BAY EXPLORATIONS

with

Call of the Sea

A California 501(c)(3) nonprofit organization

aboard
the Schooner *Seaward*

Pre-Sail Activities

www.callofthesea.org
Bay Model Pier
Sausalito, CA

Table of Contents

Dear Teacher,

Thank you for participating in CALL OF THE SEA's hands-on science and sailing program, Bay Explorations! This packet includes a timeline of things you can do to prepare yourself and your students for the trip, as well as activities that can be done in the classroom before and after your trip. Coinciding with the on-board program, the provided activities combine math skills, scientific principles, writing, problem solving, and teamwork. Using the activities before and/or after your visit to the ship can help strengthen the learning your students receive on board the ship and help them connect with the bay. Though not required in order to participate in the program, some or all of these activities can help to put your students into the seafaring mindset!

The tasks students face while on board the vessel require cooperation and teamwork. While on board, the students will be divided into three groups ("watches") and will work together to accomplish tasks and learning goals set for them by the crew. Since you know your students better than us, we highly recommend that you split them into three groups that will work well together.
Seaward is an inspected passenger vessel, which means that she is given a thorough safety inspection regularly by the US Coast Guard, and that the crew is fully trained and qualified in safety matters. **Call of the Sea is complacent with state standards requiring all students under the age of 13 to wear a life jacket on our Bay Explorations**. Adults are not required to wear a life jacket, however, we do carry enough on board for all passengers.

Our programs are conducted in protected waters, and it is extremely rare for participants to get seasick. Most over-the-counter sea sickness medications tend to make students drowsy and could impede their full participation in the program. Some of the most important strategies for fending off seasickness include dressing appropriately for the weather, eating moderately, and staying hydrated. The power of suggestion can be strong for young ones, so as you prepare we recommend simply not addressing it unless the students ask.

Thank you for bringing your students out on a Bay Exploration aboard the *Seaward*! Until we meet aboard the ship, we wish you fair winds and a following sea!

~ The Captain and Crew of Schooner *Seaward*

Dear Chaperone,

We are really looking forward to having you and your students aboard Schooner *Seaward* for our "Bay Explorations" field trip! Your group will be attending a 3-hour sailing program that includes lessons on nautical heritage and marine science. Students will take an active part in sailing the vessel and participate in hands-on learning stations in a variety of subjects. This letter will introduce you to *your* role as a chaperone and how you can help us out during the trip.

Whether you are a teacher or a parent, as a chaperone attending a "Bay Explorations" program you have an important role as a safety observer. Our programs are designed with safety in mind - the vessel meets all Coast Guard requirements and the crew is trained to maintain a safe learning environment at all times. However, extra awareness of safety issues is always appropriate. We will cover this aboard also, but here are some of the main things of which you can be aware:

Undocking and Docking - When we leave the dock and when we return, we move all the passengers to the port side of the vessel (left if you are facing forward). This is because the dock will be on the starboard side and the crew needs room to work as they tie or untie the boat. Students often become curious during docking, and it really helps if you can strategically place yourselves to help keep students on the port side of the vessel.

Lifelines - There are lifelines around the perimeter of the boat which will keep a person from falling overboard. However, risk can be further reduced by *not leaning* on the lifelines. If you see a student doing this, please remind them not to.

Companionway - This is a big hatch with a steep ladder that is used to get down below decks. When people stand in front of it, there is danger of falling in. For this reason, we try to keep the area clear. You may need to use the companionway to take students to the bathrooms, which are located below deck. Please go down BACKWARDS - it is a ladder, not stairs. To be safe, please go down first and then help the student down.

One final request - and this is *essential* to the program's success - is that you please refrain from active participation in the program. Let the students do the work and answer the questions. If they seem to be struggling, be patient - it's all part of the process. If a crewmember asks you to pitch in, please do; but otherwise it's important to let the young sailors experience the full challenge of the program. Hang back, observe, and enjoy watching them work together. As an observer, you will be in an excellent position to take candid photos of the students participating in the different activities.

If you have any questions or concerns just ask! Thanks for your help and welcome aboard!

~ The Crew of the *Seaward*

Prepare your chaperones by copying and distributing the chaperone letter.

1-2 Weeks before

The Head Educator on board the ship will give you a call to confirm the trip, to exchange pertinent information about the program and passengers, and to answer any questions you might have. Please be prepared to tell us your program option ("Oceanographer for a Day" includes Plankton, Analyzing the Environment, Seamanship and the Oceanographer All-Hands Activity. "Sailor for a Day" includes Navigation, Maritime History of the SF Bay, Seamanship and the Sailor for a Day All-Hands Activity), final passenger count, and any information about special needs individuals by this time.

Start using the activities included in this booklet!

A Few Days before

- Make sure students know to bring **warm layers**. Even when it is warm and sunny on land it is quite possible that it will be cold and wet out on the water.

Some other things students should be encouraged to bring include:

Raingear – Especially if the forecast calls for rain. We have limited rain gear on board to accommodate students.
Sunscreen – Even on cloudy days the UV can sneak through the clouds and, combined with the reflective surface of the water, lead to sunburn.
Closed-toe/rubber soled shoes – Being a working sailboat, there are many things on deck that have the potential to be tripped on or lead to stubbed toes. Also, if the deck is wet it can be slippery for non-rubber soled shoes.
Reusable water bottle-hydration is very important in preventing seasickness!
Warm Layers – Worth repeating because it can be cold out there!

Things that students should **not** bring include:

iPods/cell phones/electronics – These will just serve to distract students from what they are experiencing and there is a chance that they will get wet and ruined. Cameras are allowed, but should only be brought out at a specific time designated by the crew.
Chewing gum
Flip-flops/high heels
Snacks/chewing gum - Snacks of any kind are messy and distracting and students need both hands free throughout the program.
Short pants/skirts

The Day of the Trip!

Make plans to arrive at the dock with enough time for students to eat a quick snack if necessary, and for them **all** to use the bathrooms on shore.

Directions to *Seaward's* home pier at the Bay Model can be found on page following the chaperone letter.

If the students are not yet split up into three groups, now is a good time to do that.

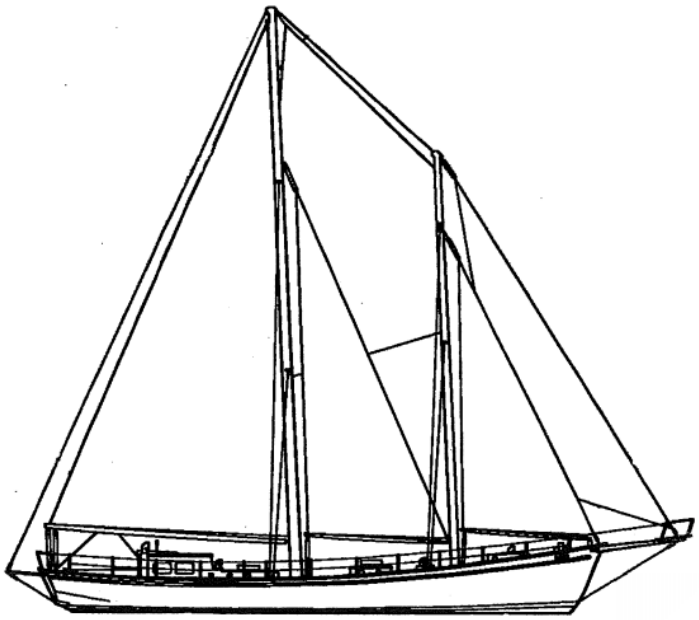
The Head Educator will walk down the dock and meet your group 15 minutes prior to your scheduled departure for introductions, a brief safety talk, and to escort you and your group to the ship.

Post-Trip

We are constantly trying to improve our programs in order to give you and your students a fun, educational, and meaningful experience out on the bay. For this reason we really appreciate it if you and your students can fill out the evaluations given to you at the end of your trip.

There are several post-trip activities included in this booklet meant to strengthen the learning that took place on the boat and provide avenues for further exploration.

It's never too early to sign-up for next year's voyage on *Seaward*!



Directions to *Seaward* at the Bay Model in Sausalito

The Bay Model is located just North of San Francisco and the Golden Gate Bridge, in Sausalito. It cannot be seen from Bridgeway, and is not obvious from Marinship Way.

From the North: Take Highway 101 to the Sausalito-Marin City Exit. Make a left at the stop light and go under the highway overpass. Make a right at the light onto Bridgeway. See directions below.

From the South: Take Highway 101 to the Sausalito-Marin City Exit. Go straight through the stoplight; you will be on Bridgeway. See the directions below.
From there, keep an eye out for the small brown and white signs for the Bay Model along the way. Continue on Bridgeway to the third stoplight. Make a left on Harbor Drive and make an immediate right onto Marinship Way, between Fed-Ex and Mollie Stone's. The road will go through a commercial area, curve around a parking lot, and head toward the water. At the stop sign, make a right to stay on Marinship Way, and follow the sign to the Bay Model. Just before the next stop sign (you will have two large warehouses on your left), take a left toward the water, which will lead you into the parking lot for the Bay Model. You should see *Seaward* at the end of the long dock.

Bay Exploration Sample Schedule

Please note that every program is different. This schedule is subject to change at the discretion of the captain and crew depending on the energy of students, weather, and wind

0845 - 0900 – Head Educator meets students
Program Introduction
0900 - 0910 – Students board
Captain's welcome & Safety Talk
0910 - 0920 – Break Away from the dock
Motor out activity
0920 – 0940 – Sampling Olympics (Oceanographer for a day)
0940 – 0955 – Set Sails
0955 – 1027 - Station 1
1027 – 1100 – Station 2
1100 – 1110 – Silent Sail
1110 – 1140 – Station 3
1140 – 1150 – Strike Sails
Debrief
1150 – 1155 – Dock
1155 – 1200 – Captain's Closing
Disembark

Guide to Activity Booklet

We hope that the activities provided in this booklet are helpful to you in preparing your students for their field trip aboard *Seaward* and for solidifying concepts we touched upon during their adventure. The pre-trip activities are intended to build up excitement and give the students a level of comfort before boarding. The post-trip activities build upon the lessons we teach onboard at our learning stations. If you are signed up for Oceanographer for a Day, the post-trip activities most closely related to your field trip are plankton, analyzing the environment and seamanship. For Sailor for a Day, the related post-trip activities are navigation, maritime history and seamanship.

Pre-trip Activities:

- Journal exercise
- HMS Challenger exercise
- Journal of a Sailor
- Letter of Intent
- Making a Watershed Model
- Marine Debris
- Learn how to tie a Knot
- Making a Compass
- Nautical Vocabulary/Talk Like a Sailor
- Learn a Sea Shanty

Post-trip Activities:

- Seamanship- Finding your speed
- Navigation- Scavenger Hunt
- History of the SF Bay- Writing a Journal Entry
- Analyzing the Environment- Community Study
- Plankton- Coloring and Sketching, Drawing a Food Web
- Moving the Ship- Understanding Tides

ACTIVITY: **Writing Exercise**

Using simple materials and methods, each student will make a small blank book and personalize it by decorating the cover.

Goals:

Students will learn to use elements of a journal entry: date, place, and observations, to exemplify the importance of a journal as a historical record.

Subjects:

writing

Vocabulary:

Expedition - a journey or voyage for a particular purpose such as exploration, usually with a team of people.
Explorer - a person who tries to find out about something unknown
Journal - a record of a person's experiences
Log - a special type of journal kept by the captain of a ship
Observation - something a person notices, using any of the five senses
Seafarer - someone who travels on the ocean

Introduction:

Journals are an important record for all types of explorers—not just the seafarers of the past, but also pioneers settling North America, scientists probing the secrets of biology, physics, and other sciences, and astronauts heading out into space. Sea captains keep a special type of journal called a log, where they write down everything that happens on the ship. Other types of journals have stories or observations or pictures. But not all records are kept in a book. There are even more ways people around the world have recorded their experiences, such as the spoken stories of native people, as well as their rock drawings, cave drawings, and murals. Much of what we know about past people comes from the records they kept.

When you go out on the boat in a couple of weeks, you will be stepping into a new world and YOU will become an explorer *and* a seafarer. Today you will practice your journaling skills so you can keep a record of your explorations, both on land and at sea.

Writing Activity:

Ask the students to think about what they would like to get out of their journey on Seaward. We are only out on the water for about 3 hours. In order to get the most out of their time on the vessel it is important to have students think about why they are going out on a boat to learn about history, science, and seamanship instead of learning about it in the classroom. Prompt them by asking "Why do you think your parents, your school, and your teachers believe it is important that you go on this field trip?" "What are you most excited about? Nervous about? Do you think sailors headed out to sea during the age of exploration felt the same way?" Give students the sense that their journal entry can come in many different forms: observations and prose writing is only one. Others include sketching, poetry, pressing a flower, gluing in a photo of the trip afterwards or other bit of memorabilia.

Extension:

Ask students to think about who might eventually read their journal entry Can you imagine someone reading what you write 2OO years from now? Who might that person be? It could be your great-great-grandchild. It could be a historian in the future, studying the twentieth century. Begin by writing a letter to the reader. Tell the reader who you are, what things you are interested in exploring, and what sort of things you will be telling about your explorations as they unfold.

Conclusion:

Close the writing activity by inviting students to describe their future readers. Students who want to may volunteer to read their journal entry. Ask the class what sort of things they each hope to explore, and write the exploration ideas on the board or on a big sheet of paper for future reference. Remind students that the journal is their own record of explorations, and that they will be using it throughout their studies, including using it for their trip to visit the ship.

Helpful Tips:

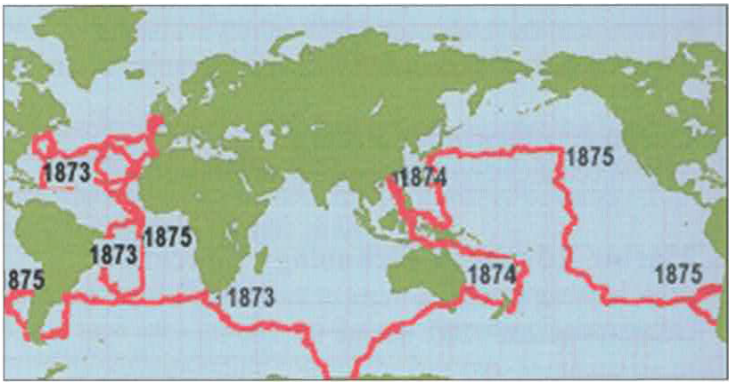
• Emphasize the role of illustrators, collectors, and storytellers in documenting explorer's voyages, for students daunted by writing.

•Encourage students to draw what they observe, make scrapbooks of items they collect from day to day, and tell stories in class.

• Start a brainstorm list on the blackboard or on a large sheet of paper of topics to include in a journal entry. (Some starter suggestions: weather, time of day, animals and plants, what you did, who was there, etc.) This list can be a "tickler" list to get students started if they get stuck and can't think of what to write.

HMS Challenger Expedition

On Seaward we will be using some of these sampling methods that they used on board the HMS Challenger!



In 1874, the HMS Challenger Expedition was organized and funded to investigate the physical conditions of the deep sea in the great ocean basins (as far as the neighborhood of the Great Southern Ice Barrier) in regard to depth, temperature, circulation, specific gravity and penetration of light.

In addition, the Expedition was instructed to obtain photographs of "native races," and the information that was recorded about the indigenous people proved to be extremely valuable, because many island cultures changed rapidly in subsequent years. You may also want to point out that commercial interest in the deep ocean was being stimulated by the desire to lay submarine telegraph cables, and there was scientific controversy over whether there was any life at all in the ocean below 1800 feet.

The Expedition's route included the North and South Atlantic, Indian and Pacific Oceans. Along this route, 362 official stations were established at which data were collected. A standard set of data was collected at each of the 360 stations along their route. Samples and data were carefully returned to Scotland for systematic analysis and documentation. The standard set of observations made and samples taken as each of the 360 stations were:

- Water depth
- Temperature at various depths
- Weather conditions
- Water conditions at surface and sometimes at depth
- Seafloor samples
- Water samples for later chemical analysis
- Samples of plant and animal life collected with dredges, trawls, and sometimes plankton nets from various depths

The primary technical instruments were weighted ropes for measuring depth; dredges and nets; thermometers; hydrometers and water sampling bottles. The final reports from the HMS challenger Expedition occupy 50 volumes with a total of 29,552 pages, and required 19 years to complete after the Expedition ended.

1. What are some human character traits that were needed by the Challenger crew?
2. What types of technology do we have today to give us more information about our oceans today?
3. What types of information are we looking for in today's expeditions?

Journal of a Sailor

Excerpt taken from the writings of Richard Henry Dana

Thursday, December 25, 1834

This day was Christmas, but it brought us no holiday. The only change was that we had a plum duff for dinner, and the crew quarreled with the steward because he did not give us our usual allowance of molasses to eat with it. He thought the plums would be a substitute for the molasses, but we were not to be cheated out of our rights.

Such are the trifles which produce quarrels on shipboard. In fact, we has been too long from port. We were getting tired of one another, and were in an irritable state, both forward and aft. Our fresh provisions were of course gone, and the captain has stopped our rice, so that we had nothing but salt beef and salt pork throughout the week, with the exception of a very small duff on Sunday. This added to the discontent, and a thousand little things, daily and almost hourly occurring, which no one who has not himself been on a long and tedious voyage can conceive of or properly appreciate- little wars and rumors of wars, reports of things said in the cabin, misunderstandings of words and looks, apparent abuses- brought us into a state in which everything seemed to go wrong. Every encroachment upon the time allowed for rest appeared unnecessary. Every shifting of the studding sails was only to "haze" the crew.

{"Haze" is a word of frequent use on board ship, and never, I believe, used elsewhere. It is very expressive to a sailor, and means to punish by hard work. Let an officer once say, "I'll haze you," and your fate is fixed. You will be "worked up," if you are not a better man than he is.}

In the midst of this state of things, my messmate S-- and myself petitioned the captain for leave to shift our berths from the steerage, where we had previously lived, into the forecastle. This, to our delight, was granted, and we turned in to "bunk" and mess with the crew forward. We began to feel like sailors, which we never fully did when we were in the steerage. While there, however useful and active you may be, you are but a mongrel- and sort of after guard and "ship's cousin." You are immediately under the eye of the officers, cannot dance, sing, play, smoke, make a noise, or growl (complain), or take any other sailor's pleasure: and you live with the steward, who is usually a go-between: and the crew never feel as though you were one of them. But if you live in the forecastle, you are "as independent as a woodsawyer's clerk", and are a sailor. You hear sailors' talk, learn their ways, their peculiarities of feeling as well as speaking and acting, and moreover pick up a great deal of curious and useful informations in seamanship, ship's customs, foreign countries, etc. from their long yarns and equally long disputes. No man can be a sailor, or know what sailors are, unless he has lived in the forecastle with them- turned in and out with them, eaten of their dishes and drunk of their cup. After I have been a week there, nothing would have tempted me to go back to my old berth, and never afterward, even in the worst of weather in a close and leaking forecastle than you can anywhere else is to make and mend clothes, and this is indispensable to sailors. A large part of their watches below they spend at this work, and here I learned that are which stood me in so good stead afterward.

Dana, Richard Henry. Two Years Before the Mast. New York: Doubleday and Company, 1949 (first published 1840)

ACTIVITY: **Letter of Intent to Sign Onboard**

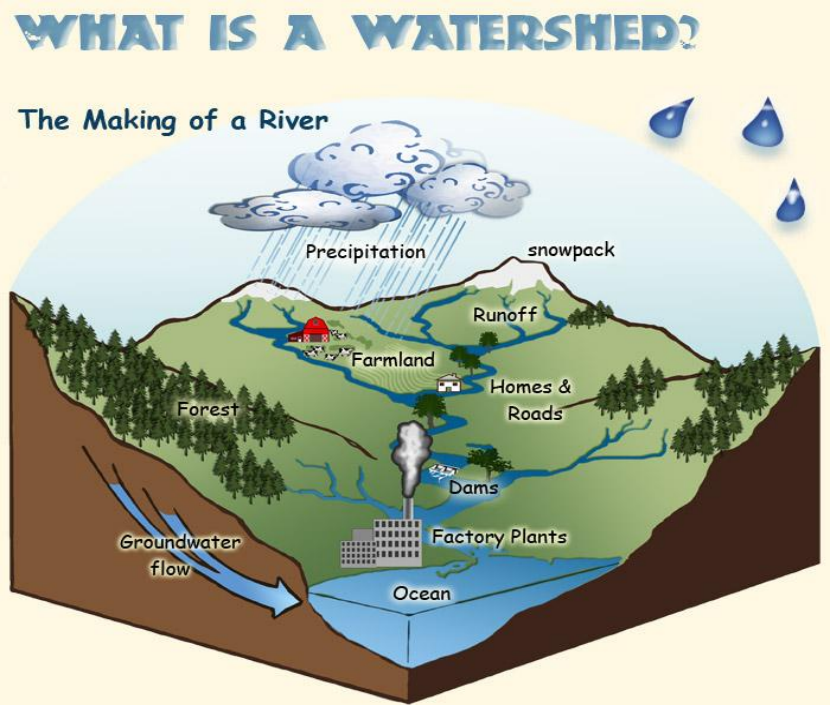
Goals:
Students will prepare students for their time on the water by having them imagine what they will experience, develop letter writing skills, and learn the different jobs on board a traditional sailing vessel.

Description
Students will write a letter to the Captain of the *Seaward* expressing their intent to sign on as deckhands.

What to do:
Brainstorm what kind of things students hope to see/do out on the San Francisco Bay. Explain the different positions on board a traditional boat and discuss the different qualities and attributes needed from each crewmember. On board Seaward we have 3 Deckhand/Educators, 1 First Mate, and 1 Captain. On traditional vessels, the crew was bigger and jobs such as these listed below were more common.

Vocabulary:
Deckhand –ship's muscle, responsible for line handling, going out on the bowsprit, dropping anchor, and whatever duties the ship needs done.
Naturalist –ship's scientist, responsible for studying and cataloguing all of the life and interesting natural phenomena observed by the ship
Bosun –ship's handyman, responsible for fixing and maintaining all of the standing and running rigging on board
Mate – ship's overseer, responsible for making sure the captain's orders are carried out
Engineer –ship's mechanic, responsible for fixing and maintaining all of the ship's electrical, mechanical, and plumbing systems
Coxswain – the ship's shuttle driver, responsible for driving and maintaining whatever small boats the ship has
Medical Officer –ship's doctor, responsible for maintaining health of the crew
Purser –ship's treasurer, responsible for keeping track of the ship's finances
Cook –ship's chef, responsible for cooking for the whole crew and in charge of all of the food on board
2) Students write a brief letter to the Captain of the Seaward explaining why they want to come on board the boat. They will pick a job on board the boat they would like to have and explain what characteristics they have that they think would fit well with the job. Explain why they want to sail on SF Bay. What do they hope to see out there?

ACTIVITY: **Making a Watershed Model**



Goals:
Students will understand what a watershed is and where they are in their own watershed and see how water and pollutants move through watersheds.
Description:
Students use a model to visualize the concept of a watershed, and to understand how they personally and we as a society alter watersheds.
Subject:
Science
Vocabulary:
Watershed – the extent of land that all drains to the same body of water
Pollutant – a harmful, often man made material that finds its way into the environment
Estuary – the body of water located at the meeting of a river and ocean
Relief Map – a 3-D map that shows elevation
Materials:
Tin foil
Spray bottle
Coffee grounds/food coloring
Collection of random objects you don't mind getting wet
White board/chalk board
Towels or a big tub

What to do:

1) 'How many of you have had a drink of water today? Used water at all? Let's see if we can come up with a list of all of the things we use water for.' Write these things on the board. Estimate which one of the things found uses the most water. The USGS reports water usage at 410,000 million gallons/day for the United States. Of that, 49% goes to hydroelectric, 31% to irrigation, 11% to public use, 4% to industrial, 2% to aquaculture, 1% to domestic and mining, and less than 1% to livestock. The average American uses 400 liters of water daily.

2) 'So we use water for a lot of things, and we use a lot of it. Where does water come from?' Introduce the idea of a watershed.

3) Make a model watershed. Do this as a class or in small groups. Lay your random objects out on a towel or in a big tub. Lay out a sheet of tin foil over the objects and loosely mold the foil to the objects so that you end up with a bumpy terrain. Now you have a relief map of a fictional place perfect for visualizing a watershed.

4) Make it rain! Spray your relief map with water. Once it has 'rained' enough you will start to see rivers, lakes and streams forming on the terrain. 'How many different bodies of water are in your map?' 'Is the ocean represented somewhere?' 'How many watersheds are there?' 'Are all of the watersheds the same size?' 'Are there any areas on the map that aren't in a watershed at all?' 'Do any of the areas on the map represent where you live?'

5) How do humans impact the watershed? We take things like water and organisms (like fish) out. Demonstrate this idea by putting holes in rivers or lakes to represent pipes for water extraction. We also put things like pollutants in. Sprinkle some coffee/food coloring in one location on the map. Watch it travel when it rains again. 'Is it just the area where pollutants come from that is affected?' 'Which is more affected, upstream or downstream of the contamination source?' 'What kind of things can be pollutants?' 'Is there anything we can do about these pollutants?'

6) Use the map on the following page: Which watershed do we live in? Find your hometown on the map of the bay. Does water flow from your home to the bay?

Conclusion:

Water is incredibly important for life on Earth, and for us too. We even use it for a wide variety of things other than just drinking! We use a lot of it and *all* of it comes from our environment, from rivers, lakes, or other bodies of fresh water. We also have the ability to do damage to our watershed by taking too much, or putting pollutants in it. Fortunately there are a lot of things we can do as individuals and as a community to preserve our watersheds.

Activity: **Marine Debris Journaling**

Out on San Francisco Bay/ Estuary we see a lot of marine debris and on Seaward we do our best to pick up as much trash as possible. Where does all of this trash come from? Well, from us! Through this activity students will learn what marine debris is and how we can prevent human waste from making it into the bay.

1. Assess Prior Knowledge: Share with students the strategy called "Brainstorming": for a specified amount of time, students are to call out terms/ words/ ideas relevant to the topic of Marine debris. This activity will give you information about student's prior knowledge in reference to marine debris, the water cycle, habitat destruction, and storm run-off.
2. In this case, it is to "**Think of all the things you can name that could be marine debris.**" The recorder is to write down everything that is named. All answers are acceptable in brainstorming and no answer is unacceptable. At the end of a determined time (usually 3-5 minutes) recorders stop writing and groups turn to face teacher.
3. When asked, groups reveal their answers. Facilitator assists students in identifying similarities and differences.
4. Place chart paper and markers around the room- divide students into triads or pairs (depending on size of whole group and wall space for charting.) Groups select a recorder. If wall space is not available students may sit in pairs or triads. Leader provides paper and markers/ pens.
5. Once you have given directions about Brainstorming, students will go to their chart paper and, when indicated, will begin writing responses until time is called
6. Leader calls on groups to report out. One method of sharing asks recorders to place a checkmark next to any of the items named by other groups. This reduces duplications and requires students to remain engaged. At the conclusion of the activity, the Leader asks the whole group for their general thoughts on marine debris. Simulate the effect marine debris has on animals by placing a rubber band around your hand. Show students how is constricts your movement. Ask students the following:
    a. How do you think these items become marine debris?
    b. How do you think we could reduce or eliminate many of these items as debris?
    c. What should we do when we find debris in our waters?

RESOURCES

NEOK-12 –games for kids on the six simple machines.

http://www.neok12.com/quiz/SIMACH01

Video from Bill Nye the Science Guy on Simple Machines

https://youtu.be/o9tXgUu7fXQ

Extension Activities

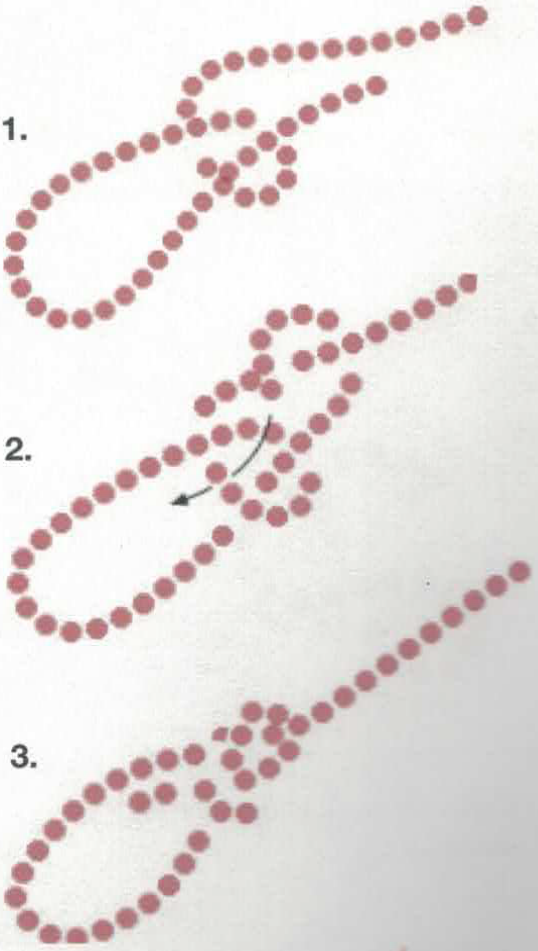
This lesson is a great opportunity to tie in knots. Knots can be taught in the classroom or at a sailing center. **Example:** Figure 8 and bowline as well as cleating.

The Bowline: The bowline puts a non-slipping loop at the end of the line. The know becomes more secure under pressure, but remains easy to untie. It is a commonly used knot on sailboats. The bowline is used to attach the head of the mailsail to the main halyard.

1. To tie a bowline, put a small loop in the line where you want the know to be. Make sure the end crosses the on top of the standing part of the line. This small loop will end up as part of the knot.

2. Run the end up through the loop you just made down behind the standing part, back up over the edge of the loop, and down through the loop again.

3. Snug the knot together, making sure the knot holds and the remaining loop does not slip.



ACTIVITY: **Making a Compass**

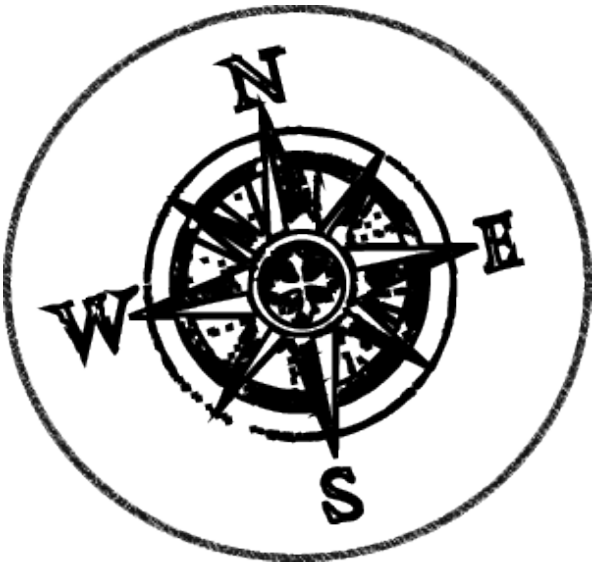
Goals:
Students will make a compass from simple materials.
Gain an understanding of how compasses use the Earth's magnetic field
Understand how people can use a compass to find their way around the Earth

Materials:
one or more very heavy-duty, powerful magnets (from science supply or museum stores) or a lot of patience and small magnets
sewing needles
a small bowl, quart yogurt container or petri dish half full of water
wine corks or styrofoam peanuts
waterproof marker
one compass (to test and calibrate the home-made ones)

What to do:
1) Magnetize the needle by drawing it repeatedly in one direction across the magnet. (Don't rub it back and forth.) You are trying to "stroke" all the molecules in the needle to lie in one direction, sort of like smoothing the fur on a cat.

2) Stick the needle the long way through the cork or styrofoam peanut, and float it in the dish of water. It should line up with the needle on the "real" compass. Mark an "N" on the end of the cork or peanut that points to north. Glue a compass rose onto the cork or peanut, with the North lined up with the "N" end of the needle.

3) Now you are ready to use it. Be sure to shield it from the wind, which may tend to push the cork to the edge of the dish. Wait for it to stop moving, and then the needle will point to North.



Cut out this compass dial and glue it to the needle and cork.

ACTIVITY: **Talk Like a Sailor**

Objective: Learn nautical vocabulary that we'll be using onboard Seaward!

What to do: At the end of this activity you will find a glossary of words typically used by sailors to define different parts of the boat and actions specific to sailing. We will be using many of these words during your Bay Explorations trip. To familiarize the students with these terms, introduce them to the vocabulary and give them the crossword puzzle on the next page or the word search provided below.

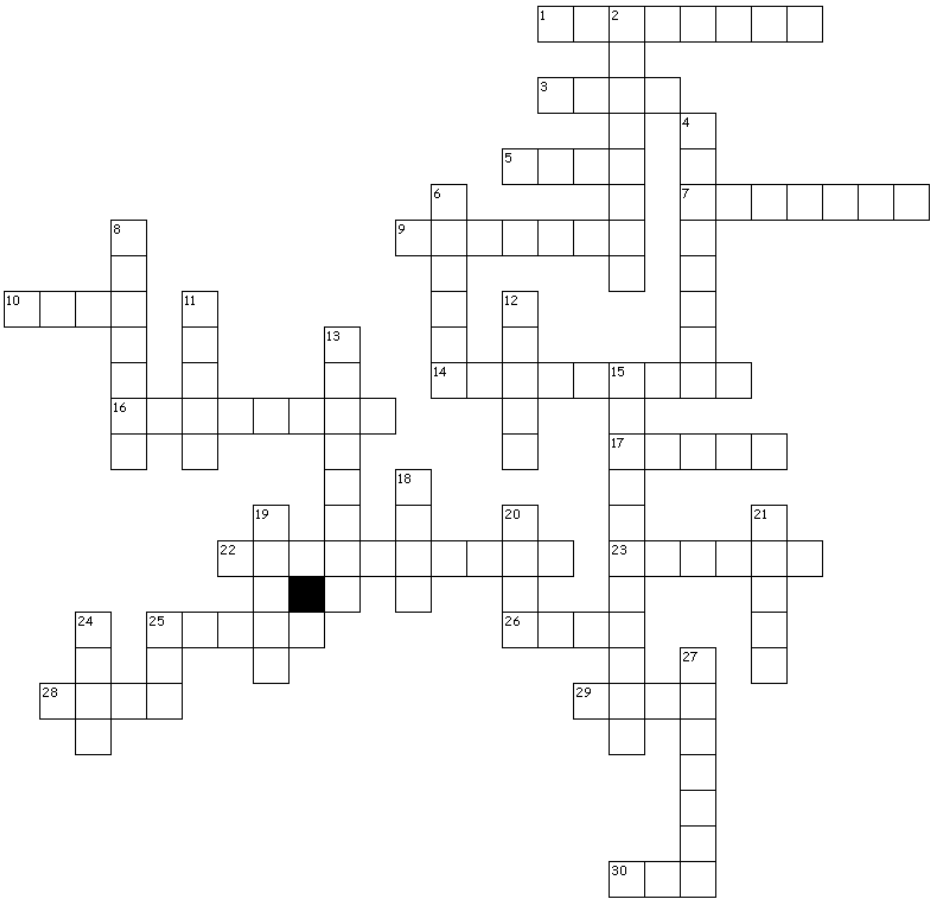
Talk Like a Sailor Word Search

C	B	E	W	M	E	Y	H	E	P	Z	E	D	H	N
A	O	O	I	U	C	G	A	N	W	O	P	N	O	O
W	B	M	S	C	S	J	L	I	T	X	R	A	C	L
T	L	Z	P	G	O	J	Y	L	G	H	E	T	R	U
T	S	A	M	A	P	X	A	S	I	T	K	O	E	X
T	F	T	O	M	S	K	R	P	J	I	D	O	W	Y
J	A	L	Z	K	X	S	D	D	V	X	Y	T	R	N
G	T	S	P	U	Y	X	R	P	C	I	A	A	T	N
H	E	L	M	U	X	A	N	V	S	C	X	L	T	A
D	S	C	H	O	O	N	E	R	H	C	T	A	W	S
A	Z	Y	B	B	J	S	C	H	E	L	T	S	Q	A
E	G	O	R	T	S	C	C	Z	B	T	Z	F	L	M
H	O	A	Z	E	E	J	H	B	O	H	S	U	K	K
M	T	Y	L	H	F	R	X	D	V	Z	A	E	F	C
S	L	A	F	R	K	F	M	P	V	H	W	G	N	R

Can you find all these words?

Boom, Bow, Compass, Crew, Halyard, Haul, Head, Helm, Line, Mast, Port, Schooner, Starboard, Stay, Stern, Vessel, Watch

Talk Like a Sailor Crossword Puzzle



Across

1. the spar that extends out in front of the bow of the ship
3. a rope on a boat
5. gather and fold a sail neatly and tie it securely when it is not in use
7. line used for hauling up a yard or sail
9. heavy lines which support a mast from side to side
10. the place where the helmsman steers the ship
14. the right side of the ship, if you are facing forward
16. a sail that flies from (is attached to) a stay
17. the back of a ship
22. the science and skill of knowing where you are
23. a ship or boat
25. a pulley on a ship
26. a vertical pole, or spar, that supports the yards and sails
28. the people who work together to run a ship, usually- made up of 2 or 3 watches
29. towards the front of a boat
30. a special type of journal kept by the captain of a ship

Down

2. a winch used for heavy work like raising an anchor
4. a ship with at least two masts, the main one taller than the fore
6. maps of the sea
8. a magnet which swings freely and points to the magnetic pole, which helps a navigator know which way is North
11. secure a line
12. heavy lines that support a mast from fore (front) to aft (back)
13. the largest sail, also the sail attached to the main mast
15. something a person notices, using any of the five senses
18. the toilet on a ship
19. a team of people who work together aboard a ship
20. a spar along the foot (bottom edge) of some fore-and-aft sails
21. pull hard, usually horizontally
24. the left side of the ship, if you are facing forward
25. the front of the ship
27. the direction from an observer to an object

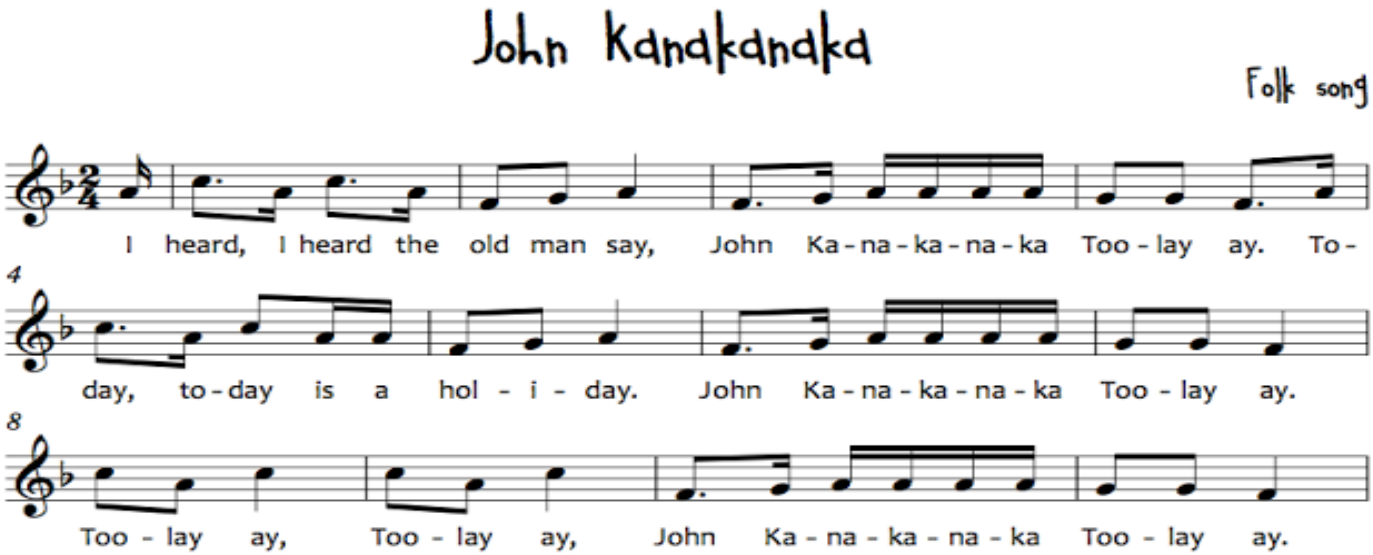
ACTIVITY: **Learn a Sea Shanty**

Objective:
Learn traditional sailing songs

Introduction:
Shanties are sea songs that sailors of the past would sing to amuse themselves on long passages and to help them work as a team. Often the songs would have a continuous beat that would be useful when the crew was hauling up a sail, hoisting the anchor or doing any other sort of activity that required repetitive motion. Most ships would have a shanty-man who was in charge of leading the song. He would sing short verses between the chorus which everyone would sing together and use the beat to haul at the same time. Shanties were often written so that it would be easy to add on extra verses if the task took longer than the song, and shanty-men took pride in coming up with funny original verses.

What to do:
The following pages have two traditional shanties, both with a good beat for working together as a team. Teach the students the songs and ask them to come up with a new line to add in. Different students can try being the "shanty-man" and singing their original verse.

This is also a good opportunity to go over the vocabulary of a sailor!



John Kanaka https://www.youtube.com/watch?v=9qxXfh2mfQk
Halyard-Shanty

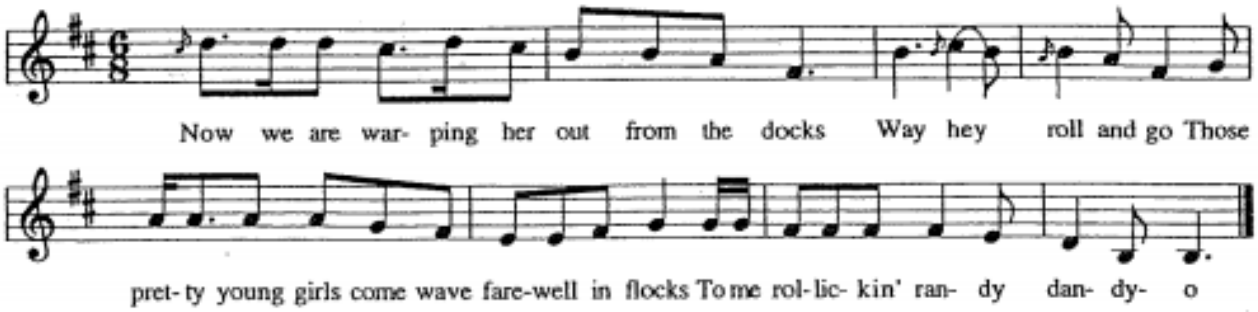
I thought I heard the Old Man say,
John Kanaka-naka tulai-e [too-lie-ay]
Today, today is a holiday!
John Kanaka-naka tulai-e
(Chorus)
Tulai-e, oh tulai-e
John Kanaka-naka tulai-e
I thought I heard the boatswain say,
John Kanaka-naka tulai-e
There's work tomorrow but no work today.
John Kanaka-naka tulai-e (*Chorus*)

The boatswain says "Before I'm through
John Kanaka-naka tulai-e
You'll curse your mother for having you"
John Kanaka-naka tulai-e (*Chorus*)

There's rotten meat and weevily bread
John Kanaka-naka tulai-e
Just like the Gate the Old Man said
John Kanaka-naka tulai-e (*Chorus*)

She would not steer and she would not stay
John Kanaka-naka tulai-e
She shipped the water both night and day
John Kanaka-naka tulai-e (*Chorus*)

Randy Dandy O
Capstan



Now we are warping her out from the docks
Chorus: Way, hey, roll and go
Those pretty young girls come wave farewell in flocks
Chorus: To me rollickin' randy dandy o

It's goodbye to all of the girls of this town
We've left you enough for to buy your silk gowns

It's goodbye to Sally, now goodbye to Sue
And all of you other girls farewell to you

We're sick of the shore and our money's all gone
So we signed on this packet to drive her along

Our anchor's aweigh and the wind's drawing free
Let's get the glad rags on her, head her for sea

Oh breast the bars, bullies, now heave with a will
And soon we'll be drivin' her off down the hill

We're bound away around Cape Horn
Where you'll wish to the Lord that you'd never been born

Around Cape Horn we all must go
Way off 'round Cape Stiff through the cold rain and snow

So heave a pawl, now heave away
Get crackin' now, lads, it's a mighty long way

Yes, heave a pawl, now heave away
Our anchor's on board and our cable's all stored

POST-TRIP ACTIVITY:

Finding Your Speed

Description:
Students will create their own chip log and measure their walking speed.

Vocabulary:
Chip Log- a tool that sailors use to measure their speed, consists of a spool of twine, knotted at regular intervals and tied off to a small wooden board
Knots- the units in which boats measure speed; nautical miles per hour, approximately 1.15 statute miles per hour

Materials:
Cardboard paper towel roll, ruler to go through the roll, String of at least 100 feet long, Small stick to tie to the end of the string, Stopwatch, Measuring tape

What to do:
Students work in groups. They will need to attach their string to their cardboard roll, tie knots every 22 feet, and attach a stick to the end of the string (make sure the 22 feet segments start at the loose end, rather than the end secured to the roll). They should then wind their string around the roll. Students measure their walking speed by having one hold the roll, another hold the stick and walk away while a third student runs the stopwatch and announces when 15 seconds have passed. The number of knots that have run out is their walking speed in knots.

Additional challenges:
Once they have their speed in knots, students can calculate their speed in miles per hour. Talk about how they could change their chip log to measure in mph (change distance between knots). Students can research why sailors use knots.

Background information on chip logs:
In the most ancient times, speed at sea was measured by dropping a piece of wood off of the stern of the moving ship. As the ship moved away from the wood, an approximate speed could be guessed. Of course, one could only do this so many times before running out of wood. This was remedied by attaching a length of line to the log; the same log could then be retrieved and used repeatedly. Marks were added to the line to allow for a more accurate speed reading. To use the log required two men; one to hold the reel aloft, facing aft at the taffrail, and one to drop the drogue overboard, turn the glass, and stop the line when the sand runs out. After stopping the line, the number of knots paid out is the speed of the ship.

POST-TRIP ACTIVITY:

Navigational Chart Scavenger Hunt

Goals:
Students will solidify navigational learning from their Seaward adventure. They will better understand how to read a chart and use it to find various landmarks and their own position.

Vocabulary:
Bearing- the direction from an observer to an object
Buoy- floating signal: a large anchored float, often equipped with lights or bells, that serves as a guide or warning to ships
Chart- map of the sea
Compass- a magnet which swings freely and points to the magnetic pole, which helps a navigator know which way is North
Compass rose- a compass on a chart or map that shows how the chart is oriented

What to do:
Print out the navigational chart provided for each student or each group of students. Have them complete the scavenger hunt.

Answers:
2. The deepest sounding is 333 feet under the Golden Gate Bridge.
3. It is more important to know depth at low tide (so that your boat won't hit the bottom).
4. Belvedere is West of Angel Island.
5. Bearing to Belvedere is West or approximately 270. Bearing to Alcatraz is Southeast, or approximately 150.
8. Fort Point is on the South side of the Golden Gate bridge.
9. The point on Angel island with a windmill is called Point Blunt.
10. Buoys help us find where we are, and help warn us where not to go.

Navigational Chart Scavenger Hunt

1. Find the golden gate bridge. Color it red.

2. Circle the deepest sounding you can find. How deep is it?

3. Is it more important to know the depth at high tide or at low tide?

4. Is Belvedere North, East, South or West of Angel Island?

5. If you were standing at the top of Angel Island, what would your bearing be to the tip of Belvedere? (Hint- don't forget to use the compass rose!) What would your bearing to Alcatraz be?

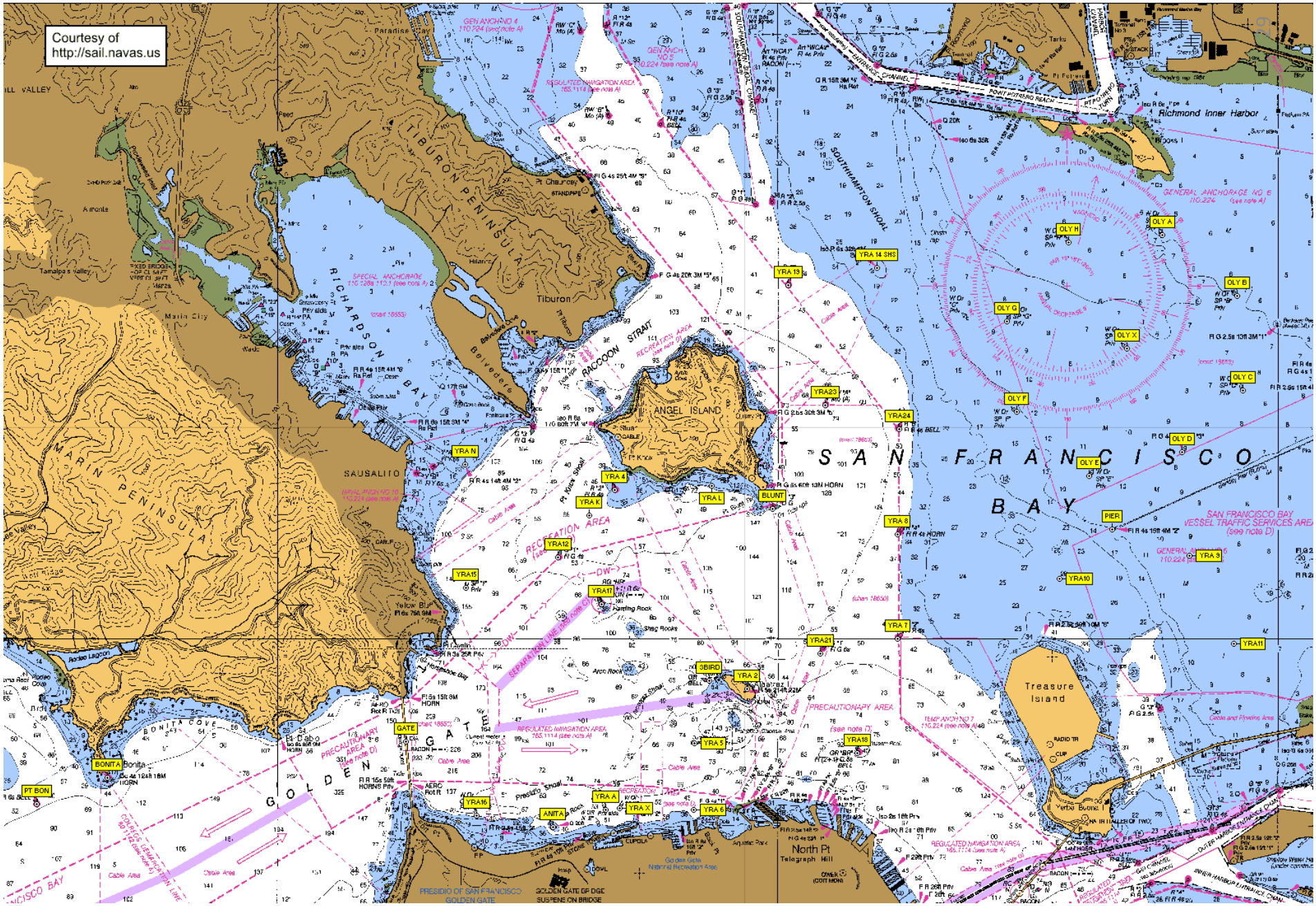
6. Chart your course! Find where you started your trip, and draw a track line to show where you went.

7. Find a good landmark in San Francisco. Put a box around it. Why is this a good landmark?

8. What is the name of the point on the South side of the Golden Gate bridge?

9. What is the name of the point on Angel Island where there is a windmill?

10. Buoys are marked as circles with points on one end on the chart. Find some buoys. Color the ones labeled "G" green and the ones labeled "R" red. Why do you think we have buoys in the bay?

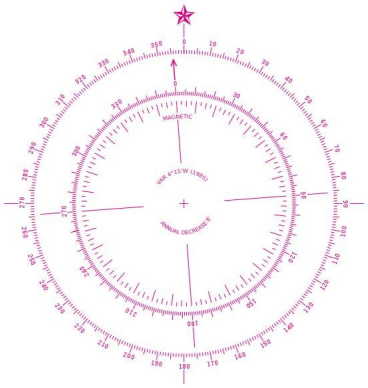

Courtesy of
http://sail.navas.us

Key to nautical chart of San Francisco Bay:

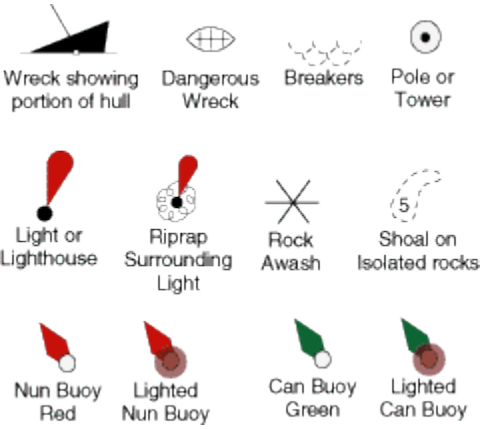
------- Pink dotted line: shipping lanes

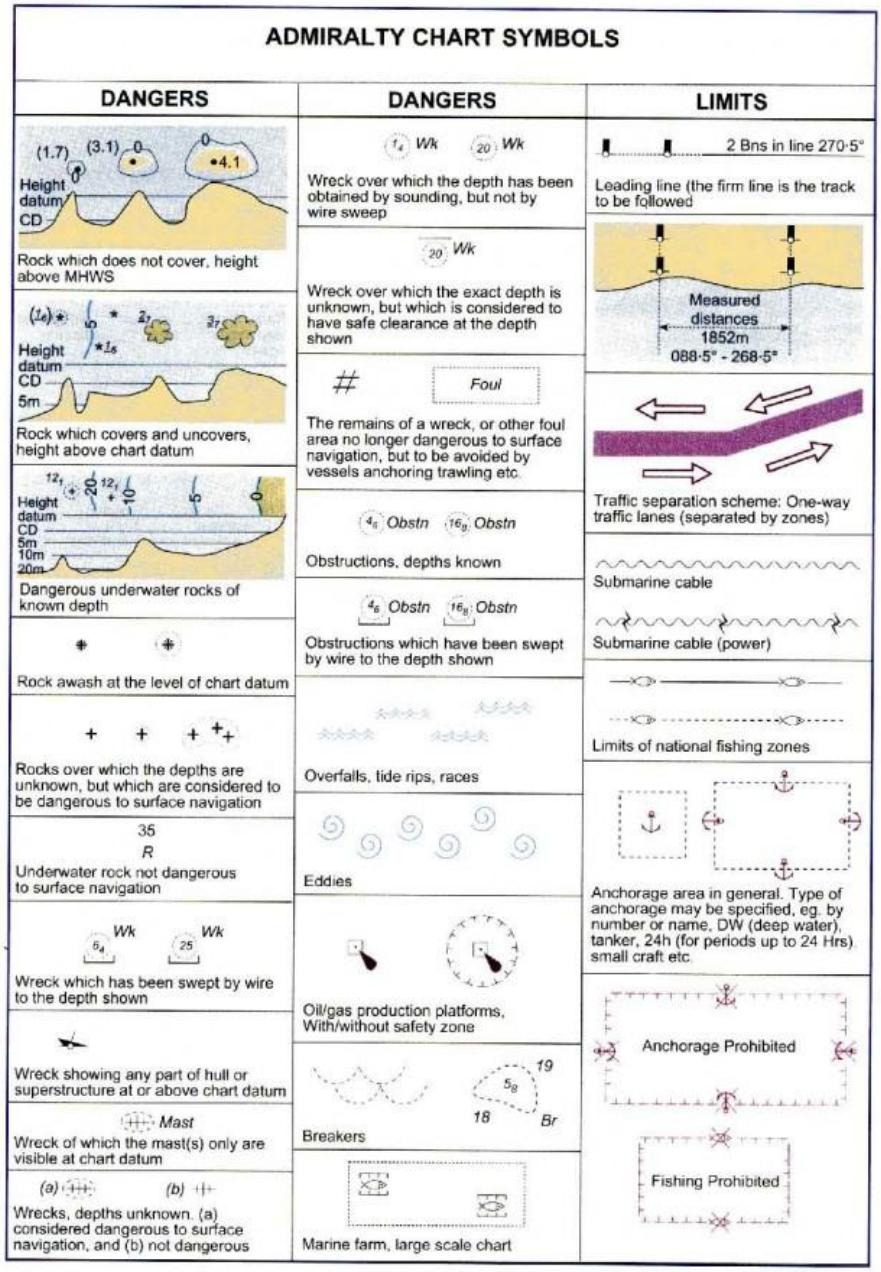
333 67 5 small numbers : depths in San Francisco Bay

Blue Area: shallow water
White Area: deep water
Yellow Area : Land



Compass Rose





POST-TRIP ACTIVITY: **Writing a Journal Entry**

Goals: Students will make a record of their experience onboard Seaward and will show how their time on the bay has become part of the history of San Francisco Bay.

Some example prompts:

1. Write a journal entry about your trip on Seaward! How have you become part of the history of the San Francisco Bay?

2. How does your experience on the bay compare to that of people who have lived here in the past? Where did you go? What was the best part of your trip?

3. What are some artifacts that people in the future might use to learn about your history? How are your artifacts different than those of the Miwok Indians, the Spanish Explorers and the Chinese Immigrants? How are they similar?

Bonus: See if you can use these vocabulary terms that we talked about during your Seaward adventure! Underline them in your journal entry.

Key Vocabulary:

Haul	Gangway	Helm	Lookout	Head
Ease	Line	Rudder	Watch	Galley
Halyard	Bow	Compass	Crew	
Navigation	Port	Bearing	Chart	
Schooner	Starboard	Fix	Shanty	

POST-TRIP ACTIVITY: **Scientific Observation**

Goals:
- To use investigative skills to gain an understanding of the local environment
- To understand the way in which organisms adapt and relate to other organisms and their environments.
- Identify and describe local flora and fauna

Description:
Students sketch a local plant or animal of their choice, hopefully a creature they saw out on the bay. They should accompany the drawing with a paragraph describing biotic and abiotic factors in the organism's habitat. The class uses a habitat map to represent a given ecosystem, and places their graphic representations of the chosen organisms within that map. The class then discusses relationships between organisms they saw out on the bay, as well as interactions between organisms and environment.

Materials:
Journals
Paper for field sketches
Pencils, and colored pencils, crayons, or markers
Bulletin board
Butcher paper
Thumb tacks

Vocabulary:
Abiotic- non-living environmental factors (e.g. temperature, soil moisture content, sunlight)
Biotic- living environmental factors, primarily plants, animals and fungi
Flora - plant life
Fauna - animal life
Habitat - the area or environment where an organism or ecological community normally lives or occurs
Ecosystem - an ecological community together with its environment, functioning as a unit
Environment - the social, cultural, and physical conditions surrounding and affecting an individual or community

What to do:
At home or in the classroom, have the students choose a plant or animal of interest from the local environment. Have each student observe the plant or animal in its natural environment. Try to choose organisms the students can observe easily (don't forget insects). During the observation period, have the students write findings in their journal. Have them include ideas about how the organisms obtain food, where they live, if they have any predators, how they get water, what sorts of temperature or sunlight requirements they have. Then have the students draw and color a sketch of the plants and animals in their journal. Have the students transfer the picture and write a short paragraph about their observations onto a page that can be used for the habitat map later.
On a bulletin board or a large sheet of butcher paper have the students draw an environment for their plants and animals. Begin by asking them what things are necessary for life; air, sun, water, and soil and include all those elements at the landscape. Have the students cut out their transferred drawings of plants and animals, and write a brief description on the back. Ask them to place their organisms on the board individually. Discuss where each animal or plant would likely be found within the environment, and with which of the other organisms it might interact.

Creatures you may have seen on the bay!

- Harbor porpoise
- Harbor Seals
- Sea Lion
- Cormorants
- Sea Nettles
- Jelly Fish
- Pelicans
- Seagulls
- Blue Herring
- Egrets
- Humpback Whale

Things to discuss:
• Discuss how organisms adapt to their environments. What specializations allow plants and animals to thrive in their specific habitats?
• Have the students decide if they would like to include humans in the ecosystem map. **Discuss the positive and negative effects humans have on the local ecosystem.**

POST-TRIP ACTIVITY: **Building a Marine Food Web**

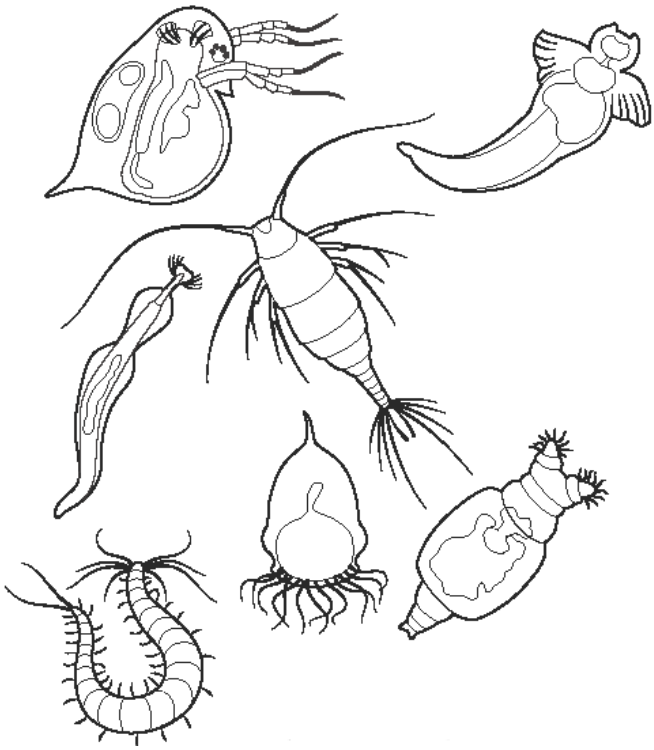
Goals: Students will synthesize the knowledge they gained on Seaward about plankton and show how phytoplankton and zooplankton support the marine food chain. Students will gain a better understanding of the roles of producers, consumers and decomposers and will visualize the complexity of ecosystems.

Subject: Science, Art

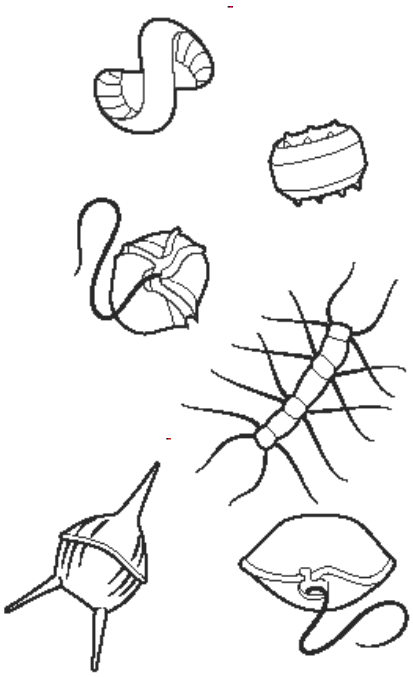
Vocabulary:
Carnivore- animal eaters
Decomposer- organisms that recycle nutrients back into the food web by feeding on detritus
Detritus- dead matter and waste products that sink to the bottom (benthic) layer
Herbivore- plant eaters
Omnivore- plant and animal eaters
Phytoplankton- plant plankton, live near the surface so they can turn sunlight into food and oxygen through photosynthesis
Plankton- drifters, marine organisms that cannot swim against the currents due to size, strength or morphology
Producer- organism that produces its own food from sunlight
Primary Consumer- organism that consumes producers
Secondary, Tertiary Consumer- organisms at higher trophic levels that consume other consumers
Zooplankton- animal plankton, some larval stages of bigger marine creatures, others are lifelong plankton species

What to do:
Have students create their own marine food web in groups. Students color the plankton images provided, cut them out and glue them onto construction paper, or imagine and draw their own. Brainstorm species that directly and indirectly rely on plankton to survive and draw them in the food webs (some direct examples include: small fish, whales, manta rays, filter feeders like clams and mussels, indirect examples can include: dolphins, sea turtles, sharks, humans, bigger fish). Students should identify if the creature is a producer, consumer or decomposer, they should also draw arrows to indicate energy flow. When they are finished, students present their food web to the rest of the class.

Zooplankton



Phytoplankton



Images from askabiologist.asu.edu

Draw your own plankton in the magnifying glass!

Remember, phytoplankton have all sorts of adaptations to help them float, so if you create a phytoplankton, come up with a way for it to stay in the sun. Some zooplankton are actually baby animals (known as larvae). What do you think a fish larvae looks like? A crab larvae?

POST-TRIP ACTIVITY: **Understanding a Tide Chart**

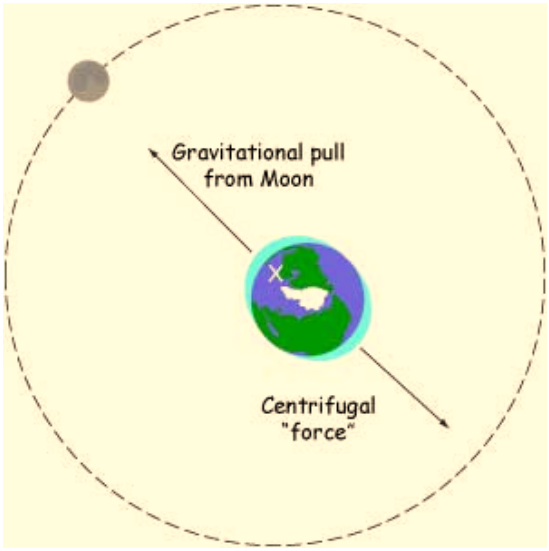
Goals: Learn what causes tides and how to read a tide chart

Subject: Science

Materials:
Globe, Piece of cardboard that is bigger than the globe's diameter, scissors, round object to signify the moon, Tide chart (included)

Vocabulary:
Ebb- current force caused by tide changing from high to low
Flood- current force caused by tide changing from low to high

Background Info:
The vertical rise and fall of water is called the *tide;* the horizontal movement of water caused by tidal flow is called *tidal current*. To keep straight these two often confused and misused terms, it helps to remember that tides rise and fall, and currents *flood* and *ebb.*
If the moon's gravitational attractive force were the only force responsible for tides, there would be a high tide on the side of the earth facing the moon, but not on the opposite side. But, of course, there is a high tide on the opposite side (caused by centrifugal force from the earth's orbit) and, just as we would expect, it is not as high as the tide on the moon's side. The moon orbits the earth once every 24 hours and 50 minutes, which is why it rises almost an hour later each night and why the times of high and low tide change each day. (Boater's Bowditch by Richard K. Hubbard)

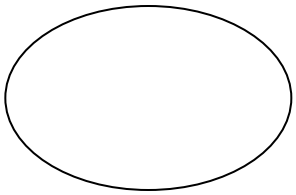


The sun is also a force that affects the tides, though not as much as the moon due to relative proximity. When the moon, the Earth and the sun are aligned, tidal changes are much bigger since the gravitational forces accumulate. When the three celestial bodies form a right angle, tides are less drastic. These two types of tide are called “Spring” and “Neap” tide.

What to do:
Cut out a circle in the cardboard so that it fits comfortably over the globe. Cut an ellipse representing the “bulge” created by the tides. Place the cardboard “bulge” over the globe. Be sure the globe can rotate while the cardboard remains in place.
Explain tides and currents with this visual. Describe a tidal cycle as it relates to S. F. Bay: Ocean water comes in, the current “floods” through the Golden Gate and fills up the Bay. When the Bay is full, it is high tide. Then the current “ebbs”, or goes out through the Golden Gate. The tide falls until low water, then the cycle repeats. Identify the forces that cause this cycle (rotation of the Earth and gravitational pull of the moon). Explain that the moon’s gravitational force on the Earth pulls water towards it into a bulge and the centrifugal force of the rotation of Earth creates a bulge on the other side. Put your finger on California and rotate it through a day, watching how the tide rises and falls. Pause at various points to identify whether the tide is high, low or between the two and talk about what the currents are doing. Once students understand this concept, have them fill out the tide worksheet.

Answers: two high tides in a day, 5:00, <1 meter , ebbing, 0600 or 1900(7:00pm), the ramp becomes steeper at low tide

Cardboard “bulge” on the globe



Tides Worksheet

Use the tide chart below to answer these questions.

How many high tides are there in a day? _____

What time is the lowest tide on February 3rd? How low is it?

_____

If the tide is going from high to low, is it *ebbing* or *flooding*?

_____

You are going to the tide pools on February 4th. What time is the best to go? _____

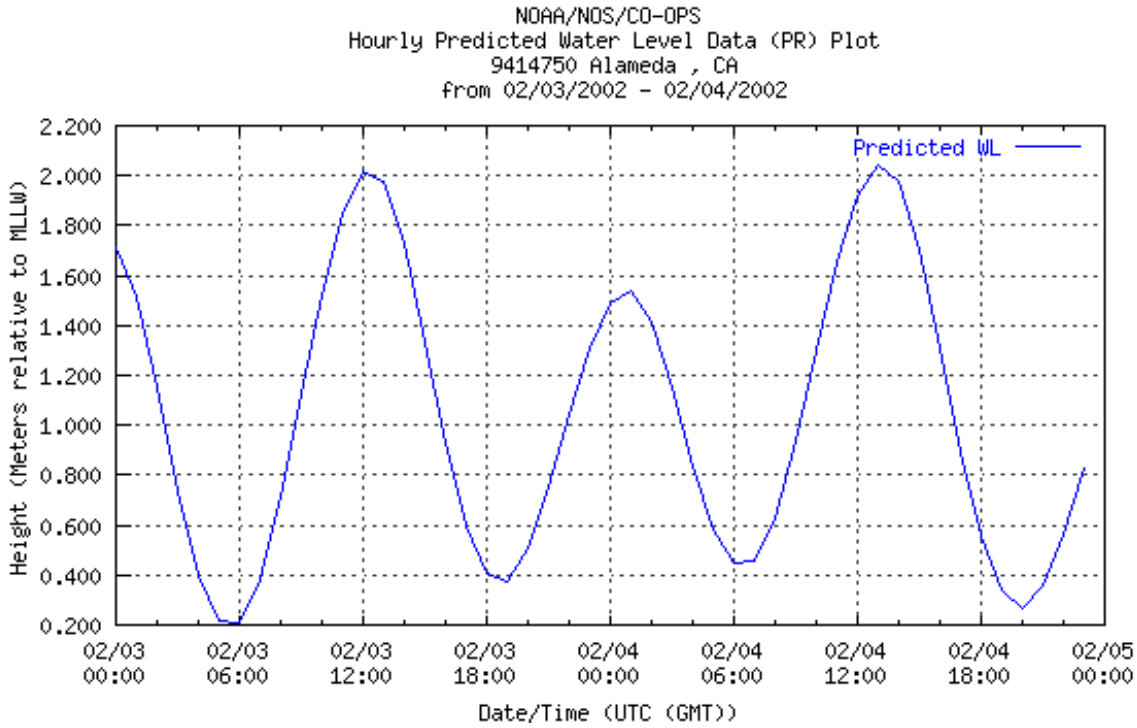
How does the gangway on Seaward change with the tides? Was it high tide or low tide when you went sailing?

_____

_____

_____

_____



Glossary

Aft – towards the stern of a boat
Bearing — the direction from an observer to an object
Belay -- secure a line
Binnacle — the cabinet that contains the navigational gear
Block — a pulley on a ship
Boom — a spar along the foot (bottom edge) of some fore-and-aft sails
Bow — the front of the ship
Bowsprit — the spar that extends out in front of the bow of the ship
Carnivore- animal eaters
Charts — maps of the sea
Compass — a magnet which swings freely and points to the magnetic pole, which helps a navigator know which way is North
Crew — the people who work together to run a ship, a crew is usually- made up of 2 or 3 watches
Current- A body of water or air moving in a definite direction, through a surrounding body of water or air in which there is less movement
Debris-The remains of something broken or destroyed
Decomposition-(decompose) The breakdown or decay of organic matter through the digestive process of microorganisms, macroinvertebrates, and scavengers.
Decomposer- organisms that recycle nutrients back into the food web by feeding on detritus
Detritus- dead matter and waste products that sink to the bottom (benthic) layer
Environmental Impact- The affect something has on the environment. Major current environmental issues may include climate change, pollution, environmental degradation, and resource depletion
Ebb- current force caused by tide changing from high to low
Fore – towards the front of a boat
Fore-and-aft sails -- triangular or nearly triangular sails similar to those on modern sailboats, which helps a ship to sail into the wind better
Flood- current force caused by tide changing from low to high
Food Chain- The path of energy in food from one object to another
Furl — gather and fold a sail neatly and tie it securely when it is not in use
Halyard — line used for hauling up a yard or sail
Head — the toilet on a ship
Heave — pull hard, usually horizontally
Helm — the place where the helmsman steers the ship
Herbivore- plant eaters
Jib— the outermost sail on the bow
Line – a rope on a boat
Log — a special type of journal kept by the captain of a ship.
Mainsail — (pronounced mains'l) the largest sail, also the sail attached to the main mast
Marine Debris-Any persistent solid material that is manufactured or processed and directly or indirectly, intentionally or unintentionally, disposed of or abandoned into the aquatic environment

Mast — a vertical pole, or spar, that supports the yards and sails
Navigation — the science and skill of knowing where you are
Omnivore- plant and animal eaters
Phytoplankton- plant plankton, live near the surface so they can turn sunlight into food and oxygen through photosynthesis
Plankton- drifters, marine organisms that cannot swim against the currents due to size, strength or morphology
Port - the left side of the ship, if you are facing forward
Producer- organism that produces its own food from sunlight
Primary Consumer- organism that consumes producers
Running rigging — lines used to control the movement of the sails and yards
Schooner — a ship with at least two masts, the main one taller than the fore
Secchi Disk- An instrument used for measuring the clarity of water, especially seawater. It consists of a circular plate divided into alternating black and white quadrants and attached to a long measuring tape. The plate is lowered into the water, and the depth at which it is no longer visible from the surface is recorded. The Secchi disk is named after its inventor, Italian astronomer Angelo Secchi
Sheet — line controlling the bottom corner of a sail
Shrouds - heavy lines which support a mast from side to side
Standing rigging - all the lines used to support the masts and yards
Starboard — the right side of the ship, if you are facing forward
Stays — heavy lines that support a mast from fore (front) to aft (back)
Staysail— a sail that flies from (is attached to) a stay
Stern — the back of a ship
Tack-The act of bringing a sailboat's bow through the wind, changing from port to starboard (left to right) while sailing upwind or close-hauled
Turbidity- How clear water is or how deep one can see into the water
Tide- A generic term used to define the alternating rise and fall in sea level with respect to the land, produced by the gravitational attraction of the moon and the sun. To a much smaller extent, tides also occur in large lakes, the atmosphere, and within the solid earth, acted upon by theses same gravitational forces of the moon and sun, Additional astronomical factors such as configuration of the coastline, depth of the water, ocean -floor topography, and other hydrographic and meteorological influences may play an important role in altering the range, interval between high and low water, and times of arrival of the tides.
Trade Winds- The prevailing surface winds over the tropical ocean are the trade winds that blow persistently from the northeast (towards southwest) in the Northern Hemisphere andand from the southeast (toward the northwest) in the Southern Hemisphere. The name of these winds was coined by sea captains who sailed for trading companies and took advantage of their persistent speed and direction when crossing the ocean. Trade winds drive both North and South Equatorial Currents westward, thus transporting warm ocean-surface waters in that direction.
Vessel — a ship or boat
Watch — traditionally a team of people who work together to watch over the safety of the ship
Watershed-Area from which water is drained; a region that contributes water to a lake, river, estuary, coast, or stream
Windlass — a winch used for heavy work like raising an anchor

For information about the packet or the Bay Exploration program, please call (415) 331-3214 or (800) 401-7835

www.callofthesea.org
info@callofthesea.org

Thanks to US Sailing for allowing Call of the Sea the use of their STEM education series activity workbook
http://sail.navas.us/