

# *A Voyage of Discovery*

## An Interdisciplinary Learning Adventure

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# Introduction

This booklet is designed to give you some basic information on the voyage you are preparing to take. You will become a sailor on a two-masted **schooner** that looks and sails very much as schooners did a hundred years ago. But don't worry about climbing ice-encrusted rigging while surviving onhardtack and salt beef; she'll be very different below decks, with comfortable bunks, electric lights, bathrooms and even a shower. The meals will be of a quality that sailors of centuries past could hardly imagine.



Please leave your nail polish and iPod at home; this is a working ship. You'll be hauling sail, standing watches and exploring some of the San Juan Islands. You'll be responsible for your own safety and that of your shipmates. The schooner's too large to sail without your contribution of muscle. You won't be climbing her rigging, though; all her sails can be handled from the safety of the deck. And don't worry about not knowing how to sail; a licensed captain and an experienced crew will "teach you the ropes," and answer your questions. The first time you join with the rest of the crew to raise sail you'll get the feel of the incredible power of teamwork. By the end of the voyage you'll get a feeling for the kind of teamwork it took to explore the Earth.

You'll sleep dorm-style in either the main lounge or the **fo'c'sle** (folk-sil or forecandle). Some people bring along earplugs, but most are so tired by the end of the day that they can sleep through even the heaviest snoring. And when you pack your bag, make sure it's a bag you'd like to sleep with; sharing your bunk with a duffel or gym bag is a lot more comfortable than sharing it with the hard edges of a suitcase. But there's always room for a guitar or almost any other acoustic musical instrument.

In addition to your duties as a sailor, you'll be taking on the role of teacher for this voyage. You will need to learn a subject well enough to teach it. This booklet gives a subject overview and suggests some topics well suited to the experience. You're not restricted to those topics, but you'll need to get your teacher or counselor's okay on your proposed subject, and only one student-- or one team of students-- will be delivering any given lesson. Your written report will be included in a unique textbook which will be printed for you and your shipmates. During the course of your voyage you'll present the lesson in the form of a lecture, play, demonstration, nature walk, game, or anything else-- subject to teacher approval-- that effectively conveys your subject. Just remember, your contribution is essential to every aspect of this voyage.

Your voyage is guaranteed to be hard work and possibly the most exhilarating fun you've ever had. Prepare yourself to take a step back into another time, and forward into adventure.

## Ship-Board Life

Your sailing adventure will begin at the dock in the historic Fairhaven district of Bellingham. You'll meet your captain and the mates, stow your gear in your bunk and join an **all hands** meeting for an orientation and safety session. Your group will be divided into three **watches** which will carry out their various shipboard duties of ship handling, cleanup and **sailing stations** together.

At a word from the captain, you'll help the mates cast off the mooring lines that hold the **Zodiac** dockside and head out into Bellingham Bay. Once underway, you'll get a feel for your jobs as a **watchstander**. The **helmsman** steers the schooner as directed by the captain or mate on duty. The **bow watch** stands at the farthest forward part of the deck, watching for obstructions, such as **deadheads**-- nearly submerged logs which can damage or even sink an unwary ship. The bow watch will also report **contacts**-- other vessels, buoys, lighthouses or land-- to the helm by calling into a **sounding tube** that connects one end of the ship with the other. A **messenger** helps the mate on duty communicate with other stations on the ship.

You'll learn some of the **Rules of the Road** and see the importance of **Aids to Navigation** during your watch. As **navigator**, you'll work with a mate to plot the ship's course through the San Juan Islands. Your stops will include **Sucia Island State Park**, **Roche Harbor**, and a hike to the site of **The Pig War** on **San Juan Island**. Five-day voyages may include **The Whale Museum** at **Friday Harbor** on San Juan Island, **Stuart Island**, and Hughes Bay.

An **anchor detail** will help the mates with the preparations needed to drop and raise the heavy **stockless anchor** the ship carries. The anchor and chain may come to the surface caked with mud, so be prepared to hose it down. The ship, too, will be hosed down and cleaned up every morning to make her ready for the day's activities. You'll also lend a hand to hoist and lower the ship's boats for trips ashore. If weather and time permits, you'll gather 'round a campfire at Sucia or Stuart Island for s'mores and sea lore.

Your teachers will coordinate the presentations of the lessons you prepared, and the captain and mates will add a few lessons of their own.

### Suggested Topics:

- Recount some of the shipwrecks that litter the waters of Washington. What were the most common factors in historic shipwrecks? In modern shipwrecks?
- Describe the different types of anchors, their evolution, and how they work.
- Detail the system of state, provincial and federal parks that dot the waters of Washington State and British Columbia. How and why were they established and what do they offer the traveler? Be sure to include underwater preserves.
- Explain the traditional and modern workings of lighthouses.
- Explain the **Rules of the Road** and how they work.
- Explain the different types of **aids to navigation** and how they are used.

# Sail Power

Sailing ships have evolved from log rafts with skin sails to technological marvels like the 12-meter boats which race for the America's Cup every four years. Whatever their design, they are all influenced by many of the same factors. The shape, length and breadth of their hulls can be calculated to determine their **hull speed**. Their sailing rig, whether **lateen**, **square-rigged** or **fore and aft** will determine how easily they are handled and how well they sail up wind.



Up wind? How can a boat sail up wind?



Ancient ships could only travel where the winds blew them, like a raft bobbing down a river. Sailors had to use oars or wait until the winds shifted to take them home. But shipbuilders slowly learned that if their sails could be made to pivot and catch the wind at an angle they could sail a little into the wind. By running a zigzag course they could slowly sail up wind. As

designs improved, ships sailed ever closer **into the wind**.

Great square-riggers sailed the oceans of the world for centuries, carrying explorers, traders and settlers into the New World. Sailing rigs such as **barks**, **brigs**, **snows**, **ships**, and finally **clippers** carried people and cargo around the world, making use of the predictable **trade winds**, avoiding the **doldrums**.

The square-riggers were magnificent vessels. But every course change required a lot of time and a large crew to climb aloft to handle the sails. It took considerable sail area to move the square-rigger's huge bulk, and they were cumbersome vessels to handle in port. In the era before steam tugs there were many groundings and wrecks.



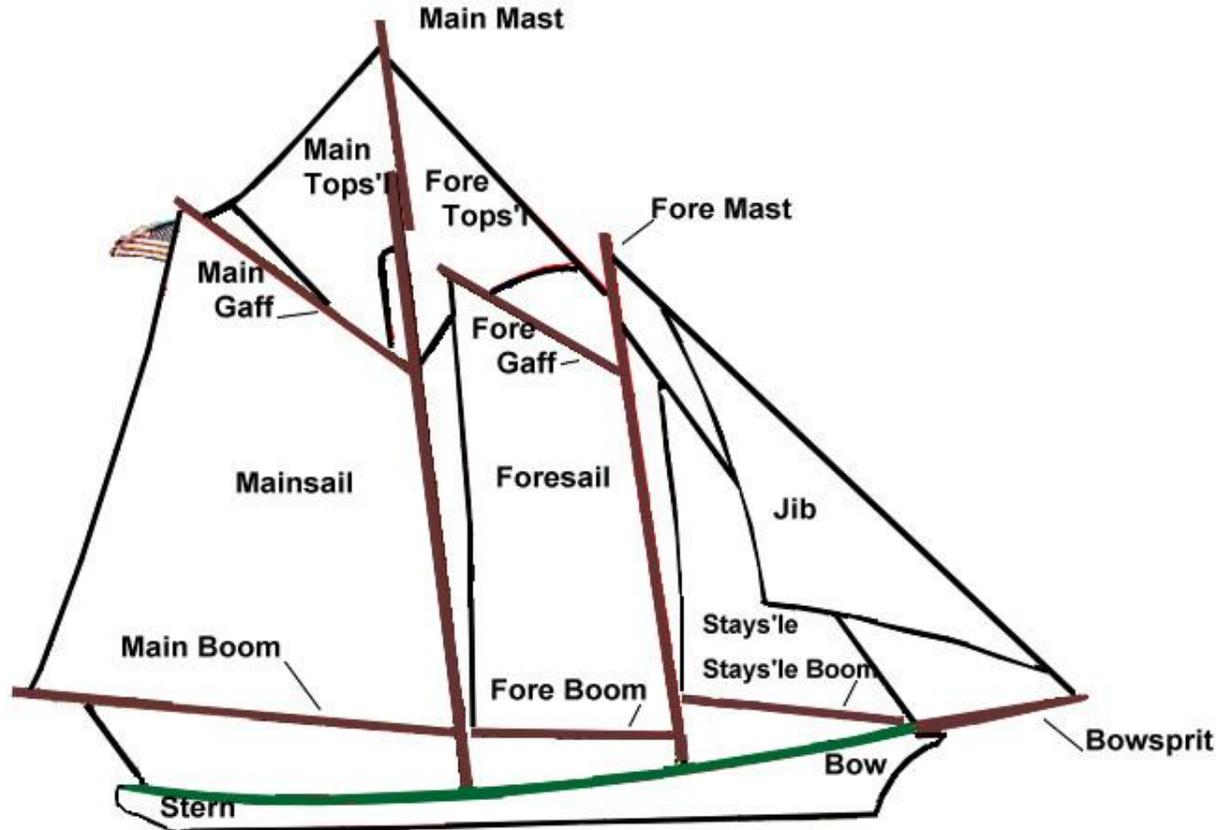
A livelier boat was needed, one that could be handled faster and with a smaller crew. **Pinkies**, large boats with two **gaff-rigged** sails were a popular rig on the American seaboard. Shipwrights began building them bigger, until they resembled the sailing ship we now call the schooner. They never rivaled the great square-riggers for cargo carrying capacity, but for a combination of speed, ease of handling and seaworthiness, they were unrivaled.

## Suggested Topics:

- Show the types of sailing rigs, their evolution and advantages.
- Explain the history of maritime trade in the Northwest and its dependence on sailing technology.
- Explain **hull speed** and its relation to **sail area**.
- What is **mechanical advantage** and why is it crucial in operating a sailing ship?



# Schooner Terminology



**Aft** - To go aft. The rear or "after" part of a vessel. Toward the stern.

**Come About** - To tack by turning into the wind.

**Downhaul** - The line a sailors hauls on to pull down a sail.

**Fo'c'sle** - Forecastle. The forwardmost compartment in a vessel. Usually a berthing area.

**Forward** - To go forward. The front or forward part of a vessel. Toward the bow.

**Galley** - The ship's kitchen space.

**Halyard** - A line used to pull a sail up.

**Head** - The toilet area.

**Jibe** - To tack by turning away from the wind, a dangerous maneuver on a large ship.

**Leeward** - The direction away from the wind. Down wind.

**Line** - Rope.

**Luff** - Sails hanging loose or flapping.

**Port** - When facing the bow, port is to the left.

**Preventer** - A line tied to a boom to prevent it from swinging during an accidental jibe.

**Sheet** - The line which runs through a pair of blocks and controls the movement of the boom.

**Starboard** - When facing the bow, starboard is to the right.

**Tack** - Position of the ship relative to its sails.

**Windward** - The direction toward the wind. Up wind.

## Sailors Arts

In the days of sail, most seamen were illiterate men who spent years away from their families-- if they even had families. Mail was rare at best, work was hard and entertainment was limited to their own creativity. But they developed astonishingly beautiful ways of working with rope, canvas, wood, bone and tooth that are prized by collectors and practiced by modern artists who spend their lives ashore.



Sailors developed folk arts that ranged from the most practical of knots such as the bowline, to the elaborate etchings on whale tooth ivory called **scrimshaw**. Along the way they composed work songs called **chanties** (pronounced "shantys"), heartfelt laments, like **Shenandoah**, and lively **jigs** for dancing.

A lucky few sailors were literate men, either well-educated upper class men who sought the adventure of a sailor's life-- like Richard Henry Dana, who wrote his memoir, **Two Years Before the Mast**-- or largely self-educated men like Herman Melville, author of seafaring novels such as **Moby-Dick**, **Billy Budd** and **White-Jacket**. Others, such as Rudyard Kipling, observed the seafaring life as outsiders, but conveyed its realities with considerable accuracy and imagination.

### Suggested Topics:

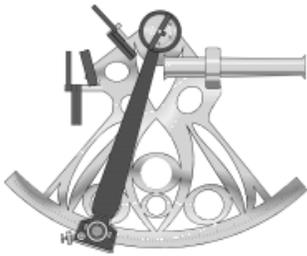
- Learn the different types of chanties, including **long haul chanties** and **short haul chanties**.
- Learn a variety of working knots used in a sailing ship and show how they were used in developing fancy knotting, such as **macrame**.
- Show the history of **scrimshaw** and its rise and fall with the whaling industry.
- Sailing ships carried a wide variety of boats for different purposes. Show the development of some of these boats and how they might have been used for carrying people, provisions, rescue and even escape.
- Read a classic maritime novel, memoir or history and report on it.
- **Captains Courageous** takes place on a fishing schooner similar in design to the **Zodiac**. Write a book report for your group's textbook and make an oral report on the differences and similarities between life on the **We're Here** and life on the **Zodiac**.

## Navigation

"Where am I and which way should I go?" The task of reliably getting from Point A to Point B with your cargo-- and your life-- has occupied sailors' minds for thousands of years. Cataloging the position of the stars, establishing a pattern of mathematically defined lines covering the Earth, and the development of accurate timekeeping led to increasingly sophisticated charts of the ocean, and more precise methods of navigation.



Compass



**Sextant**

Traditionally, sailors engaged in three types of navigation:

- **Piloting**-- determining a course through coastal waters by relying on visible features of the landscape, including lighthouses, buoys and rangemarkers.
- **Deduced Reckoning**-- frequently called "dead reckoning," the sailor determines the ship's approximate position by drawing a series of vectors-- determined by the ship's course and speed-- from the ship's last a known reliable position. Wind and current are not considered in dead reckoning, but are factored into "estimated position."
- **Celestial Navigation**-- by using a sextant, a clock and a set of mathematical tables, a sailor can determine a ship's position on Earth with an accuracy of several miles.

Modern navigation involves considerably more technical equipment, and less skill on the part of the sailor. Electronic navigation includes:

- **Radar**--which shows the distance and bearing (direction) to landmarks.
- **Loran**--which gives latitude and longitude via radio signals from stations ashore.
- **Global Positioning System (GPS)**--which gives latitude and longitude world-wide from satellites.

In any form of navigation, the sailor seeks to define exactly where on the globe his or her vessel lies. **Parallels of Latitude**-- lines which appear on maps and charts running parallel to the Equator-- and **Meridians of Longitude**-- north-south lines which intersect both poles-- form a gridwork encompassing the globe. The navigator can determine position on this grid of lines using any of the above tools and some well-established mathematical formulae.

### **Suggested Topics:**

- Explain the use of vectors in dead reckoning.
- Show the development of navigational theory starting with the backstaff or quadrant.
- Explain the development of the chronometer and it's importance to navigation.
- Compare and contrast the use of a traditional magnetic compass and a modern gyro compass.
- Explain the symbols and information shown on navigation charts.
- Show how the position of the ship is determined from landmarks using a chart, compass and drafting tools.

# Water-Borne History

## The First Nations

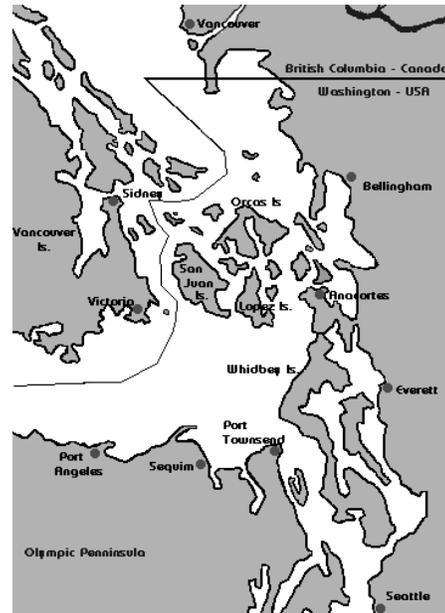
The islands, rivers and bays of what is now Washington have been home to humans for thousands of years. With a mild climate, the annual abundance of salmon and berries, and the extraordinary versatility of the cedar tree, more than a score of different Native bands lived in relative harmony. Unlike many areas of North America where harsh conditions forced many of the early inhabitants of the continent into a nomadic lifestyle, the people living on the shores of Puget Sound enjoyed a relatively settled existence and had substantial leisure time in which to develop art, dance and storytelling.

Each Northwest band built cedar canoes, houses and totem poles, but each developed a distinctive style of carving and decoration. They created their arts for religious reasons, personal enjoyment, to trade, and to give away during elaborate **potlatch** ceremonies. European merchants were awed by the exquisite arts developed by the Totem people and a lively trade flourished.

But contact between Europeans and Natives were not without violent and destructive episodes. Murders occurred on both sides, but the most serious threat to the First Nations was the invisible invasion of cholera, smallpox, and measles. The Native population of plummeted and many were forced from their traditional lands and crowded onto reservations.

### Suggested Topics:

- What was life in Puget Sound like before the Europeans arrived? How did the various tribal groups interact? Have the cultures and traditions of these groups survived?
- In what ways were the interactions between the Native populations and the settlers the same/different than in other parts of the country? How did these early interactions effect the development of the state?
- Describe a potlatch and its political and social importance.
- Describe the day to day life of one or more of these cultures.
- The Makah were renowned whalers. In 1996 members of the tribe petitioned the federal government to allow them to once again hunt whales. What are the issues and history surrounding their request? What were the results?
- Study the mythological traditions of the Northwest people and share their stories.
- Describe the reservation system today and the challenges facing Native Americans.



## European Explorers

In the 1500s a Greek sailor bearing the Spanish name Juan de Fuca claimed to have sailed more than twenty days along a great east-reaching seaway at about the 47<sup>th</sup> latitude. De Fuca believed he had found the much hoped for Northwest Passage which would connect the Pacific and Atlantic Oceans. His claims were roundly discounted until 1787 when English explorer Charles Barkley sailed through a passage which matched de Fuca's description. He named the waters the **Strait of Juan de Fuca**.

In the early 1700s, Danish explorer Vitus Bering led two important Russian expeditions into Northwest waters, traveling from Alaska-- and the sea which now bears his name-- to as far south as the Columbia river. He carried aboard a young German naturalist named George W. Steller. The charts and information brought back by the Bering voyages sent generations of Russian traders paddling into the water of the Northwest, in search of the valuable pelts of sea otters. Russia established outposts from Alaska to California, but in 1824 ceded all rights to the lands south of Alaska to the United States.

Spanish explorers had claimed much of the Northwest for Spain in the 1780s, and in 1790 an expedition led by Francisco Eliza established a settlement in Nootka Sound on what came to be known as Vancouver Island. Later Spanish expeditions charted the coast of what is now Washington and British Columbia, but none entered Puget Sound.



Captain George Vancouver had sailed as a lieutenant with England's greatest sailor-explorer, Captain James Cook. The Cook expeditions mapped much of the Pacific, but missed both the mouth of the Columbia River and the Strait of Juan de Fuca during the voyage of 1778. Vancouver returned to the Northwest in 1792 in command of the HMS *Discovery* and *Chatam*. The islands and mountains of Washington and British Columbia bear the names of many of his officers and crew. On July 4, 1792, Vancouver claimed the Northwest for Great Britain.

In 1805, Meriwether Lewis and William Clark first saw the Pacific Ocean, having journeyed overland on orders from President Thomas Jefferson. In 1841, Captain Charles Wilkes led an American naval expedition which charted the Pacific coast and the connecting waters of Puget Sound. Wilkes did not attempt to directly claim the Northwest for the United States, but his reports to Washington encouraged the U.S. to eventually do so.

### Suggested Topics:

- How did European politics affect the claims laid in the Northwest? How did politics affect colonization? Did the Native inhabitants of the region regard the different nations' explorers differently?
- Detail Vancouver's "Voyage of Discovery."
- What navigational challenges did maritime explorers face? How did the equipment de Fuca carried differ from that of Captain Cook? Of Captain Wilkes? Of today?
- What was life like in the early European outposts? What were the differences between the various nation's outposts?

## Conflicts-- Modern and Historic

In the early 1800s, Oregon Country-- as the lands of the Pacific Northwest were known-- was occupied by British and American settlers. Even after the area became Washington Territory in 1853, parts of the San Juan area were claimed by both Britain and the United States. In 1869 the death of a British Pig at the hands of an American farmer nearly started a war.

By that time the settlements of Olympia, Seattle, Port Townsend , and Whatcom (later Bellingham) were thriving and the state number 12,000 settlers of European ancestry. In 1889, Washington became the 42d state.

During the 1980's when many nations started claiming jurisdiction over oceanic resources out to 200 miles from shore, the seaward extension of borders was often an issue of contention. Access to fishing grounds was immediately important, with the fishermen of various nations standing to win or lose the ability exploit vast resources. The potential for oil production and mining minerals offshore was also important. Squabbles for resources broke out between the U.S. and Canada.

### Suggested Topics:

- Detail the **Pig War** and political forces that shaped the settler's outlook. Explain how the conflict was resolved and any lasting effects it may have had.
- What were the economic and political forces that allowed the U.S. to gain title to Oregon Territory instead of the British Empire and Canada?
- How were the cultures of the Native populations affected by the conflicting European and American claims of sovereignty.
- How did these two nations avoid violent conflict? Can their example help other nations avoid war? Why isn't that example working for the present dispute over Frasier River sockeye salmon?
- What are the cultural, fishing and environmental factors that have created the perceived salmon shortage?
- Show the changes in fishing methods over the last hundred years. Have these changes contributed to the current dispute?

## Bounty

Every new arrival in the Northwest was delighted by the stunning wealth of the land. Food was everywhere, in the form of fish leaping upstream, oysters, clams and mussels filling the tideflats and berry bushes filling meadow and wood.

### Suggested Topics:

- Contrast the menu at a 19<sup>th</sup> century potlatch with a settler's diet and your own.
- Plan and prepare a meal reflecting the wild foods found by early Northwesterners.
- Detail the specific wild foods found in the Northwest.

# Natural History

## Geology

Mountains thrust up out of the sea here-- not like the well-worn Atlantic coast where the terrain visible from ships rarely rise a hundred feet above the water. The Northwest coast is young and turbulent. Volcanoes dot the landscape. Hot springs are common. What must the early European explorers have thought as they sailed through the mountain-edged Straits of Juan de Fuca? Such a magnificent landscape would surely hold the Northwest Passage. Vancouver was certain he had found the entry to that almost mythical body of water when he discovered **Deception Pass**. But the stiff current that flows through Deception Pass was simply evidence of the remarkable geologic forces that have created the Northwest coast.

The interaction of tectonic plates and the action of glaciers both contributed to the formation of Puget Sound, the Straits of Juan De Fuca and the San Juan Islands. The resulting deep bays, natural channels, river deltas and sloping beaches all affect the movement of water currents. The moon and sun create tidal pull which causes tidal ranges that can exceed ten feet. Ships, both sail and engine powered, must take these forces into account when sailing in Northwest waters.

### Suggested Topics:

- Explain the chronology of the geologic events which shaped the coastal lands of our part of the country. Speculate on what further changes we may expect.
- How did the geology of the region shape its inhabitants?
- Detail the geological development and features of Sucia Island.
- How are volcanoes in the Cascades caused by movement of the ocean floor west of the Olympic Mountains?
- What was the pattern of ice flow in the Puget Sound region during the most recent ice age?
- What were the causes and patterns of the great floods in Eastern Washington during the last ice age? What was happening in Puget Sound during the times of those great floods?

## Ecology

Humans moved slowly into the western hemisphere. They crossed from Asia, probably journeying both by land and water into the new world. They created communities and traditions tied to the new land. Some stayed in what is now Alaska; others moved south and east. And as they moved, they changed the land.



Mastodon and mammoth roamed the ice age plains. Saber-tooth tigers hunted their pray. About fifty-four large mammal species became extinct within a few thousand

years after the arrival of humans. These new settlers may have brought old world species into the new land as well. Though not farmers, they may have carried edible seeds that found their way into the welcoming soil and-- for better or worse-- became a part of the landscape.

Europeans, arriving in their much larger vessels, introduced hundreds of new species over a very short period of time. And they began to harvest the land in a way unfathomable to the First Nations. Forests were logged and shipped to far-off ports. San Franciscans dined on Washington oysters. Canned salmon traveled farther than the hardiest live chinook. Even rock, in the form of sand and gravel, left the riverbed, beach and mine to become an ingredient in concrete construction.

The changes brought increased comfort and opportunities to the people of the region. But, frequently, they degraded the land in the process. Logging operations clogged previously rich salmon streams. Dredging covered once productive shellfish beds. Wetlands were filled for construction. Waste piled up and pollution fouled the air and water.

In the 1960s the region-- and the country-- realized it had a problem. A balance had to be found between the desire for human comfort and the demands of the environment. People are a part of the web of life, and the web of species must survive for humans to survive.

### **Suggested Topics:**

- The concept of "keystone species" was developed in the intertidal areas of Washington State. Give examples of how the activities of starfish and sea otters allow scores of other species to survive, and how the diversity of communities is greatly diminished when keystone species are removed.
- Animals and plants occur in horizontal bands on the intertidal rocks. Why is that? What are the factors which control that distribution?
- Explain why some years Fraser River sockeye salmon come through the San Juan Islands, and thus become vulnerable to U.S. fishermen, and why some years the fish return from sea via the Straits of Georgia, and thus remain in Canadian territory.
- Orca (formerly known as Killer Whales) are unique species among mammals by maintaining for 100,000 years separate non-interbreeding populations in the same geographic area. Explain the two populations of Orca and the structure (family make-up) of pods.
- Explain why eagle populations are recovering in the Northwest.
- What is kelp? Why are kelp forests important?
- What is phytoplankton? Why is it important?
- Why are there different types of trees in different places around the Pacific Northwest? What species are currently dominant in the San Juan Islands? What types would dominate the forests there if humans did not cut down trees or start fires? How long would it take for such "climax species" to establish their dominance if an area was set aside from human disturbance?

# Sea and Sky

## Oceanography

It is impossible to live in western Washington and not be affected by the ocean. The connecting waters of Puget Sound and the Straits of Juan de Fuca influence the weather, harbor a tremendous diversity of food, and either throw up a barrier to travel or - if you have a boat or don't mind waiting in ferry lines-- provide an easy means to reach islands in the U.S. and Canada. And people have a major impact on the ocean, as well.

Nearly all scientific and mathematical disciplines have a niche within the overall science of oceanography. Geologists work on the sea floor as well as the land, revealing the Earth's history through the record contained in core samples. Chemists can determine the path of deep ocean currents by plotting the position of chemically similar bands of water through careful sampling techniques. Satellite radar data coupled with advanced computer cartography can even reveal profiles of the ocean floor.

The condition of the oceans effects what we experience on the land, and its affects are far-reaching. The El Niño winds that blow off the coast of Chile may give us a warm winter, wet spring, and an uncharacteristically dry summer.

### Suggested Topics:

- How is development and growth of the human community affecting the water quality of Puget Sound? What needs to be done to ensure good water quality in the future?
- What determines the size of wind waves on water. Explain fetch.
- What causes the rise and fall of the tides. How similar is the range and pattern of tides at different places on earth?
- Why aren't tsunamis considered to be tidal waves? What causes them? How big have they been in Puget Sound?
- What is an estuary? Why are they important?
- How do sailors use currents? What problems do currents cause? How fast do currents go in the San Juan Island area? How do you get through a pass which has high currents?
- Demonstrate how currents and tides behave in the bays and straits of the waters connecting to Puget Sound. Explain how sailors use tide and current tables to plan their trips.
- Illustrate and explain the forces at work in Deception Pass and its surrounding waters.

## Meteorology

It has been said that predicting the weather in Puget Sound is easy. "If you can't see the Mountain, it's raining; if you can see the Mountain, it's going to rain."

In fact, weather is extremely difficult to predict in specific localities of this region. Although the effect of the ocean on overall weather patterns is fairly predictable, allowing accurate predictions for large areas, the manner in which winds from the ocean split around the Olympic Mountains make specific predictions for localities very difficult. The location where the air masses merge after taking different routes around the Olympics can cause the weather in nearby areas to be quite different, and predicting the exact location of these merging areas is difficult.

### Suggested Topics:

- Explain the general pattern of winds in Washington State, and how the two mountain ranges of western Washington affect the winds.
- Explain how to get Marine weather forecasts. Demonstrate the use of the ship's radio.
- How are ships protected from lightning damage? What happens when lightning hits a ship?
- Explain the "rain shadow" of Washington State, and show isopluvial diagrams of western Washington.
- Explain the changes in the winds and water of the South Pacific Ocean which seem to cause El Niño events. Describe the changes in global weather and Northwest U.S. weather which are associated with El Niño.