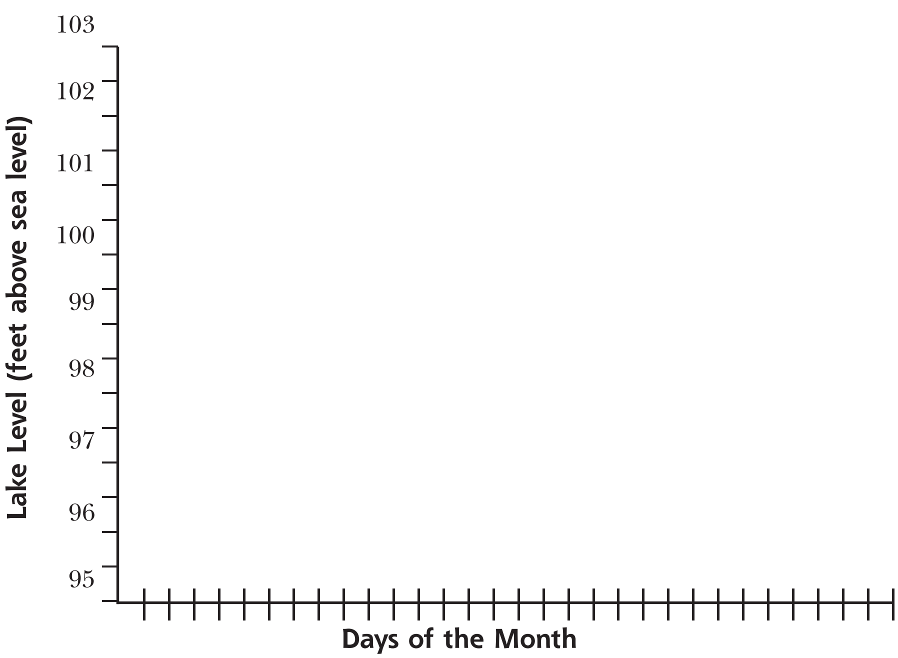
They will need to be able to read and interpret a bar graph and perform addition and subtraction of decimals. A large wall graph could be created for the classroom as well.

You will need:
- graph paper or prepared blank graph form
- daily lake-level data available in the *Burlington Free Press* or in the *Press-Republican* (Plattsburgh)

STUDENT ACTIVITY

The x-axis represents days of the month. The y-axis represents the lake level in feet above sea level.

1. Collect and graph daily information during spring runoff (late March to mid-April).
2. Have students calculate the overall increase in lake level, largest single daily increase, smallest daily increase, etc.



Other Ideas

• Compare changes in the lake level with temperature and precipitation patterns.

• Information on snow depth at the stake on Mt. Mansfield is also printed in the weather section of the ***Burlington Free Press*** *(expressed as inches). Compare snow melt with lake level.*

• Challenge students to calculate the volume of water it would take to raise the level of the lake one foot. You will need to know the surface area of the lake in square feet in order to perform the calculation. The surface area is 415 square miles. One square mile = 5,280 feet x 5,280 feet.

• Calculate the volume of water it would take to fill your classroom.

Activity: **River Jigsaw**

TEACHER NOTES *and* INFO

This activity requires students to work together to identify and solve a problem. Each person in a group is given a card with several pieces of information on it. Some of the information is useful and some is not. One of the cards includes the question to be answered or problem to be solved. Since each person holds some useful information, the group must work together to solve the problem.

This activity has students calculate average stream flow or discharge. This is a measure of the amount or volume of water passing a point within a specific amount of time. It is easy to calculate based on stream width, depth and velocity.

If you look at a stream in cross-section, you can see that the cross-sectional area at one location is the stream width times the stream depth. This area is multiplied by stream velocity and the result is the volume of water passing through that cross section in a given amount of time. The diagram and example below illustrate how to calculate discharge.

Make copies of the cards for each group (see next page).

DISCHARGE

= Area x Velocity

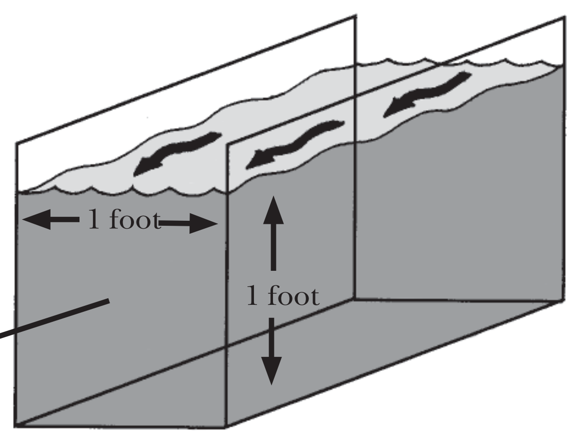
↓

= 1 ft^2 x 1 ft/second

↓

= 1 ft^3/second

Velocity =
1 foot/second



STUDENT ACTIVITY

Divide the class into groups of four and have each group appoint a leader, timekeeper, recorder and reporter. Give each member of the group one of the four cards. Together, the group will have all the necessary information. Group members may not show their cards to other members of the group. They need to explain the information. Through quiet discussion, the group will identify the question to be answered and decide which information is useful. The group then solves the problem. When all the groups are done, the reporter will share the process and the solution with the class.

Card 1

1. Velocity is a measure of distance covered over a period of time.
2. The average stream depth is 4 feet.
3. Discharge is measured in cubic feet per second.

Card 2

1. The average width of the stream is 30 feet.
2. You figure out discharge by multiplying the area by the water velocity.
3. There is a hydro-dam 1/4 mile upstream.

Card 3

1. It took an orange 10 seconds to float 20 feet downstream.
2. Area = Length x Width.
3. Calculate the stream flow or discharge.

Card 4

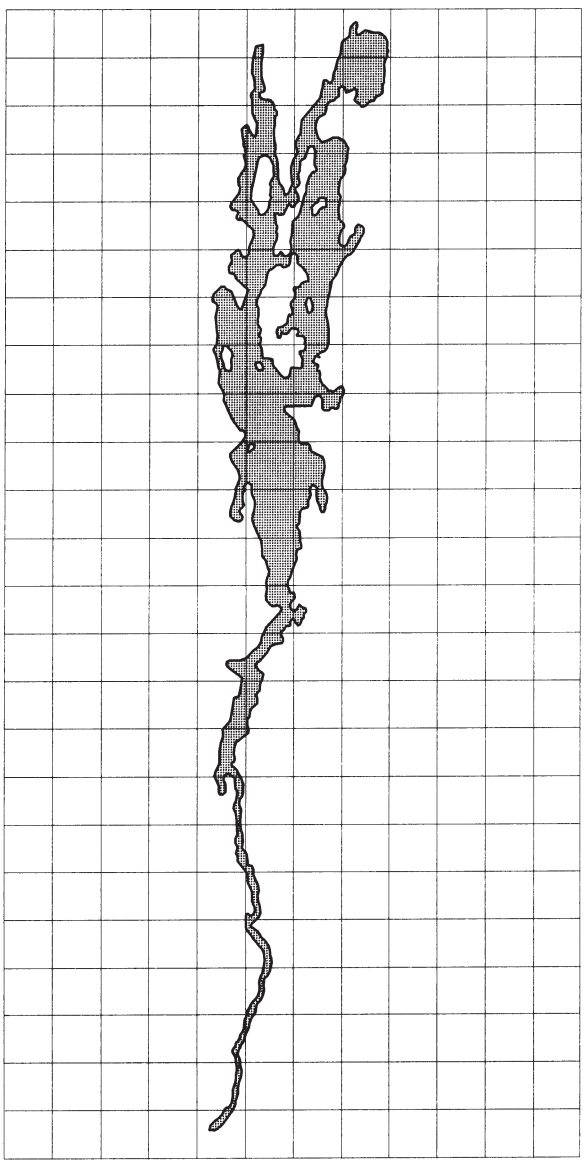
1. Discharge can change quickly as a result of the hydro-dam.
2. Discharge is the amount or volume of water passing a certain point within a given period of time.
3. Water is flowing at a rate of 2 feet per second.

Activity: Gigantic Geography

TEACHER NOTES *and* INFO

This activity uses the concept of scale to create a room- or hall-sized floor map of the outline of Lake Champlain.

Trace a map of the lake onto standard graph paper. If you have floor tiles, one square on the graph paper can equal one square tile on the floor and you have a built-in scale enlargement, with one-to-one correspondence. If you don't have floor tiles, you will have to calculate a scale that corresponds to the size of your map.



The map is laid down, square by square, using colored floor tape, which is available at sporting goods stores. It familiarizes students with lake features, is visually striking, relatively simple and requires few materials. Students, both those involved in the mapping and observers, enjoy watching it grow. Once the lake outline is mapped, points of interest can also be marked with tape.

This project works best with pairs of students working together on a given map section.

STUDENT ACTIVITY

1. Trace a 12- to 18-inch map of Lake Champlain onto standard graph paper. If the map is taped to a window and the graph paper is taped over it, it's easy to trace.
2. Once you trace the map, determine the length and width of the lake in squares. This will be the number of floor tiles or floor area that you will need to transfer the map accurately.
3. Divide the lake into sections and assign a pair of students to each section. Make copies of the map so each team will have its own map.
4. Mark off the floor space that will be used, with a starting and stopping place for each team.
5. Have students lay floor tape according to the pattern on the

graph paper. They must follow the pattern square-by-square. It is a good idea to have them cross off squares as they do them.

Tips for laying tape

• The floor beneath the tape should be clean.

• The tape should be laid smoothly, without bubbles or rough edges. This is especially important in a high-traffic hallway.

• Cut the tape with an Exacto knife or razor blade. Use caution!

• The tape will curve, but sharp turns require cutting and piecing.

You will need:
- page-sized map of Lake Champlain (see p.viii)
- floor tape
- Exacto knife or razor blades (one per team)
- graph paper
- one copy of the traced map per team

Other Ideas

• Map a section of the lake instead of the entire lake.

• Mark and label points of interest on the floor map with tape.

• Determine the relative surface area of the lake by counting tiles, estimating parts of tiles, etc.

Activity: **Ferry Tales**

You will need:

- copies of the LCT Ferry Schedule

You can order them from:

Lake Champlain Transportation Company
King Street Dock
Burlington, VT 05401
802-864-9804

TEACHER NOTES *and* INFO

This activity requires students to read and interpret the Lake Champlain Transportation's (LCT) ferry schedule in order to solve word or "story" problems. An answer key is not provided because the schedule changes!

STUDENT ACTIVITY

Hand out copies of the ferry schedule and spend some time interpreting it together as a class. Hand out "Story Problems" and let students answer questions.

STUDENT HANDOUT - "Story Problems"

Activity: **Do the Data!**

TEACHER NOTES *and* INFO

This activity requires students to perform basic math operations using large numbers. They need to pay attention to operation signs and the placement of parentheses. The calculations lead them to interesting and less well-known facts about the Lake Champlain Basin.

STUDENT ACTIVITY

Distribute the handout "Do the Data!" to your students, along with some scrap paper where they can work out each problem.

STUDENT HANDOUT - "Do the Data!"

Story Problems

1. School is out for the summer. You and your family would like to cross the lake by ferry and have lunch at a restaurant in Essex, New York. The restaurant is a 5-minute drive from the ferry dock in Essex. Your reservations are for 12:30 p.m. What ferry do you need to catch from Charlotte in order to get to the restaurant on time?

2. Your family is made up of 2 adults, one 11-year-old child, one 8-year-old child and one 5-year-old child. What will the round-trip fare be for your family to travel from Charlotte to Essex in the car?

3. If the speed of the ferry averages 6 miles per hour and the trip takes 20 minutes, about how far does the ferry travel on a one-way trip between Charlotte, Vermont, and Essex, New York?

4. You are biking with a friend and plan to bike from Burlington to Grand Isle, Vermont. From there you intend to cross the lake on the ferry to Plattsburgh, New York, bicycle from Plattsburgh to Port Kent, New York, and then return to Burlington by ferry. How much will you each have to pay for ferry transportation? Figure this out for the age you are now.

5. Which ferry runs throughout the year?

6. When (date and time) is the first possible ferry of the year you can catch from Essex, New York to Charlotte, Vermont?

7. If you miss the 8:30 a.m. ferry from Port Kent, New York, during the summer, what time is the next ferry you can take?

8. How much time will you need for a round-trip ride between Burlington and Port Kent if you turn around and take the next ferry back?
Hint: There is a wait while the ferry unloads and reloads. Read the schedule.

9. For a family of four traveling by car (2 adults, 2 children ages 6–12), what is the difference in the cost of 1 round-trip between Grand Isle and Plattsburgh and 2 one-way trips?

10. If you leave Plattsburgh on the 9:00 a.m. ferry, what time will you reach Grand Isle?

Do the Data!

Calculate the following:

1. The number of people who drink water drawn from Lake Champlain.
61,352 + 4,578 + 12,910 + 109,160 = ____________

2. The number of fish species in Lake Champlain.
(443 - 200) ÷ 3 = ____________

3. The approximate number of people living in the Lake Champlain Basin.
500 x 8 x 5 x 15 x 2 = ____________

4. The record high-water level (feet above sea level) for the lake [as of 1996].
231.75 - 129.86 = ____________

5. The record low-water level (feet above sea level) for the lake [as of 1996].
38,808 ÷ 10 ÷ 14 ÷ 3 = ____________

6. The year of the record high-water level.
(60 x 40) - (250 +157) = ____________

7. The year of the record low-water level.
(425 + 763 + 1209 + 12) - (227 + 274) = ____________

8. The number of acres of wetlands in the Lake Champlain Basin.
(47 + 63 + 36 + 54) x (350 + 614 + 236 + 124 + 176) = ____________

9. The number of amphibian species found in the Lake Champlain area.
649,740 ÷ 52 ÷ 35 ÷ 17 = ____________

10. The number of reptile species in the Lake Champlain area.
(342 + 117) + (25 + 619) - (628 + 455) =

____

11. The approximate number of years that humans have inhabited the Lake Champlain Basin.
10 x 10 x 10 x 10 = ____________

12. The year zebra mussels were first discovered in Lake Champlain.
3 x 5 x 7 x 2 x 9 + (61 + 42) = ____________

13. The number of mammal species in the Lake Champlain area.
(112 + 35) - (57 + 34) = ____________

14. Speed limit (in m.p.h.) for boats within 200 feet of shore.
2,880 ÷ 24 ÷ 8 ÷ 3 = ____________

15. The number of miles of Lake Champlain shoreline.
(214 x 58) - (473 x 25) = ____________

16. Up to this number of ducks and geese use the Lake Champlain Basin during migration.
12,423 + 16,004 + 7,998 + 3,575 = ____________

17. Number of boats observed on Lake Champlain on one summer day in 1992.
(25 x 3 x 497) ÷ (651 - 648) = ____________

18. The amount of phosphorus (in metric tons) that enters the lake each year.
936,000 ÷ 45 ÷ 32 = ____________

19. The number of islands in Lake Champlain.
2,045,009 - 2,044,939 = ____________

20. Adult zebra mussel colonies can have this many individuals in one square meter.
3,126 + 12,009 + 648 + 24,217 =

____

Answers: 1. 188,000, **2.** 81, **3.** 600,000, **4.** 101.89 ft., **5.** 92.4 ft., **6.** 1993, **7.** 1908, **8.** 300,000, **9.** 21, **10.** 20, **11.** 10,000, **12.** 1993, **13.** 56, **14.** 5, **15.** 587, **16.** 40,000, **17.** 12,425, **18.** 650, **19.** 70, **20.** 40,000.