Teacher Guide

Available at http://www.salish.org
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TEACHER CHECKLIST AND TIMELINE on back cover
Dear Group Leader,

Thank you for organizing your trip with Salish Sea Expeditions! As you likely already know, Salish Sea Expeditions' science and sailing programs begin in the classroom, proceed with a 3-5 day boat expedition, and conclude back in the classroom where students and staff work together to complete their Student Synthesis Project, which will be posted online at the Salish website.

This packet is designed to provide materials and answer questions that you may have about our programs. In this packet, you will find important information and a number of forms that you will need to help you prepare for your trip. In Appendix B you will find forms that need to be returned to the Salish office before your trip. In Appendix C you will find forms to be photocopied and distributed, including a homework packet you may choose to distribute to your students, a guide sheet for adult chaperones and a list of what to bring. This Teachers’ Guide is filled with information that will answer questions and prepare you for the trip, but please feel free to contact us at anytime.

Using INQUIRY-BASED SCIENCE is key to the experience that students have with Salish Sea Expeditions. Inquiry-based science is a student-centered, active learning approach focused on questioning, critical thinking, and problem solving. It provides students with opportunities to take the initiative, observe and question phenomena, pose explanations of what they see, devise and conduct tests to support or contradict their theories, analyze data, and draw conclusions from their experimental data. Students will help direct their own learning experience.

Lastly, if you have questions or concerns about your trip, please do not hesitate to contact us at any time. We look forward to working with you and helping your students plan an expedition of learning and adventure!

Thank you,

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Salish Programs

Source- Land Based Watershed Research

More than a decade of meaningful, inquiry-based field science expeditions on Puget Sound have elicited consistent feedback from teachers like you that the type of science experiences we offer are some of the most lasting and engaging of your students’ careers. We also regularly hear about the many obstacles faced in providing quality, field-based inquiry science opportunities for students outside of the Salish expedition.

In an attempt to break down some of these barriers, and facilitate replication of the student-centered, “Salish-style” science experience, Salish has designed Source, a land based program focused on stormwater and watershed sciences. This program can be carried out on school grounds or a local waterway. Typically, this is a 10 hour program that can be tailored to the teachers curriculum and time frame and has a restoration* component addition if you are interested in a service learning or “action piece” for your students.

Source is a customized, watershed-based program extension to our successful boat-based Sea Investigators program. Through Source, Salish will work with you to develop either short-term or longer-term inquiry opportunities and field-based science projects, allowing your students to connect with their local watershed as they repeat the process of designing and conducting their own field investigations.

Source research can be limited to the students participating in an expedition aboard Carlyn, or it can include any number of additional teachers, classrooms, or potentially, an entire grade level. Give your Carlyn students a chance to share their excitement and aptitude for field research with their peers!

Our goal is to assist you in overcoming the obstacles you face in getting your students out of the classroom. Whether it’s lacking the time to organize field excursions; money for substitutes, transportation, or equipment; or access to quality curriculum that engages students, we will help fill the gaps that prevent you from acting on these objectives.

Source offers:

- Customized curriculum development for watershed/stormwater research and integration with your current teaching objectives;
- Teacher trainings to assist you in facilitating inquiry based learning in a field research setting;
- Access to sampling equipment and field resources;
- Staff consultation and additional classroom visits, if desired; and
- An end-of-year, NOAA-sponsored Student Science Symposium where student delegations will present their research to Sound and Source participants, peers, local scientists, and the community.
- Restoration component at the end of program*

*Due to student and teacher requests we have added a service learning, “action piece” to our Source program. Salish staff work with you and your students to design and implement a feasible restoration component. Salish staff work hard to connect teachers and students with local experts in the field of restoration to educate and assist in this cumulating event. Some restoration projects include seeding of oyster bags, removal of invasive species, design of rain gardens and planting of riparian buffers.
Sound Program- Boat Based Research

Salish combines innovative classroom study with actual field research, providing an exciting educational opportunity for youth to learn scientific principles and practice problem-solving skills while investigating scientific issues surrounding the waters of Puget Sound. Salish programs have three components:

- Expedition Preparation (2- two hour classroom sessions or 1- three hour session)
- Expedition (3-5 Days)
- Expedition Synthesis (1- two hour classroom session)

**Expedition Preparation**

Salish educators work with you and your students to design a custom expedition that matches your specific interests and objectives. In order to prepare students for the Expedition section of our program we highly encourage two separate classroom sessions of two hours in length. The closer to the start of your expedition they are, the better. During the Expedition Preparation visits, Salish staff will:

- Provide an overview of the on-board science and sailing components, the scientific method, Puget Sound history, oceanography, and water quality issues.
- Have students work together to develop a research question and generate a prediction (hypothesis).
- Prepare students for a safe, comfortable and fun expedition.

Please note that we understand time and classroom constraints, and we can design pre-trip sessions to fit your scheduling requirements.
Expedition

While at sea, the group is divided into two watches (WIND & WATER). The watch system allows for the students to participate equally in science and sailing. While on the expedition, Salish staff will assist your group in accomplishing the following:

- Designing and conducting an experiment to test the student-prediction. Students will prepare and deploy oceanographic equipment, along with the collection and analysis of samples.
- Sailing and navigating the ship, along with nautical science classes as time allows.
- Each student rotates through shipboard chores including cooking, washing dishes, cleaning the heads (toilets) logging their daily experiences and washing the deck.

- Each night Carlyn anchors or docks at a marine state park. One watch will experience sleeping onboard Carlyn. The other watch sleeps ashore in Salish’s tents, allowing the students the opportunity to explore the marine state park.
- There can be an opportunity for large group activities ashore in the evenings, even just to run and explore. Evening group activities may include night hikes, astronomy, beach combing, and group games. Please tell Salish Staff of any preferences so that they can plan accordingly.

We do our best to separate sleeping quarters by gender and all quarters are supervised by adults. Dinner and breakfast take place where the watch sleeps. Salish provides rain gear, lifejackets, food, cooking and camping supplies.

Sample Watch Schedule

9:00-11:30 WIND-science WATER-sailing
11:30-1:00 Lunch/Exploration
1:00-4:00 WATER-science WIND-sailing
4:00-5:00 Land Excursion/Docking
Shore WIND
Ship WATER
[switch next day/night]
Expedition Synthesis

After the Expedition, Salish educators return to the classroom to assist students with preparing their Student Synthesis Project. The Student Synthesis Project is the students' opportunity to communicate their field science experience to others, focusing on their prediction, experimental design, results and conclusions of their Expedition. This project begins with the ideas developed during the first classroom visit and ends as a final published presentation of their scientific experience, which will be posted on the Salish website.

- Students will re-evaluate data, research methods and error. Students discuss what they learned about designing a research project and what new questions they have as a result of their research.
- Salish educators will lead students in developing their Student Synthesis Project, whether it is a scientific paper, a PowerPoint presentation, or another format of their choosing.
- This is a great opportunity for you as a teacher to incorporate Salish into your curriculum and/or community! Think early about ideas you may have or wish to try for this portion of our program.

Salish staff will provide samples (see Appendix A), outlines and assistance and review throughout the students' synthesis process.

Synthesis Projects

The synthesis project is the cornerstone of the Salish curriculum. It acts as a bridge between the field and the classroom and gives students an opportunity to step back from the excitement of the field trip and see their science research from beginning to end. In effect, it allows them to put all the pieces of the Scientific Method together and share their findings with their community as professional scientists do. Included are some abridged examples of projects student groups have created. Though the format is only limited by student creativity and your goals as a teacher, students often choose Power Point presentations, posters or written reports as their means of conveying their research to schools, parents and larger communities. Finished projects are posted on Salish's website in our Online Journal of Student Research on Puget Sound.
Cascade Middle School, Burien, WA
Pictures from presentation given to school community
Introduction

- Our Hypothesis:
  - If we collect zooplankton from shallow and deep water, then there will be less zooplankton in deep water because there is less oxygen in the deep water and zooplankton need oxygen to survive.

Procedures

Zooplankton Net Deployment:
- 5 minutes in the water
- One at surface
- One at 10m down
Niskin bottle deployment:
- 10m down
- Test DO ASAP
Bucket and rope:
- Surface
- Test DO ASAP

Our hypothesis: refuted or proven?

- Our hypothesis was refuted due to the data we collected.
- We found out that at deeper depths, there were more zooplankton.
- During the day, the zooplankton swim down to deeper depths to avoid the predators who can’t see them at the deeper depths.
- Then at night, the zooplankton sneak up on the “sleeping” phytoplankton and eat them.

Food and Cooking

During the expedition, we had to cook our own food. We were split up to cook different meals everyday. The group would eat lunch as a whole. During breakfast and dinner we split up into two groups to eat.

On the menu, we had chilli, rice, soup, potatoes, pineapple, pasta, hamburgers and hotdogs, cereal, grapefruit, and a mouthful bullet.
The Effect of Time of Day and Depth on the Amount of Plankton in the Water

We hypothesized that if we tested the water at daytime and nighttime then there will be more plankton at the surface during the day than at night because the phytoplankton photosynthesize and the zooplankton follow the phytoplankton. To our astonishment, we were amazed that our prediction was proven correct. Some people in the group had the idea of using the secchi disk next time, so we know the clarity of the water. In addition, we thought it might have been better if we used the Niskin bottle so we would be able to collect different waters from different depths. These two ideas may have further improved our experiment.

Our class, a group of students from the International Community School ranging from 7th grade to 11th, ventured aboard the Carlyn for our annual Focus Week. We set out with a goal of experimenting and researching plankton in the Puget Sound given the types of equipment available to us on the boat.

Our prediction questioned the amounts of plankton in the water at different times of day. We hypothesized that if we tested the water at daytime and nighttime, then there would be more plankton at the surface during the day than at night because the phytoplankton photosynthesize and the zooplankton follow the phytoplankton. This makes the variables in our experiment 1) the depth at which we towed, 2) the length of tow, and 3) the time of day. We predicted that there would be more phytoplankton at the surface because there was more sunlight and we already knew that phytoplankton survive through photosynthesis. Therefore we decided to perform both a surface and a ten meter tow for each type of plankton at different times of the day; one tow in the morning, one in the afternoon and one at night.

We decided upon this specific experiment because we knew that there was a large and plentiful plankton community residing in the Puget Sound coupled with the fact that plankton seemed like it would be the easiest to catch and analyze based on the equipment provided. In the end, our results came back very much consistent with what we hypothesized: there were more of both types of plankton at the surface.

We tested the water in the morning, afternoon, and in the evening at two different depths. During the morning science watch, the Wind or Water group would take samples of plankton, which we then filtered and later examined as we recorded the data. The same procedure was done for the afternoon watch, and whichever group was sleeping on Carlyn would take samples at night.

Materials:
° Zooplankton Net
° Phytoplankton Net
° Rope Lines
° Lead Weights
° Plankton Settler
° Graduated Cylinders
° Timer
° Plastic Tubs
° Funnel
° Spoons
We tested the water for phytoplankton and zooplankton between 1000 -1100, 1400-1500 and at least 30 minutes after sunset. Additionally, at each of these times we deployed the plankton net between 0-1 m from the surface and 8-10 m from the surface.

After preparing the nets by securing the nets to the stanchions and attaching the weights to the nets, we requested permission from the captain to deploy the nets. After we received confirmation from the captain, we deployed the nets for 3 minutes at the surface. Originally, we deployed the nets for 5 minutes but after receiving a superfluous amount of plankton we reduced the time to 3 minutes. Then we repeated the tow at our second depth of 8-10 m.

After the completion of the tow, the water was filtered out of the sample with the plankton settler, spoons, squeegee, and wash bottle over the tubs to prevent loss of the plankton sample. Then the collection of plankton was funneled into graduated cylinders labeled with the time, type of plankton and depth. Then we repeated the tows at the other times. The samples were left to settle and we measured and recorded the volume of the plankton. Then we averaged and graphed the data.

V. Results

Plankton vs. Time of Day
VI. Discussion

As the data in the graphs show, our results were consistent with our prediction: there were more of both types of plankton at the surface, and the daytime tows, especially the afternoon tow, produced a higher volume of plankton. This made sense since the afternoon tows were done at the time of day when the plankton had been exposed to sun for the longest, and had had the most time to drift towards the surface.

Some people in the group had the idea of using the secchi disk next time, so we would know the clarity of the water at each sample site. In addition, we think it will be better if we use the Niskin bottle to collect different waters from different depths so we can look at other characteristics of the water. We would also like to include more information about the tides to see if tides affect plankton levels.

One unique thing about our samples was that we collected many more milliliters of plankton when we were right next to the sewage outflow area off of Seattle than in our other sample sites. We know that plankton feed off the nutrients in the water, and the higher nutrient levels near the sewage area probably caused this huge increase in the plankton volume. It would be interesting to design a future study comparing plankton levels around Puget Sound at different distances from sewage outflow areas.

VII. Cruise Summary

Over the three nights that we sailed on Carlyn, we stayed at Fay Bainbridge State Park and at two different locations on Blake Island. During our stay, we had many delicious meals that we prepared. Some memorable meals include three batches of homemade macaroni and cheese, chocolate chip pancakes, and fifty grilled cheese sandwiches. We had some very delicious desserts, as well. These included apple crisp, dip ‘n go, and banana boats.

On the last day of our trip, we elected captain, mate, navigator, chief scientist, and a couple more jobs. This gave us an experience of what it was like to be a part of the crew on Carlyn. We were able to sail by ourselves and navigate our way back to Elliott Bay. However, there wasn’t any wind, so we did not get the full experience of running a sixty foot sailboat by ourselves.
Wind was a giant factor that greatly impacted our trip. At three in the morning while anchored near Blake Island, the wind began to upset Carlyn by knocking her into the buoy area. So Captain Scott, Erin, and Dave ran around on deck and relocated us to the other side of Blake Island. Also, we were very thankful to not have any rain. Although we put on our bright yellow raingear, it did not shower at all, contrary to the weather prediction.

On shore, we had dip 'n go and played Carlyn Family Fun Fun Fun (Fun). Our two watches are very competitive and to hear that we tied did not make us very happy. Dip 'n go was great, and we invented a new kind called “dip 'n whip 'n go.” Our favorite things to dip are the alphabet cookies, bananas, and pretzels.

We saw much wildlife throughout our trip. On Blake Island, we saw raccoons and a couple of deer, and while sailing, we saw about six or seven sea lions. Also, we saw many, many jellyfish. Thanks to further research after our trip, we have discovered that the highly dense population of jellyfish might be due world climate change.


The Boat

Carlyn is a 61’ yawl built in 1996 and is leased to Salish Sea Expeditions by Four Winds*Westward Ho Camp on Orcas Island. The ship is Coast Guard certified to carry thirty passengers and has the capacity to sleep sixteen. She has 4 sails, two cabins and two heads (toilets). While underway it is required that all aboard wear life jackets provided by Salish Sea Expeditions.

The vessel is designed and rigged to support the experiential education interests of Salish, allowing maximum student participation in all shipboard operations, including raising and lowering of sails, line handling, navigation and steerage. Our onboard oceanographic laboratory is fully equipped and outfitted to serve the research interests of our participants.
Background Information

Your students will be in charge of as much of their expedition as possible—they will plan meals, sail, steer and navigate the boat, and most importantly, they will conduct a true inquiry-based investigation. Though our program is self-contained, you may wish to provide some background for your students.

Included in the appendices are some basic background information on Puget Sound, a list of scientific equipment available on the boat and the parameters they test for, a list of links for research, and a list of local and national standards supported by our program. Our educators have great ideas and lesson plans on hand and are very creative and willing to help you incorporate our program into your classroom.

Some ideas include:

- Have students complete a Salish Homework Packet
- Watch the Salish DVD as a class;
- Find newspaper articles about the Puget Sound’s health;
- Research oceanographic equipment and parameters;
- Study the Natural History, ecology and biology of Puget Sound, and;
- Read Salish’s online Journal of Student Research on Puget Sound.

Please feel free to contact Salish for additional information!
Hot Tips for Teachers!

The following are insider tips from other teachers and our staff to smooth out your planning process and make the most of your Salish experience…

- Use the checklist on the back of the Teacher Guide.
- Fill out group information form to assist us in preparing our staff for your goals and needs for the program.
- Schedule Classroom visits ASAP by contacting the Education Director at (206) 780-7848 or educationdirector@salish.org.
- Start thinking about what form you may want your students’ synthesis project to take. Scientific paper? Presentation? For whom? A visual product for display at school? Participation in our end-of-year Student Science Symposium?
- Build Salish into your curriculum. Do background preparation on Puget Sound, the Scientific Method, sailing, or investigate any topic that may help students prepare in achieving your own objectives. Salish is available to assist with resources and ideas. (See Appendix A)
- Distribute and collect student paperwork early, including Pre-trip evaluations and Hold Harmless forms. It saves loads of stress and scrambling on your end and on ours.
- Don’t forget to arrange transportation to and from the dock for your group! Marina information and logistical support are available from Salish and on our website.
- Choose chaperones carefully…please see the onboard chaperone roles sheet in the appendix for expectations!
- Salish is very flexible and receptive—if you have questions, ideas or needs, contact us and we will do our best to accommodate you.

Mentally prepare for the trip—teachers are often used to Doing It All and sometimes feel restless because Salish educators do all the work! If you have specific ideas of how you’d like to be involved, please share them with Salish staff; if not, sit back and enjoy the break, you deserve it!
Paperwork: what is what…

There is a lot of paperwork involved in the planning process of a Salish trip; this is a reference guide of what’s what in the land of paperwork. In this guide, all forms and paperwork titles are printed in **bold**. Appendix B/Misc. contains forms that need to be filled out and returned to Salish. Appendix C contains paperwork to be distributed to participants and chaperones.

We are here to help with logistics! Call us at any time with questions. Electronic copies of all paperwork are available online, just click on the for teachers tab.

**APPENDIX B:**

- **Group Information Form**—provides Salish with demographic information about your group and your goals and objectives for the trip. It is important to get this form completely filled out and back to us 2 week before your first classroom visit.

- **Student Hold Harmless**—the student release, food allergy, and medical history form. **VERY IMPORTANT to get back to Salish 2 weeks BEFORE the expedition, whether delivered to Salish staff at classroom visits, or returned by mail, scan/email, or fax (206.780.9005).**

- **Adult Hold Harmless**—the teacher/chaperone release, food allergy, and medical history form. VERY IMPORTANT to get back to Salish 2 weeks before the expedition.

- **Watch Group Form**—identifies members of student groups for onboard programming. Watch groups will work together during the day and sleep onshore or on the boat at night. Please return to Salish at least 1 week before expedition to aid in day-of boat preparation.

**APPENDIX C:**

- **What to Bring**—lists for students to prepare and pack for their trip.

- **Chaperone Roles and Responsibilities**—information for chaperones regarding their role on the expedition.

- **Parent Letter [optional]**—To assist in preparing parents for their child’s expedition.

- **Frequently Asked Questions [optional]**—for curious parents and participants.

**MISC. (not included within Teacher Guide):**

- **Meal Planning Sheets (available online)**—used by students to plan meals for trip. They are distributed with menu idea packets. One sheet is used per meal.

- **Contract**—detailing trip cost, locations, dates and payment details. Signed copy required at Salish office prior to sailing.

- **Pre-trip and Post-trip Questionnaires**—assessment tool to be completed by students before first classroom visit that Salish uses for pre and post trip comparisons. Please return to Salish staff in the classroom.
Appendix A:

Background Information

- Puget Sound Primer
- “Homework” Packet
- Scientific Capabilities
- Standards Alignment
A Puget Sound and Salish Sea Primer

**GEOGRAPHY**

The Salish Sea is the traditional name for the inland waters of Canada and Washington State, stretching from Puget Sound to Johnstone Strait that was used by the First Nation peoples who historically and presently inhabit the area. The Salish Sea consists of three natural basins: the Strait of Georgia, the Strait of Juan de Fuca, and Puget Sound along with many islands both large and small.

The Puget Sound is the country’s second largest inland sea, behind Chesapeake Bay. It extends from the southern end of Whidbey Island to Olympia, Washington. It is characterized as a semi-enclosed glacial fjord.

Puget Sound is an estuary, where salt water from the ocean mixes with fresh water that falls as precipitation or drains from the surrounding land. Made up of a series of underwater valleys and ridges, Puget Sound is deep, with an average depth of 450 feet and a maximum depth of 930. More than 10,000 streams and rivers drain into Puget Sound. Nearly 85 percent of the basin’s annual surface water runoff comes from 10 rivers: the Nooksack, Skagit, Snohomish, Stillaguamish, Cedar River/Lake Washington Canal, Green/Duwamish, Puyallup, Nisqually, Skokomish, and Elwha. Major urban areas include Seattle, Tacoma, Olympia, Everett, and Bellingham.

The San Juan Islands lie just north of the Puget Sound and along with the Canadian Gulf Islands make up the San Juan archipelago which consist of more than 450 islands at high tide.
GEOLOGY AND HYDROLOGY

The Puget Sound was formed by the carving action of glaciers about 20,000 years ago. During the retreat and re-formation of these glaciers a series of shallow sills (underwater valleys and ridges) were created, which re-circulate water from the depths to the surface of the basin. In particular, sills at the Tacoma Narrows and Admiralty Inlet greatly influence water movement through the basin. Mixing at the Admiralty Inlet sill draws seaward-moving surface water down into the inward-moving salty water from the Strait of Juan de Fuca. Puget Sound's circulation pattern acts as a pump to raise deep water toward the surface at the south end of the main basin. Water flow is also complicated by the islands, narrow passages, and changes in water depth that characterize Puget Sound. In some of the shallow, semi-enclosed bays of the southern basin, water moves sluggishly. Water is funneled at high speeds through passages connecting with the main system.

Puget Sound's striking terrain is largely the result of extensive glacial and tectonic activity. Other geologic processes, including weathering, erosion, and sedimentation, have further defined the region's landforms and physical characteristics. Dense coniferous forests dominate, interspersed with a variety of deciduous woodlands, wetlands, and shrub prairies. The soil and cover provide important and habitat for wildlife and against precipitation and naturally slowing, storing, cleansing water as it drains Sound. The shoreline environment is a complex beaches, bluffs, deltas, and wetlands. Forming a between land and ocean, nurture some of the most and productive habitats in the

BIOLOGY AND ECOLOGY

Puget Sound is renowned for its incredible abundance and diversity of life. It is home to a spectacular array of marine mammals, birds, fish, and invertebrates. Charismatic species such as Orca Whales, Salmon, Giant Pacific Octopus, and Bald Eagles are known far and wide, yet they are just a glimpse of the richness the Puget Sound offers.

In most Marine ecosystems, nutrients—in the form of dead, decomposing matter and fecal matter—sink. However, in the Sound, the upwelling created by the sills (see above) circulates and when combined with deep, cold, oxygen rich water, creates and ideal environment for phytoplankton—which kick start an incredibly productive ecosystem and food web.
There are many different habitats that support the wide variety of life found in the Puget Sound. There are rocky shores, gravel and sand beaches, and mudflats. Each support a different assortment of species suited to their environment. Barnacles and seastars cling to rocks, shore crabs hide under cobbles, sand dollars dig into sand, and geoducks and large worms are buried in the mud. Kelp forests and eelgrass beds also support extensive ecosystems.

The water column is the domain of plankton. Phytoplankton, like diatoms and dinoflagellates support herbivorous zooplankton such as copepods and nauplii which feed carnivorous zooplankton such as chaetognaths.

ENVIRONMENTAL ISSUES
Puget Sound is bordered by 2,500 miles of shoreline. These stretches are a mosaic of beaches, bluffs, deltas, mudflats, and wetlands. Much of the promise and potential of this region is based on natural resources, and the tourism and recreation industries these resources support. While much of the Sound is healthy, recent growth and development in the region are stressing the system. Puget Sound has significant challenges, from water pollution and sediments laden with toxic pollutants to sharp declines in populations of salmon, orcas, marine birds, and rockfish. A steady loss of habitat, alarming declines in some fish and wildlife populations, and closures of commercial shellfish beds are signs that the very best of Puget Sound is threatened.

Toxic sediments
Historically and currently industry around the Puget Sound has released toxins like PCBs and heavy metals into the watershed which concentrate in marine sediments and are incorporated into the food chain by filter feeders such as bivalves. These toxins can then travel and concentrate through the food chain affecting even the largest of marine mammals.

SEWAGE OUTFALL AND EUTROPHICATION
Though most urban homes connected to a sewage system, there are 472,000 systems in the Puget Sound region. Many of these are or in disrepair which along agricultural and domestic fertilizers, send excessive nutrients (in the form of nitrates and phosphates) the watershed and eventually into Puget Sound. A process called eutrophication affects slow moving portions of the Sound where this excess of nutrients supports a dense growth of algae, phytoplankton, and other
organisms, which eventually die and fall to the bottom and decay, thus depleting the waters of oxygen. Low oxygen levels (hypoxia) are of concern for all living things in the Sound.

HABITAT LOSS, WETLAND DESTRUCTION, AND STORM WATER RUN-OFF

Urbanization has been happening in the Puget Sound area at a staggering rate. The population of the Puget Sound area has reached almost 4.5 million people and is growing. The result is a huge amount of development in the area. Direct habitat loss due to development is only part of the story. Even with wetland mitigation regulations in place, the Puget Sound area has lost 70% of its wetlands. The loss of this land represents a huge amount of storm water and urban runoff and pollutants (including petroleum products, heavy metals, household chemicals, animal waste, and sediments and chemicals from construction sites, roads, highways, parking lots, lawns and other developed lands) that flows directly into the streams and rivers that feed the Puget Sound. In the winter, when storm runoff is highest, eroding stream banks and widening stream channels deposit excessive sediment and also alter natural streams and wetlands, affecting habitats along streams and river mouths.
The Salish Sea

The Salish Sea was formed about 20,000 years ago during the last ice age by the carving action of glaciers. There are 3 major parts of the Salish Sea which are, 1. The Georgia Strait (to the north), 2. The Strait of Juan de Fuca (to the west), and 3. Puget Sound (to the south). During the retreat and advance of these glaciers a series of shallow sills (underwater valleys and ridges) were created, which circulate water from the deep areas of the Salish Sea to the surface.

The Salish Sea is an estuary, where salt water from the ocean mixes with fresh water that falls as precipitation or drains from the surrounding land. More than 10,000 streams and rivers drain into the Salish Sea. Made up of a series of underwater valleys and ridges, the Salish Sea is deep, with some areas in the Georgia Strait over 2000ft deep, while Puget Sound has an average depth of 450ft with a maximum depth of 930ft.

In most Marine ecosystems, nutrients—in the form of dead, decomposing matter and fecal matter—sink. However, in the Salish Sea, the upwelling (vertical mixing of water) created by the sills circulates nutrients all around. When these nutrients are combined with deep, cold, oxygen rich water, it is a unique and ideal environment for phytoplankton (free-floating photosynthetic plants)—which are the base of an incredibly productive ecosystem and food web.

Vocabulary: Use this space to list and define new vocabulary from the introduction
Estuarine Food Web:

The Salish Sea supports a very unique and delicate food web. Because estuaries can support both freshwater and salt-tolerant species, they are some of the most diverse habitats in the world! The arrows in this diagram illustrate the transfer of energy (who is eating who) between species.

*Image Source: www.somethingfishy.ie*

1. Which species is linked to the most other species?

2. Where would humans fit in this food web? Draw yourself and the energy arrows needed to incorporate you into this food web.

3. Imagine that the plankton died – how would this affect the food web?
Marine Ecosystem:

Mark where you find the following major parts of the drawing

Dissolved Oxygen (D.O.): The oceans equivalent to oxygen in the air. The amount of oxygen has a direct relationship between the size and number of animals found in a body of water. Phytoplankton are the MAIN source of oxygen in the ocean. Where would we find areas of more dissolved oxygen in the drawing?

Phytoplankton: Floating and drifting green plants transported by ocean currents. These small, mostly microscopic, plants form the beginning of an aquatic food chain. Additionally, phytoplankton take in sunlight, convert the sunlight into food and release oxygen into the water to be used by another life. This process is called photosynthesis.

Zooplankton: Small floating animals that eat phytoplankton and, in turn, are eaten by larger animals along the aquatic food chain such as fish, clams and oysters. They are carried around with ocean currents.

Fishes: A vertebrate (animal with a spine) that lives in water. Healthy bodies of water have many different kinds and sizes of fish. Salmon are the most important species of fish in the Salish Sea.

Crustaceans: Animals that have a hard outer shell (exoskeleton) that they shed as they grow larger. Crabs, shrimp, krill and barnacles are all examples.

Molluscs: Organisms that use Calcium Carbonate (CaCO3) to make their shells such as clams, mussels, oysters and marine snails. These organisms are particularly vulnerable to erosion of their shells by the process of ocean acidification.

Mammals: Larger marine animals such as seals, sea lions, porpoises, whales, Orcas and otters. These organisms are the top of the marine food web, but are dependent on every other part for their survival.
Review Questions:

1. Where does the water come from that feeds Puget Sound, and what makes it unique?

2. What factors contribute to the diversity of life within Puget Sound?

Human Impact on the Puget Sound:

What is a watershed?

“An area of land within which the surface water (rain, snowmelt, etc.) all drains to a common body of water.”

Watersheds are defined geographically because mountains and hills determine the direction of water flow and funnel small creeks into progressively larger bodies of water, such as rivers, Puget Sound, the Salish Sea, and eventually the Pacific Ocean. We all live in a watershed.

This image illustrates a watershed that has become developed. The river in this region is the common body of water and will collect rain and storm water runoff (surface water that is not absorbed into the ground) from both sides.

1. In what ways can you see that human behavior has an impact on watershed health? Circle your examples in the image.

2. How does rain water behave differently on both sides of the river?

3. Why do you think watershed health is important?
Puget Sound Processes: Water quality parameters, Nutrients + Eutrophication

The following are important for the health of the Salish Sea and the life that resides there. They are measured (except for pH + turbidity) in units of PPM (parts per million).

- **Nitrates**: an essential nutrient for plant (phytoplankton) life + growth. Naturally occurring but also found in animal + human waste, fertilizer and stormwater runoff.

- **Phosphates**: also an essential nutrient for plant life and occurs naturally but is found also in waste, fertilizers and many detergents.

- **Copper**: a micronutrient (necessary in VERY small levels) that can have negative effects on plankton + salmon if there is too much. Copper is found in car brakes, bottom paint on boats, and electronic waste.

- **Silica**: the most abundant mineral on earth. Silica is used by diatoms (type of phytoplankton) to grow their shells.

- **Surfactants**: fancy word for soap. There are also natural surfactants, but too much of them in the water can be bad for fish + other organisms. They can come from car washes, cleaning products and stormwater.

- **pH**: a measure of how acidic or basic something is on a scale from 0-14. 0=very acidic, 7=distilled water, 14=very basic. Most aquatic life lives between a pH of 6.5-8.0.

- **Turbidity**: how cloudy/dirty a liquid is. Turbidity can increase from erosion into the water or also from too many phytoplankton in the water.
A process called eutrophication affects slow moving areas of the Salish Sea where too many nutrients (Nitrogen and Phosphorus in this diagram) can result in a dense growth of algae, phytoplankton and zooplankton, which eventually die and fall to the bottom and decay. This process of decomposing lowers dissolved oxygen levels. Low oxygen levels (hypoxia) are of concern for all living things living in the Sound. Areas with low oxygen levels are often referred to as Dead Zones because of the lack of organisms ability to survive there.

Questions:

1. Where do these nutrients (Nitrogen and Phosphorus) come from?

2. Circle the correct words to complete the sentence:

A dramatic (increase / decrease) of phytoplankton will eventually cause dissolved oxygen levels to (increase / decrease).

**Upwelling: Sills and water circulation in the Salish Sea**

Upwelling is a process in which the colder, nutrient-rich waters are driven upwards to replace the warmer, often nutrient-depleted surface waters. Wind, currents, sills and other elements of the landscape can all affect upwelling.

1. How might upwelling affect marine life?
Number the steps of the scientific method in the correct order:

1. Plan Your Experiment
2. Experiment
3. Collect and Record Data
4. Think of an Idea
5. Research Your Topic
6. Ah Ha!
7. Come to a Conclusion

Source: www.crsd.org

**Question:** Are there any steps that you would include that aren’t listed?

**Variables:** Match with the correct definition

A. Manipulated/Independent Variable
B. Responding/Dependent Variable
C. Controlled Variable

1. _____ The variable changed by the scientist.
2. _____ Something that the scientist wants to remain constant throughout their experiment.
3. _____ Variable observed by the scientist and affected by changes to #1.
Match the name of the equipment with its function:

<table>
<thead>
<tr>
<th>Name of Equipment</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Niskin Bottle</td>
<td>Food for rabbits.</td>
</tr>
<tr>
<td>2. Phytoplankton Net</td>
<td>Collects animal plankton from the water column.</td>
</tr>
<tr>
<td>3. Zooplankton Net</td>
<td>Fine mesh material collects plant plankton.</td>
</tr>
<tr>
<td>4. DO Probe/Temp</td>
<td>Measures the amount of salt in the water.</td>
</tr>
<tr>
<td>5. Refractometer</td>
<td>Uses chemical reagents and a color sensing laser to read amounts of certain nutrients</td>
</tr>
<tr>
<td>6. Secchi Disk</td>
<td>Measures the temperature and dissolved oxygen in the water.</td>
</tr>
<tr>
<td>7. Carrot</td>
<td>Collects water at different depths</td>
</tr>
<tr>
<td>8. Colorimeter</td>
<td>Measure the clarity of the water.</td>
</tr>
</tbody>
</table>
### Part III: Brainstorm + parameter relationships

Circle the equipment and variables you are most interested in investigating while aboard the Carlyn.

<table>
<thead>
<tr>
<th>Equipment</th>
<th>Manipulated/Independent Variables</th>
<th>Responding/Dependent Variables (Parameters)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Niskin Bottle</td>
<td>Depth of Sample</td>
<td>Dissolved Oxygen</td>
</tr>
<tr>
<td>Phytoplankton Net</td>
<td>Depth of Sound</td>
<td>Nitrates</td>
</tr>
<tr>
<td>Zooplankton Net</td>
<td>Nearshore/ Offshore</td>
<td>Phosphates</td>
</tr>
<tr>
<td>DO Probe</td>
<td>Proximity to freshwater</td>
<td>Surfactants</td>
</tr>
<tr>
<td>Refractometer</td>
<td>Developed/undeveloped</td>
<td>Silica</td>
</tr>
<tr>
<td>Secchi Disk</td>
<td>Zooplankton</td>
<td>Temperature</td>
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<tr>
<td>Colorimeter</td>
<td>Phytoplankton</td>
<td>Salinity</td>
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<td></td>
<td>Currents</td>
<td>Phytoplankton</td>
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<tr>
<td></td>
<td></td>
<td>Turbidity</td>
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<tr>
<td></td>
<td></td>
<td>Zooplankton</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Copper</td>
</tr>
</tbody>
</table>

**Questions:**

1. Which three parameters are you most interested in measuring? How do you predict they are related?

2. What pieces of equipment would you need to be able to measure those 3 parameters?
Scientific Capabilities on Board

WATER QUALITY MONITORING
Water quality monitoring in the Salish Sea is highly variable and dynamic, changing with proximity to land, river mouths, currents, as well as many other factors. To give the best snapshot of water quality in our research areas we employ the following equipment:

- **Phosphate, nitrate, copper, surfactant, turbidity and silicate test kits** (LaMotte): measure the amount of important water quality parameters in the water column. While necessary to aquatic life at small levels, problems can arise when these parameters reach high levels.

- **Colorimeter**: used in conjunction with water quality test kits to obtain measurements from specific water samples. Results recorded in PPM (parts per million).

- **Dissolved oxygen/temperature probe**: continuously measures dissolved oxygen/temperature throughout the water column to 50ft. These vertical transects give a good indication of biological activity.

- **Refractometer**: measures salinity of a water sample using a drop of water and light refraction.

- **Niskin bottle**: used to collect water samples from discrete depths, which are then chemically analyzed.

- **Secchi disk**: used to estimate the transparency of seawater, and can provide a relative measure of productivity or turbidity.

- **pH probes**: measure how acidic or basic the water is on a scale from 0-14. pH is an important water quality measurement with most organisms only tolerating a small range, typically around 6-8.5.

BIOLOGICAL MONITORING
The biological life of the Salish Sea is dependent upon local water quality. Through collection and analysis of biological and water quality samples we are able to employ the scientific process to determine relationships at different locations. Biological sampling equipment onboard includes:

- **Phytoplankton net**: This 63-micrometer mesh net collects the smallest plankton, which can then be analyzed using volume measurements as well as under a compound microscope.

- **Zooplankton net**: This 120-micrometer mesh net collects animal plankton, allowing phytoplankton to pass through the larger mesh.

- **Dissecting and Compound microscopes**: used to more closely analyze plankton by species.

- **Seives**: can be used to sort sediments collected from shore to classify sediment composition and/or to uncover macro-invertebrates.

- **Fisheye underwater camera**: camera to deploy off of the side of the vessel to observe creatures when visibility allows.
Salish’s curriculum is academically rigorous and includes integration of Science, Geography, Reading, Communication, Health and Fitness, Math, and other disciplines. The following are a few ways Salish supports teachers and Washington Schools in achieving National and State Learning Standards Requirements. For more grade levels please see our website.

<table>
<thead>
<tr>
<th>Lesson Plans</th>
<th>Student “I Can Statements”</th>
<th>Common Core State Standard</th>
<th>Next Generation Science Standards</th>
<th>Ocean Literacy Principals</th>
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<tr>
<td>Classroom visit #1</td>
<td>9</td>
<td>6-8.RST.1</td>
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<td>7.RP.A.2.D</td>
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<td>8.F.B.4</td>
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<td>8.SL.5</td>
<td>8.GA.1A</td>
<td>8.GA.1B</td>
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<tr>
<td>Classroom Visit #3</td>
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<td>8.SL.4</td>
<td>6.RP.A.3</td>
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<td>10</td>
<td>6-8.RST.9</td>
<td></td>
<td>MS-LS2-5</td>
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Common Core, Next Generation Science, and Essential Academic Learning Requirements

Salish’s curriculum is academically rigorous and includes integration of Science, Geography, Reading, Communication, Health and Fitness, Math, and other disciplines. The following are a few ways Salish supports teachers and Washington Schools in achieving Common Core, Next Generation Science and the Essential Academic Learning Requirements. As Salish programs are individually tailored to age group and background individual GLE’s are left out.

**Navigation/Charting** – Students are involved with learning the parts of a chart and how to use nautical charts to plot our course. *(Geo 1.1, ELAR, MATH, CCSS.Math.Content.8.G.A.1a, CCSS.Math.Content.8.G.A.1b)*

**Exploration and Discussion of Puget Sound** – Students learn the natural history of Puget Sound and study current events to guide their original research project construction. *(Science MS-ESS2-1., MS-ESS2-6; MS-ESS2-3, Geo 3.1-3.3 ELAR; Reading/Writing CCSS.ELA-Literacy.RST.6-8.1, RST.6-8.9)*

**Equipment Deployment and Sample Analysis** – Following written and oral instructions, *(Reading & Writing CCSS.ELA-Literacy.RST.6-8.3, CCSS.ELA-Literacy.RST.6-8.7)* students will execute the steps necessary to correctly complete the task. As samples are collected, students will analyze them to explore how they fit into their research project *(Science MS-ETS1-4; MS-ETS1-3 Math CCSS.Math.Content.7.EE.B.3, CCSS.Math.Content.7.EE.B.4 )*  

**Data Recording** – Students write quantitative data and observational notes during they and their classmates’ research process *(Writing CCSS.ELA-Literacy.RST.6-8.7).* Students may calculate mass or volume of samples *(Math CCSS.Math.Content.7.EE.B.4,)* and use test results to extrapolate final results *(Math CCSS.Math.Content.8.F.A.1, CCSS.Math.Content.8.F.B.4 ).*

**Journal Writing** – Many students will keep journals recording their expedition in addition to their scientific recording, which allows them a different style of writing for a different audience *(Writing CCSS.ELA-Literacy.RST.6-8.1, CCSS.ELA-Literacy.RST.6-8.2).*

**Research Project** – A large portion of the expedition will be focused on the students’ designed research project. In order for this to be effective, students must listen carefully to each other, instructors, and staff *(Comm 1.1, 1.2 ELAR).* Students will employ the Scientific Method *(Science MS-ETS1-2, MS-ETS1-3, MS-ETS1-4; Math CCSS.Math.Content.7.EE.B.3)* for their research project and the steps will guide their process *(Math CCSS.Math.Content.8.SP.A.3, CCSS.Math.Content.8.F.B.4, CCSS.Math.Content.8.F.B.5 Writing CCSS.ELA-Literacy.RST.6-8.8, CCSS.ELA-Literacy.RST.6-8.9).*

**Peer Education** – Students will be involved in the “Each-one-Teach-one” method of peer education. After receiving relevant information and instructions from staff about equipment and procedures, students will need to communicate these directions and requirements to their classmates *(Comm 2.2, 2.3, 3.1 ELAR)*

**Sail Crew Participation** – With the assistance of Salish Sea Expeditions’ staff, students will raise sails, tend sheets, haul in lines, take the helm, and become a safe member of the sailing crew *(Health & Fit 1.2, 4.1ELAR).*
Post-Trip Presentation – Using data collected, experiences recorded, research compiled and artifacts obtained, students will create a presentation about their expedition (*Writing CCSS.ELA-Literacy.RST.6-8.7, CCSS.ELA-Literacy.RST.6-8.8, CCSS.ELA-Literacy.RST.6-8.9*). This may be in the form of a newsletter or journal article (*Writing 2.1, 3.1-3.5*), an oral presentation (*Comm 2.1ELAR; Arts 2.2ELAR*), a poster (*Art 2.1, 3.2ELAR*), a web page (*Writing/Reading CCSS.ELA-Literacy.RST.6-8.1, CCSS.ELA-Literacy.RST.6-8.2, CCSS.ELA-Literacy.RST.6-8.10*), or other method (*Math 4.3*).

Group Process – Throughout the trip, all students will be working as a team to create their research project, construct their trip, execute their project, prepare their selected meals (*Health & Fit 1.1ELAR*), and live for 3-5 days in a confined space together (*Comm 3.2, 3.3ELAR*) with a finite amount of resources (*Econ 1.1ELAR*).
Appendix B:

Paperwork to be returned to Salish

- Group Information Form – Please Return ASAP
- Student Hold Harmless—“Parent/Guardian Consent” (at least 2 weeks prior to trip)
- Adult Hold Harmless—“Adult Chaperone Release” (at least 2 weeks prior to trip)
- Watch Group Form (at least 2 weeks prior to trip)

Not included in Teacher Guide
(Can be found at www.salish.org)

- Contract – please return ASAP!
- Meal Sheets – please return at least 2 weeks prior to trip!
- Pre-Trip & Post-Trip Questionnaires


PARENT/GUARDIAN CONSENT

________________________ has my permission to participate in the Salish Sea Expedition program with (School Name) ________________________________, aboard the S/V Carlyn. In granting this permission, I recognize that I am agreeing to 1) accept general liability for my child’s participation in this program and 2) hold harmless Salish Sea Expeditions and Four Winds, Inc. (owner of vessel), their officers, directors, employees and volunteers from all claims, liability or lawsuits arising from my child’s misbehavior or disregard of regulations while participating on a Salish Sea Expedition. I certify that I am aware of the inherent dangers of sailing and water-related activities and hereby assume such risks. I also accept liability for my child’s motor vehicle transportation by Salish Sea Expeditions.

I recognize that as part of each program, Salish Sea Expeditions may ask my child to help evaluate the effectiveness of the Salish program. This may include a short questionnaire, observation of all students while aboard, and informal discussions. No student will be identified by name in the information or reports of the program evaluation.

Date: ______________________ Signature of Parent/Guardian:_________________________

Student Signature:___________________________________________________________

Print first and last name: Mr.  Mrs. Ms. (circle one)____________________________________

Home Phone: (___)________________  Work Phone: (______)________________________

Cell phone or pager: (______)_________________________  Preferred Phone: □ H  □ W  □ C

Mailing address: _______________________________  City: ______________ State: _______

Zip:___________  Parent/Guardian’s Email: _____________________________________

Photographic Release:
I do ___  I do not ___ give permission to Salish Sea Expeditions to take photographs in which my image appears. These may appear in a newsletter or other materials. (Students will not be named in photos)

Media Release:
I do ___  I do not ___ give permission to Salish Sea Expeditions for my image to be included in any media (print, radio, tv or Web) coverage that may take place during my expedition.

Your child’s birthday: ______________________  Male ___  Female ___
MEDICAL & EMERGENCY CONTACT INFORMATION (confidential)

Please complete the checklist below. For all “yes” answers, please elaborate in the space below or on a separate piece of paper.

Does your child currently have (or have a history of) any of the following:  
Yes | No
--- | ---
asthma or any other respiratory problems?  
diabetes?  
allergic reactions to anything (e.g. food, medicines, bites or stings)?  
epilepsy, fainting or dizziness, or seizures?  
cardiac conditions (e.g. heart murmurs, irregular heartbeat)?  
dietary restrictions (e.g. allergies, vegetarian, lactose intolerant)?  
eating disorders (e.g. anorexia, bulimia)?  
pregnancy?  
eck/neck/shoulder/knee/ankle/wrist/arm problems?  
any other medical conditions that we should be aware of?

If you answered “yes” to any of the above, please elaborate here with reactions to allergies and medications. Be as specific as possible as we may need to provide this information to medical personnel in an emergency if we are not able to contact you. If your child will be taking medications during the program (prescribed or over the counter), please specify what and how often.

<table>
<thead>
<tr>
<th>Medical Condition</th>
<th>Name of Medication</th>
<th>Dosage</th>
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<tbody>
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</tbody>
</table>

Allergic Reaction Symptoms: (Be as specific as possible)

__________________________________________________________________________________

If the participant has any fear of the water, please indicate here: ______________________________

In the event of an accident or emergency, your child will be transported to a medical facility. Every effort will be made to contact you. In the event that we are unable to reach you, do you give medical personnel permission to begin treatment?_____________________

Your child’s doctor:__________________________ Telephone#:__________________________

Insurance Carrier:__________________________ Policy #:__________________________

If we are unable to contact you in the event of an accident or emergency, please provide an additional emergency contact:

Name (Print)________________________________________________________________________

Relation______________________ Telephone____________________________________________
ADULT CHAPERONE RELEASE

Name _____________________________ staff member of participating school?  Yes  No

Participating Schools Name __________________________________________

I recognize that I am agreeing to 1) accept general liability for my participation in this program aboard S/V Carlyn and 2) hold harmless Salish Sea Expeditions and Four Winds, Inc. (owner of the vessel), their officers, directors, employees and volunteers from all claims, liability or lawsuits arising from my behavior or disregard of regulations while participating on a Salish Sea Expedition.

I certify that I am aware of the inherent dangers of sailing and water-related activities and hereby assume such risks. I also accept liability for my motor vehicle transportation by Salish Sea Expeditions.

Date: ______________________  Signature:_______________________________________

Print first and last name: Mr.  Mrs. Ms. (circle one)________________________________________

Home Phone: (___)_________________  Work Phone: (______)________________________

Cell phone or pager: (_____)-____________  Preferred Phone: □ H  □ W  □ C

Mailing address: _______________________________  City: ______________ State: _______

Zip:___________  Email: __________________________________

Photographic Release:

I do ___  I do not ___ give permission to Salish Sea Expeditions to take photographs in which my image appears. These may appear in a newsletter or other materials. (You will not be named in photos)

Media Release:

I do___  I do not____ give permission to Salish Sea Expeditions for my image to be included in any media (print, radio, tv or Web) coverage that may take place during my expedition.
MEDICAL & EMERGENCY CONTACT INFORMATION (confidential)

Please complete the checklist below. For all “yes” answers, please elaborate in the space below or on a separate piece of paper.

Does you currently have (or have a history of) any of the following:

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If you answered “yes” to any of the above, please elaborate here with reactions to allergies and medications. Be as specific as possible as we may need to provide this information to medical personnel in an emergency. If you will be taking medications during the program (prescribed or over the counter), please specify what and how often.

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Allergic Reaction Symptoms: (Be as specific as possible)

__________________________________________________________________________________

__________________________________________________________________________________

If you have any fear of the water, please indicate here: ______________________________

In the event of an accident or emergency, you will be transported to a medical facility. In the event that we are unable to communicate with you, do you give medical personnel permission to begin treatment? ________________

Your doctor: _______________________________ Telephone#: _______________________________

Insurance Carrier: _______________________________ Policy #: _______________________________

Please provide an additional emergency contact:

Name (Print)______________________________ Telephone______________________________

Relation______________________ Telephone_________________________________________
Dear Teacher/Group Leader:

Your students need to be divided into two watch groups before coming aboard Carlyn. Because you know your students best, we leave the group making decisions up to you. Each watch will rotate through all activities as a unit.

Please choose groups with care and consider social dynamics in your decision making. We strongly recommend mixed ages and genders within each watch group!

Please Note: 30 participants is our maximum number (29 students + minimum 1 chaperone)

<table>
<thead>
<tr>
<th>WIND WATCH</th>
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Sample Watch Schedule
9:00-11:30 WIND-Science WATER-Sailing
11:30-1:00 Lunch/Exploration
1:00-4:00 WATER-Science WIND-Sailing
4:00-5:00 Land Excursion/Docking
Shore WIND
Ship WATER
[switch next day/night]
Group Information Form

Please complete this form and fax it to (206)780-9005, email the information to kristen@salish.org, or mail it to:
647 Horizon View Place Bainbridge Island, WA 98110

General information

Group/School Name:__________________________________________________________

Teacher/Organizer: ___________________ E-mail: _____________________________

School Phone #: _______________ Home/Cell Phone #: ________________________

Secondary Contact: ________________ E-mail: ________________________________

School Phone #: _______________ Home/Cell Phone #: ________________________

Grade/Age of Students: _______ _______ School District: __________ ESD____

# of Students: Female_____ Male_____ # of Adults: Female_____ Male_______

Mailing address: ___________________________________________________________

County: ________________________ Free & Reduced lunch % of school:__________

Billing Address (if different from above):_____________________________________

________________________________________________________

School/Group Type (circle one): Public  Private  Home  Other_________________

Student demographics:

<table>
<thead>
<tr>
<th>ETHNICITY</th>
<th># OF STUDENTS</th>
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<tbody>
<tr>
<td>African American</td>
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<td>Other</td>
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School Program Planning & Logistics

Is your school currently aligned with the Next Generation Science Standards?

Teacher Goals & Objectives in relation to Salish Program

List of coursework topics conducted in class to prepare students for Salish Research Project:

Classroom Visit Request Dates (Each 2-Hour visit scheduled within 2 weeks of each other):

Synthesis Project Goals Required (i.e. PowerPoint Presentation, Report, Poster, etc.):

Special Needs (i.e. dietary restrictions, ADA, etc.):

Confirm Sailing Expedition Logistics

Confirm Expedition Dates:

Departure Marina:

Arrival Marina:

Marina Arrival (Day One) Time: ____________________________ (Suggested Time: 9:00 am)

Marina Departure Time (Last Day): ____________________________ (Suggested Time: 4:00 pm)

A/V Equipment Available in Class (Laptop, Projector, speakers, etc.): ____________

Are you a Salish Alum Teacher? ____________

Travelling by bus? ____________

Bus Line Phone Contact Info: ____________________________

Important Information for Sail Dates:

Emergency Contact – On-call Salish Cell Phone: 206.715.0312

Boat Cell Phone (Only Teachers or Chaperones May Use Day of Trip): 206.714.0423
Appendix C:
Information and paperwork to be distributed to students and parents

- Chaperone Roles and Responsibilities
- What to Bring
- Parent letter [optional]
- FAQ [optional]
Onboard Roles and Responsibilities  
Chaperones and Group Leaders

The student experience is the primary focus of our expeditions. While teachers and parent chaperones are encouraged to participate in all aspects of the program, we also ask that you hang back and let students take charge as much as possible (during watches, discussions, cooking, games, etc.), even if you’re tempted to jump in yourselves. Be prepared for the students to impress you with how well they can accomplish their goals as a team when they set their minds to task together! We will also ask you to support the Salish staff as they enforce rules and safety policies on the vessel and on shore.

Chaperone Responsibilities:

- Assist in enforcing safety rules (see reverse)
- Know station bill responsibilities for emergencies (primarily crowd control, muster on cabin top)
- Monitor students for warmth, dryness, and dehydration; remind them to be proactive about these, as most injuries on the water can be attributed to these factors
- Assist with mid-day galley tasks whenever possible; these can include helping with group dishes, monitoring lunch, helping prepare lunch or snack, or general galley cleanup
- Assist with the donning of raingear – this is often a task that needs many helping hands and must be done quickly to keep students dry!
- Assist staff with taking photos with the Salish camera throughout the trip
- Assist on-deck Exploration meetings (see below) with one watch group while other watch eats lunch
- Assist with night-time activities, including tent set-up, student down-time during dinner prep, night hikes, beach explorations, night games, and getting students into bed and settled down to sleep

Teacher Responsibilities (in addition to Chaperone responsibilities listed above):

- Ensure students have and take prescribed medications; make plan for evening/morning medication distribution for each watch group
- Assist educators in the science discussions during science watch and all-group watch meetings – these are a great opportunity to draw connections between Salish and what you do in the classroom

Lunch/Exploration:

There are two sittings for lunch: One watch will eat lunch and one will do an “Exploration” activity, then they will switch. Exploration is a chance for teachers or chaperones to teach about a special interest of theirs and expose students to new topics. Educators may capitalize on using different learning styles such as drawing, math, spatial etc. Explorations can also be a time for student relaxation: telling stories, playing games, journal writing, etc. Meanwhile, Salish staff can re-group a bit and discuss the plan for the afternoon. Sometimes after lunch the Program Coordinator may pull the whole group together for a brief activity.

- Sample lesson brought onboard by teacher/chaperone: “Lifecycle of Pacific Salmon”
- Sample game with materials onboard: “Two Truths and a Lie” or “Build a Chart” cruise track activity

Accident or Injury – the Program Coordinator (or Captain on ship at night) should be informed immediately of any accident or injury to a person on a program – ideally before medical attention is administered

(over)
General Safety
These rules will be explained further onboard, and we’ll ask for your support in enforcing them. One key item of note: Please NO use of cell phones. We have a no cell phone policy and after the first warning we/you will confiscate and stow phones till the end of program. Thanks in advance for your help!

On the boat:
- No running, pushing, horseplay
- No leaning on lifelines, arms and legs must stay inside lifelines at all times
- Lifejackets (PFD’s) on and buckled when on deck and boat is underway; must be outer-most layer
- One hand for yourself, one for the ship
- Go up and down the companionways like ladders (“stairways” down below decks) – proper form will be demonstrated upon arrival
- No standing on the cabin top while underway
- Refrain from touching items unless familiar with them/instructed to do so
- Watch out for traveler, winches, halyards and any other line (rope) under strain
- Don’t stand on coils
- Work and walk on the windward or “high” side when boat is heeling (tipping)
- Anything going over overboard (science gear, buckets, etc.) must be tied to boat
- During docking, all students sitting and quiet on the side opposite of the dock

On shore:
- Shoes on at all times, except when getting out of small boats
- Check in with staff before leaving campsite area
- No leaving tents after official lights out
- No Swimming – ever

Dingy/Small Boats:
- No standing in dingy; no horseplay. Students cannot drive the outboard motor!
- Life jackets, buckled
- Inflatable must be available to use in case of emergency

Hiking/Beach Exploration:
- Teachers/chaperones will be asked by the staff to hike with interested students or set up a hiking structure they are comfortable with and will take responsibility for.

Galley & Cooking:
- A staff member must light stove and carefully supervise all use of stove
- Water and propane conservation at all times
- Only staff goes into the chilly bin (large cooler in main cabin where cold food is kept)

Sleeping
- Tents - boys and girls segregated.
- On boat - if possible, boys and girls segregated. If not possible, segregate as much as possible and have 2 adults in mixed cabin (e.g. separated by main cabin table or in the two most aft bunks.) Get teacher’s input.

Behavior
If a student misbehaves in a way that is severely disrupting the program or jeopardizing the safety of anyone, bring it to the attention of the Program Coordinator, and the Captain or Mate if the Program Coordinator is unavailable. The Program Coordinator and group leader will determine the best course of action.
WHAT TO BRING

Space is VERY limited aboard the Carlyn. At night, you will sleep with your gear in your tent or on your bunk. It is important that you pack ONLY the items listed below. Notice that the suggested items can be layered for warmth and are more versatile than a single heavy coat. Please pack in a SMALL soft duffel, back pack, or laundry bag. Plan on wearing the same clothes for multiple days.

* For Teachers and Chaperones- If you are a coffee or tea drinker, please don’t forget to bring some.

- Sleeping bag – line stuff sack with plastic bag or put in plastic bag
- Wool sweaters or fleece jackets (something that keeps you warm when wet)
- 2 Long-sleeved T-shirts or turtlenecks
- 1 Pair long pants
- 1 T-shirt
- Long underwear – wool, capilene or polypropylene are best (tops & bottoms)
- 4-5 pairs of thick socks (wool or synthetic material, no ankle socks!)
- 1 pair sneakers or other sturdy closed-toe shoe (think good in wet conditions)
- Warm beanie hat (wool or fleece)
- Windbreaker jacket
- Baseball cap (or some sort of sun hat)
- Toilet items
  - toothbrush/paste - deodorant
  - comb/hairbrush - feminine hygiene products
- Sunglasses + Flashlight

Optional:
- Disposable camera.
- Waterproof shoes or boots (If you have them)

Salish Sea will provide the following items:
- Lifejacket (Type III)
- Raingear (jackets and pants, all sizes)
- Sleeping Pads & Tents for camping
- Food (including snacks)

Please DO NOT bring the following items:
- Cell phones, video games, iPods, radios, walkmans, cd players
- Controlled substances: drugs, alcohol, cigarettes
- Pillows or stuffed animals
- Excessive personal products
- Food (snacks, candy, gum, etc..)
- Expensive cameras or other valuables

Please Note: The U.S. Coast Guard has a zero tolerance policy with regards to drugs on inspected vessels. This means that any illegal drugs in any amount found aboard Carlyn will result in confiscation of the vessel and our captain will lose his license. Please do not put your classmates at risk by operating equipment in an impaired state or Salish Sea Expeditions at risk of losing the ship and program due to your actions. If any participants are found with any amount of drugs, alcohol, cigarettes, firearms or fireworks we will call the parents and arrange for that child to be picked up as soon as possible.

In case of emergency, please contact the on-call director at (206) 715-0312.
Dear Parent/Guardian,

Salish Sea Expeditions provides multi-day marine science Expeditions for 5th-12th grade students. Because your child is scheduled to take part in one of these Expeditions, we would like to share some of the details about the program to better prepare you and your child.

The program is designed to enhance what your child is learning in the classroom by providing an opportunity to learn and practice skills in a "real world" setting. The program is unique in that each Expedition is custom designed by its participants. Your child will work with classmates and Salish marine science educators weeks before the trip to choose a topic that they will study from the ship. Students will also select their travel route and operate the vessel during their trip. They will spend evenings camping or sleeping aboard the boat where they will prepare their meals and share time with classmates and staff. Students are key decision makers in every aspect of planning their expedition, operating the ship, and conducting their science research.

The research sailing vessel used, Carlyn, was built in 1995-96 according to the safety standards specified by the U.S. Coast Guard’s Sailing School Vessel Act. Carlyn is subject to yearly inspections by the Coast Guard that are designed to ensure that she is maintained and operated in accordance with the highest safety standards. Carlyn carries all required safety equipment and the captain instructs the students in its use when they board the vessel.

Carlyn is a 61’ yawl that is certified to carry thirty passengers. Carlyn was designed and constructed to work with students. During the program, concepts of math and physics will come alive for your child as he/she works with classmates to operate the vessel and carry out the science research project. They will have the opportunity to learn about maritime history and Puget Sound natural and cultural history.

Salish Sea Expeditions staff consists of highly qualified science and sailing educators and Coast Guard licensed mariners. All have experience working with students in residential settings and have passed drug tests and law enforcement background checks. In addition to the varied experiences that they bring to the program, all staff participate in training specific to the Salish program and operation of Carlyn. Staff members are also certified in First Aid, CPR and Lifesaving.

We look forward to sharing this experience with your child and his or her classmates. If you have questions or concerns, please contact your teacher or Salish Sea Expeditions.

Sincerely,

Kristen Cann
Education Director
kristen@salish.org
(206) 780-7848x2#
**FREQUENTLY ASKED QUESTIONS**

**What is Salish Sea Expeditions?**
Salish Sea Expeditions is a 501(c)(3) nonprofit organization established to provide an opportunity for students to design and conduct real scientific research from the decks of a sailing vessel on Puget Sound.

**What vessel is used?**
Programs occur aboard Carlyn, a 61’ yawl built in 1996, belonging to Four Winds*Westward Ho Camps. Carlyn is a US Coast Guard (USCG) inspected vessel.

**What is the maximum/minimum number of participants?**
The Coast Guard will allow for 30 passengers. Salish requires at least one chaperone. Through experience, we have found that the ideal group size is 16-24 students with 2 chaperones.

**How many crew members are there, and what qualifications do they have?**
There are a minimum of six crew members on all programs. All have experience working with teenagers in residential settings and all have first aid training. The Captain and Mate are licensed by the USCG and have experience operating sailing school vessels. The Educators/Scientists have science degrees with experience both in the teaching and research fields. Most also have sea time experience. Specific qualifications vary from season to season.

**How long are programs?**
You can choose the length of your program aboard the ship from 5-7 hours or 3-5 days. We also offer pre- and post-trip classroom sessions at no additional charge. These sessions are designed to maximize the experience by providing students with the background knowledge and skills they will need to be involved in the decision-making process. **For our multi-day programs**- At a minimum, we recommend at least one 2 hour pre-trip session focusing on covering background information, becoming familiar with available research equipment, and developing a hypothesis. Post-trip sessions focus on creation of presentations in order to communicate the results of the expedition. You decide how much time you would like to dedicate to these sessions and what additional topics you would like us to address. Sessions can be arranged before, during or after school.

**What does a program involve?**
In the classroom, students are taught scientific principles and provided with background scientific information. They then identify a suitable marine research topic and work with our staff to organize a research expedition. Students are key decision makers in every aspect of planning and conducting the program. **For our multi-day programs**-Groups must be willing to work within the “watch system” structure used by most non-pleasure marine vessels. This is a rotation that allows for equal sharing of all aspects of the expedition. Everyone will be expected to help handle sail, cook meals, launch and recover scientific gear, scrub toilets, evaluate data, plot a course, wash dishes, stand a night watch, etc. On overnight programs, one watch (half the students) sleep ashore in tents at a marine state park and the other watch sleeps on board Carlyn.

**We don’t have enough students; can we pair with another group?**
Yes, you can pair with another group. We can try to help you find one or you can come up with your own. Your group can be mixed age (any combination of 5-12th graders) and parents are also welcome to participate as part of the group. In all cases we would need to insure that program plans meet the needs of all parties and we would arrange for the entire group to meet before going out on the boat.
**Will boys and girls be sleeping in the same areas?**
Sleeping arrangements are based on the number of male and female students. We can sleep up to 7 students in each compartment. Student selection is based on teachers and students will be assigned individual bunks. If a compartment has to be mixed gender it will be approached with the teacher. The sleeping areas of the ship are divided into two completely separate compartments, each having its own “head” (toilet and sink). There will be at least one adult in each sleeping area. There are several large tents for camping ashore that will be organized in single sex units (this is one of the few aspects of the program where student input will not be sought).

**What are the sleeping areas like?**
Open dormitories. Each bunk has a thick, covered mattress with a “fiddle” to keep sleepers from rolling out if the ship moves in the night. Space is very limited and students will also be sharing their bunk with their personal gear. For this reason, we ask that they bring only the items on the list and pack in a soft bag. For those sleeping ashore, we provide insulated pads and tents.

**Is sea sickness a problem?**
Sea sickness is generally caused by the motion of big ocean swells. Puget Sound is protected from swells by the land that surrounds it. Seasickness can often act as a self-fulfilling prophesy; if you come aboard convinced you will get seasick, then you probably will! Most people that experience seasickness do so when they are below decks for long periods of time. They usually feel better just by coming up on deck, getting some fresh air, and looking at the horizon. If you know that motion sickness is a problem, consult your doctor about a motion sickness product. These products tend to make you feel drowsy and usually need to be taken several hours before going out on the water. Please, only use them if you know that motion sickness is a problem! You may want to look into alternative remedies such as ginger (tea or candied) and wrist bands that work using pressure points.

**What instruments will be available for research?**
- Stereo Microscopes
- Compound Microscopes with video camera attachment
- Plankton nets (zooplankton & phytoplankton) & Plankton sieve
- Dip Net
- Bottom grab
- Sediment Sieves
- Secchi disc
- Niskin water sampling bottle
- Water Quality Kits (DO, phosphate, nitrate, silicates, pH)
- Dissolved Oxygen, Salinity, Temperature and pH probes
- Refractometer
- Computer for tracking and analyzing data and writing the cruise report.
- Glassware, buckets, tubs, rulers, resource books, field guides, etc.
- Weather Monitoring (barometer, thermometer, Beaufort scale)

Additional research equipment is available for loan (beach seine, core sampler, CTD, etc.) should our capabilities not meet your research needs. Exactly what equipment your group uses depends on what the students want to study. Again, our program is not “canned;” once your students decide what they want to study we’ll design the program together.

**Where in Puget Sound will we be and how can we let parents know?**
Before your expedition starts, your students will have a great many decisions to make in planning their expedition. Parents and teachers will always be aware of the marina and city that their trip will be departing from. Due to the student directed nature of our programs and the fact that students decide where they will be sailing and collecting samples each morning we cannot exactly say where the boat will be. You may follow the ships course and see nightly updates from students onboard by visiting our "Ship logs" just click the Parents and Students tab on our website www.salish.org

**How far will the boat travel each day?**
As with all aspects of the trip planning, your students will be deciding exactly where to sail each day, taking into consideration what sampling needs to get done, the tides and currents and where they want to camp for the evening. In general, the greater the distance you attempt to sail, the less time you have for sampling stations. We encourage the students to make conservative plans that do not cover a lot of physical distance so that they have greater flexibility in meeting the challenges of the day.

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*Salish Sea Expeditions* 1257 Patmos Lane NW, Bainbridge Island Washington 98110 * (206) 780-7848
Website: www.salish.org  * Email: info@salish.org  * Fax (206) 780-9005
How far will the boat be from the campers?
Ideal locations are those where the ship is in direct sight of the camp. Occasionally the campsite will not have a protected enough moorage for Carlyn, in which case the ship will moor in the closest possible safe anchorage. In general, we try to keep the campers and the boat as close together as possible. Staff and chaperones will be sleeping with the watch ashore.

What kind of communication system is there between boat and campers?
Most of our camping locations are marine state parks. We communicate between ship and shore via our hand held two-way radios or cell phone.

What kind of plan do you have for emergencies while students are on board?
Any vessel carrying passengers for hire must meet construction and operations standards established by the US Coast Guard. Carlyn was designed and is maintained with a Coast Guard Certification. As such, the safety margin in construction standards and operational requirements are quite high. Carlyn is required to have plans that meet or exceed response standards set by the USCG for just about any incident. These mainly address major vessel incidents such as man-overboard, fire, collision, and abandon ship. Every Captain is required by law to thoroughly train and drill their crew in whatever the approved procedures are for that particular vessel. When you board the vessel, the Captain will personally discuss with the group what to do in the event of an emergency. An emergency drill will be part of your program. Carlyn is also required to carry emergency supplies and equipment including radios, flares, first aid kits, life raft, life sling and jackets. We have established safety procedures for every activity the students participate in, both aboard the ship and while ashore. Students are informed of the procedures before engaging in the activity. Students who can not follow the procedures do not participate.

Do students wear Personal Flotation Devices-PFD’s (lifejackets)?
Yes. Any time they are working on deck while the boat is underway or in the small boats they will be required to wear Type III PFD’s (like kayakers wear). We are also required to carry the Type I PFD’s (highest USCG buoyancy rating) for each person on board.

Could a parent contact their child if there were an emergency at home?
Yes. During office hours, the preferred method is to contact our office staff and they will call the ship on the cell phone. After hours, the on-call director will be available by cell phone for emergencies. That emergency number is (206) 715-0312. The on-call director will have access to the boat cell phone as well.

What are your payment policies?
The total fee for a multi-day program is $2800/day for up to 30 participants. This includes pre and post trip classroom visits, all food, all supplies and instruction. Our payment policy is a nonrefundable deposit of $600/day aboard due with your contract, the first 1/3rd of the total cost due 90 days prior to your expedition, the second 1/3rd of the total cost due at 60 days prior to your expedition and the balance due 30 days prior to the expedition. If that doesn’t work in your district, just let us know and we’ll work out an alternative. The total fee for a day sail program is 400/hr with a minimum of 5 hours. Our payment policy is the same as stated above.

What do students need that is not covered in the program fee?
Students will need to bring appropriate clothing (we will supply a list) packed in a duffel or gym bag and a backpacking type (compressible) sleeping bag. For day sails students will also need to bring a bagged lunch. We supply rain gear, tents, sleeping pads and PFD’s.

How much insurance coverage do you have?
Participants are covered by a $1,000,000 liability policy.

Salish Sea Expeditions * 1257 Patmos Lane NW, Bainbridge Island Washington 98110 * (206) 780-7848
Website: www.salish.org * Email: info@salish.org * Fax (206) 780-9005
TEACHER TIMELINE & CHECKLIST

As soon as possible:
- Submit your deposit and contract
- Fill out and return Group Information Form at least 1 week before the first classroom visit
- Call or e-mail our Education Director, to discuss trip details and logistics, schedule classroom visits, discuss Sound and Source, set up parent-presentations if needed, and any other planning questions
- Begin fundraising efforts; contact Salish for ideas and support
- Review school or district’s risk management protocols for field trips; contact Salish for information or supporting materials!

Before Classroom visit #1:
- Arrange for transportation to and from the dock; contact Salish for logistical help
- Distribute and collect Hold Harmless agreements and return to Salish 2 weeks before the trip start
- Complete Meal Planning Sheets with your group, find out if there are any major dietary restrictions or allergies, and return Meal Sheets at least 2 weeks prior to trip, or by arrangement with Salish office
- Distribute and collect Pre-trip questionnaires and give to Salish staff at first classroom visit
- Distribute Homework Packet to each student
- Submit payments according to schedule on your contract
- Carefully consider any adult chaperones and give them Adult Hold Harmless form and Chaperone Roles and Responsibilities sheet

Before Classroom visit #2
- Divide your students into two even “Watch” groups and submit Watch Group Form to Salish staff
- Copy and distribute What to Bring list
- Return any additional paperwork to Salish staff

Before your trip:
- Double check transportation arrangements and departure/arrival docks with Salish.
- Distribute parent letters if you choose

The day of your trip:
- Meet the Program Coordinator at the dock with your students and chaperones at 9:00 am!

Questions? Call Kristen Cann at the office (206) 780-7848x2# or email: kristen@salish.org  Salish Emergency on call cell-(206) 715-0312