Acknowledgments

This evaluation project was a collaborative effort between the Padilla Bay Reserve staff and Stromholt Evaluation and was completed with the assistance of numerous others. Special thanks are due to Rachel Ackerman, of the Padilla Bay Reserve staff, for the time and energy she invested in data coding and entry, which contributed immensely to this project. Glen "Alex" Alexander and Susan Wood were instrumental in their contributions of expertise and support throughout this project. Our appreciation also goes to the teachers and students who shared their thoughts and ideas with us along the way.
Introduction

Padilla Bay National Estuarine Research Reserve is a governmental organization for research and education about the Salish Sea. Teachers, students and other groups learn about this valuable estuarine system. Through field trips, teacher workshops, and public programs, Padilla Bay Reserve strives to increase understanding and appreciation of estuaries and foster stewardship and engagement through education. In summer 2011, Stromholt Evaluation was contracted to partner with the staff of the Padilla Bay Reserve to conduct an evaluation of a Bay-Watershed Education Training (B-WET) education program. About 7000 students per year in grades K-12 visit the Reserve and take part in indoor and outdoor lessons taught by environmental educators as part of their studies. The focus of the evaluation was on upper elementary students and teachers who took part in the Padilla Bay professional development workshops about estuary education.

The primary objectives of the evaluation were to:

1. Implement evaluation tools developed in 2010 for student programs and teacher professional development sessions
2. Review and analyze evaluation data
3. Report results

Results Overview

This project utilized the evaluation protocol development completed in 2010, in collaboration between the outside evaluator and the education team at Padilla Bay. In 2010, we worked together to review and clarify the goals of the Padilla Bay educational programs, develop appropriate assessment tools that address the goals, and examine the results of the pilot evaluation carried out in spring 2010. This year, data was collected from teachers and students using the tools developed in 2010.

The outcomes of the Padilla Bay Reserve programs continue to be very positive. We found that the Padilla Bay programs have a positive impact on students and teachers alike. Students were able to recall many of the important lessons they learned during their time at Padilla Bay Reserve and consistently demonstrated enthusiasm for the programs. Teachers had an overwhelmingly positive response to the professional development training they received from Padilla Bay and have shared what they have learned with their students and other teachers. Several teachers reported a willingness to share their work and examples of student learning with Padilla Bay in an effort to show the merits of the program.

I very much enjoyed this workshop and all of the people leading it. This was time well spent and I look forward to starting my new year and apply the new strategies and ideas I have gained.

-Teacher workshop participant, 2011
<table>
<thead>
<tr>
<th>Inputs</th>
<th>Activities</th>
<th>Participants</th>
<th>Short-term</th>
<th>Medium-term</th>
<th>Long-term</th>
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<tbody>
<tr>
<td>Facilities</td>
<td>Field Study: Students investigate the local environment of Padilla Bay through experiential activities in the field and in their classroom. Focus is on conservation, appreciation and understanding of relationships with the environment including stewardship. Teachers are encouraged to do pre and post trip lessons in the classroom to support activities at Padilla Bay Reserve. Logistics: Long (four to five hours) or short (90 minutes) program. The long program may include Estuary Soup Skit, the Padilla Bay video, exploration of the mud flats, plankton sampling, use of microscopes and the &quot;chalk talk&quot; showing how estuaries have changed in Puget Sound over time due to human development. The short program includes all of these activities except the visit to the beach and use of microscopes.</td>
<td>Upper elementary school students</td>
<td>Participants will: Demonstrate interest in and enthusiasm for estuaries Understand the interconnectedness of natural and social communities, including their own position Describe the cultural, economic, aesthetic, biological and environmental values of healthy estuaries and watersheds Recognize how science can be used to learn more about and improve the health of estuaries Describe stewardship behaviors over which they have control that affect estuary resources Share information with parents and peers Show citizenship behavior back in the classroom</td>
<td>Participants will: Show continued interest and enthusiasm for estuaries. Develop increased connection to their local environment and community Become inspired to take initiative and responsibility for conservation behaviors Demonstrate increased knowledge of environmentally sound behaviors Show citizenship behavior across settings</td>
<td>Participants will: Take action to promote conservation in their community Apply concepts learned in this program to their everyday life and community Participate in government and other citizenship activities</td>
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<td>Program Budget</td>
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<td>Materials</td>
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<td>Curriculum:</td>
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<td>Staffing:</td>
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<td>Program Instructors</td>
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<td>Program</td>
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<tr>
<td>Coordinator</td>
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<td>Other org. staff</td>
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<td>Volunteers</td>
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<td>Partners:</td>
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<tr>
<td>Public and private schools K-12</td>
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</tbody>
</table>

Figure 1. Logic Model for upper elementary programs at Padilla Bay Reserve 2010
Analysis of results from current programs

Part 1: Student Program Evaluation

The 2011 evaluation of Padilla Bay programs was implemented in accordance with the logic model developed in 2010. To understand how Padilla Bay programs yielded outcomes, teachers were asked to implement both the Student Questionnaire and the Student Letter. The Student Questionnaire is an existing pre/post multiple choice survey focused on content. The Student Letter was developed in 2010 to address the wide range of other outcomes staff believed were a part of their program. The letter tool includes a series of open-ended questions in the form of a letter to Padilla Bay staff. Teachers were able to choose to implement either or both of the tools and several adapted the letter tool to utilize questions of interest to them and their students. Because of this, some questions were not coded for in all collected letters.

In spring 2011, 127 students completed the Student Questionnaire and 190 students completed the Student Letter. A summary of highlights from this year’s evaluation is found below. Figures 2-5 illustrate the distribution of student responses to each question in the student letter. Figure 6 links the evaluation plan, including several outcomes chosen from the logic model, to the data collected in the student survey and letter assessment tool.

![The best part of my visit to Padilla Bay Reserve](image1)

**Figure 2.** Student responses describing their experience at Padilla Bay. Responses are recorded as percentage of student respondents.

![How are living and nonliving things dependent on each other in estuaries?](image2)

**Figure 3.** Student responses describing interdependencies in estuaries. Responses are recorded as percentage of student respondents.
Figure 4. Student responses describing human dependencies on estuaries. Responses are recorded as percentage of student respondents.

Figure 5. Student responses describing actions they believe they can take to keep estuaries healthy. Responses are recorded as percentage of student responses.
### Student Program Evaluation: Learning Outcomes

<table>
<thead>
<tr>
<th>Outcomes linked from Logic Model</th>
<th>Data</th>
<th>Student Quote</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Outcome 1: Attitudes</strong></td>
<td>Demonstrate interest in and enthusiasm for estuaries</td>
<td>More than 75% of students reported that they enjoyed the field trip and 45% identified the beach as their favorite part.</td>
</tr>
<tr>
<td><strong>Outcome 2: Content Knowledge</strong></td>
<td>Understand how a healthy estuary functions</td>
<td>99% of students who responded to this question were able to identify at least one interdependent relationship in an estuary.</td>
</tr>
<tr>
<td><strong>Outcome 3: Content Knowledge</strong></td>
<td>Describe the cultural, economic, aesthetic, biological and environmental values of healthy estuaries and watersheds</td>
<td>All students who responded to this question were able to name at least one way that humans depend on healthy estuaries, including food, oxygen, research, and recreation, among other answers.</td>
</tr>
<tr>
<td><strong>Outcome 4: Science Process</strong></td>
<td>Recognize how science can be used to learn more about and improve the health of estuaries</td>
<td>This question was not addressed in the assessments used this year.</td>
</tr>
<tr>
<td><strong>Outcome 5: Awareness</strong></td>
<td>Describe stewardship behaviors over which they have control that affect estuary resources</td>
<td>100% of students who responded to this question were able to identify at least one thing they could personally do to keep estuaries healthy.</td>
</tr>
</tbody>
</table>

*Figure 6. Results for the five outcomes from the logic model which were the focus of the pilot evaluation plan. Because teachers seemed to adapt the Letter Tool, using questions of their choosing, many pieces of student work did not reflect specific outcomes listed here.*
**Part 2: Teacher Evaluation**

During 2011, three different surveys were implemented with teachers regarding their participation in the professional development sessions offered by Padilla Bay Reserve. First, a 10 month follow-up survey was given to teachers who participated in the 2010 workshops. Second, teachers were asked to complete a curriculum survey to submit with their collected student assessments to keep track of which lessons students had participated in. Finally, an exit survey was given to teachers who participated in the 2011 professional development sessions.

The goal of the follow-up survey to the 2010 workshop was to learn more about how the teacher professional development program influenced student learning and teacher development. Padilla Bay staff were interested in how teachers used what they learned at the workshop back in the classroom and their perceptions of the impact of this work on their students. In addition, the survey investigated how the curriculum work teachers did aligned with the Meaningful Watershed Experience goals and how they shared their work in this area with other teachers. Nine of the nineteen teachers who participated in the 2010 workshops completed this follow-up survey in spring 2011.

Teachers in the summer 2011 workshops completed an exit survey designed to gather their impressions of the workshop, the usefulness of the activities and content covered, and their impressions of the logistics of the workshop itself. Padilla Bay staff were interested in how teachers planned to use what they learned in the workshop and measure their levels of enthusiasm for implementing estuary related lessons in their classrooms and on field trips. Sixteen teachers completed these exit surveys.

2010 Teacher Workshop Follow-Up Survey

Teachers did a wide variety of activities with their students after their participation in the 2010 workshop. Eight out of nine teachers responded that they had done some kind of activity. Some teachers included one or two activities in their regular repertoire such as having students research and write reports about Puget Sound or construct an “eco-column” in stacked pop bottles. At least one teacher supplemented the 4th grade FOSS kit with the estuary studies materials from the workshop, including notes, pictures and the DVD.

Other teachers were able to do much more comprehensive estuary studies activities with their students. One teacher was able to schedule several activities focused on making a difference in the community by educating others about the impacts of their behaviors. Another teacher was able to do a whole series of activities tied together field trips to do water quality testing, the Student Green Congress, a macroinvertebrate study, nature mapping and a barnacle study. Finally, one teacher indicated an entire flow of lessons that

In February, my students organized a family activity night where they taught their families the environmental lessons that they had learned from collaborating with Pierce County Public Works and Utilities. My older students also created an environmental newspaper, FOSS for Fish that discussed planting trees, recycling, and storm water.

- Teacher workshop participant, 2010
included both lesson the teacher adapted from the workshop materials and existing lessons from the Padilla Bay website, including a field trip to the center, the water treatment plant, and Camp Seymour.

Seven of the nine teachers who responded to the survey reported using lessons and activities they created themselves, from the Padilla Bay website and curriculum those presented at the Padilla Bay Workshop, and including a field trip to an estuary. Most teachers have also used some kind of journaling activity, a method encouraged in the workshop. Additionally, teachers reported involving their students in other activities such as field studies and data collection, research papers and tree planting.

Eight teachers reported that due to their participation in the Padilla Bay workshop, they believed their students showed improvements in interest and enthusiasm for the environment. All nine who responded reported improvements in student content knowledge, including the interconnectedness of humans and nature, and stewardship behavior, while seven saw improvements in stewardship behavior and interest in science. For example, one teachers said, “I teach a self-contained special education class for students on the autism spectrum. I have noticed a significant increase in social skills and their ability to perspective take.” Most teachers said they had evidence of these gains, particularly around interest and enthusiasm for the environment and content knowledge, including the interconnectedness of humans and nature. Teachers reported a variety of evidence of student improvement in these areas, including anecdotal evidence, but also pre/post assessments, journals, human impact paragraphs, and behavior change.

Eight of nine teachers stated that the experience with Padilla Bay Reserve made them more comfortable teaching about estuaries or the environment. Only one teacher said that they felt confident already, but that the workshop has given them more contacts such as People for Puget Sound, for engaging their students. Other teachers cited the usefulness of working with other teachers, using the website, and the guidance and support of the Padilla Bay staff. Two teachers said that they have previously felt uncomfortable teaching science, but that this has changed since their participation in the workshop. As one teacher said, “Science has always been difficult for me to teach because I feel I don’t understand it, so the lessons we receive annually help me as well as the students.” Another teacher noted, “Your workshop was one of the best I have attended!”

Teachers shared their experiences primarily with their team teachers and other colleagues within their school. Some have been able to share with other outside of their school, including the Alpha Rho Chapter of Delta Kappa Gamma (an international group for women educators), networking meetings of South Sound Green, and families at their school.

Overall, teachers stated that their lessons met most of the Meaningful Watershed Experiences (MWE) expectations. The results are tallied below.

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**The experience was very valuable. As I stated earlier, without the support that I received, I probably would not have taken on environmental service-learning projects in my classroom. My students and I thank you for giving us this opportunity**

- Teacher workshop participant, 2010

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**Make a direct connection to the marine or estuarine environment.** Experiences demonstrate to students that local actions can impact the greater marine environment.

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<th>Yes</th>
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**Are an integral part of the instructional program.** The experience is a part of the curriculum being taught in the classroom.

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<th>Yes</th>
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<tr>
<td>6</td>
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**Part of sustained activity.** It includes preparation, an outdoor experience, analysis, and reporting.

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**Reflects an integrated approach to learning.** Other disciplines besides science (art, history, English, economics) are incorporated.

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**Projects involve external sharing and communication.** Students share what they have learned with each other and the community (i.e., newsletters, journals, community presentations, letters).

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<td>3</td>
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*Figure 7. Teachers felt that the lessons they taught met most of the MWEs. Sharing with others seems to be a particular challenge.*

**Teacher Fieldtrip Curriculum Survey**

Teachers were requested by Padilla Bay staff to fill out a short form about the activities they did in their classroom that related to Padilla Bay and send it back with their completed student assessments. Nine teachers returned these forms, reporting on their use of Padilla Bay created pre/post trip activities, as well as other activities. Four of the nine teachers said that they did some activities, while the other five said they did a lot of activities. Teachers most commonly used the wordsearch, crossword puzzle, vocabulary, and videos. Two teachers said they used all of the provided activities. Four teachers indicated that they did not do any other additional activities. Of the five that did do other activities, 3 said they did some and 2 reported that they did a lot of activities. These commonly included salmon curricula, riparian ecosystem lessons, water cycles, and watersheds. Though teachers reported very little formal sharing by students of what they learned through Padilla Bay, they did describe a variety of informal sharing, to peers, parents, and school communities.

**2011 Teacher Workshop Exit Survey**

The Estuary Education Teacher Workshops in Olympia and Padilla Bay in summer 2011 provided high-quality, meaningful training to 16 teachers. Teachers were overwhelmingly positive about their experience, citing the workshop leaders’ enthusiasm and organization consistently as highlights of the workshops.

All but two of the teachers stated that the workshop increased the likelihood that they would include a field experience for their students. Two teachers noted that they are already doing so and one of them said that this will expand their usual repertoire of
experience. One teacher said, "I was already planning on bringing my students here for a field experience, but now I'm more excited than ever!" Another teacher said, "It is always a good reminder to me to be a student again and experience the different level of interest I feel when I'm in the field. I will definitely be including field experiences." Teachers felt they were given the resources and encouragement needed to incorporate lessons they learned during the professional development in both field experiences and back in the classroom.

The Meaningful Watershed Education Experiences (MWEE) is "valuable and important" to teachers. Generally, teachers felt that the experiences are a great way to connect estuaries to the lives of their students. The structure and content were useful to teachers and provide guidelines that are easy to follow and will help students understand "their role in the watershed (as) an essential component of being good stewards of our earth." More than one teacher highlighted this training as the best workshop they have ever attended, citing the real world application, different voices of speakers, and "informative on how past and present choices have a lasting impact." As one teacher said, "Best workshop I have ever taken. I have many fun, practical, and inexpensive lessons to incorporate into my science units." Though a few teachers noted that the MWEE contain a lot of information to process, or to add on top of what is required of them, the response was overwhelmingly positive.

As last year, every teacher who participated in the workshops said that they plan to use the teaching materials introduced in class. The websites, online curriculum, and science journals were mentioned repeatedly as resources that could be used effectively. One teacher even noted that science journals could be used in other subjects. Another said how much she enjoyed actually creating her own science journal instead of just talking about how students would use theirs. Among the other resources teachers said they would use were: plankton collector, book titles, tide charts, quadrats, and songs. One teacher mentioned that some of it was beyond what she might do with her elementary students.

The feedback about the workshop itself was very positive, and many of the suggestions for improvement heard last year were not mentioned this year. Two teachers felt there was more information presented than they could take on and one mentioned that the "speakers weren't too helpful for elementary education ideas," but others felt that information gave teachers the foundation they needed to teach the material well.

Teachers valued the creative aspects of the curriculum and lesson ideas and the variety of formats used in the training. They appreciated hearing from a variety of experts, but one teacher did note that it was a bit hard to listen at the end of the day. The field trips and observation activities were especially valuable. One teacher noted that they were not sure if Puget Sound is an estuary or if only the river mouths are estuaries.

Padilla Bay National Estuarine Research Reserve
Recommendations for Future Evaluation

Based on the outcomes of the 2011 evaluation and the needs of the program and staff, there are several recommendations for future evaluation.

Student Evaluation

Based on the results of the 2010 pilot, teachers were given several options for implementing and returning student assessments to Padilla Bay staff. This resulted in the return of large amounts of data. However, teachers did not seem to be consistent in their use of the assessment tools. There was great variation in how each class answered questions in the student letter. At least one class had mostly identical letters and others seemed to answer different questions than those in the letter tool. The great flexibility given to teachers seems to provide room for them to do the assessments, but it makes it challenging to code and summarize what students have learned. Staff may want to consider other ways to report about student data that allow for teacher flexibility and adaptation, or they may want to try to standardize the instructions for teacher implementation.

Teacher and Curriculum Evaluation

Several recommendations made in 2010 continue to be worth considering.

• Continue to implement surveys for teachers regarding the professional development. These surveys offered useful information for how teachers are using what they learned with Padilla Bay that can inform future professional development workshops and curriculum development.
• Contact teachers who have agreed to be contacted, to collect examples of student work that demonstrate the outcomes in the logic model.
• Increase the response rate for the professional development workshop survey and the fieldtrip curriculum surveys teachers receive with the student assessments by emailing or calling to remind teachers. If needed, call teachers to implement the fieldtrip curriculum survey by phone.
Appendices
Appendix 1: Student Letter
Appendix 2: Student Questionnaire
Appendix 3: Teacher Workshop Follow-Up Survey
Padilla Bay Student Letter

Dear Students,

Thanks for visiting Padilla Bay and taking the time to learn about estuaries. We would like to know if you enjoyed your trip and what you learned from it. Please write us a letter and answer the following questions –

1. Did you have fun on the field trip and why? What part was the most fun?
2. Describe one way that plants, animals, and non-living things in an estuary depend on each other. Please be specific.
3. What is one thing you can do to keep estuaries healthy and clean?
4. Is there anything else you would like to tell us about your trip to Padilla Bay Estuary Reserve?

Dear Padilla Bay teachers,

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(Please write on the back of the page if you need more space.)
Padilla Bay Student Questionnaire

Circle One:  **Pre-trip**  **Post-trip**

Date ___________________  Name __________________________

School ________________________________

Grade ________________  Teacher ____________________________

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**Estuary Questions**

1. What is an estuary?
   a. A place where wildlife is protected from hunting and fishing
   b. A muddy beach
   c. A place where fresh water from the land mixes with salt water from the ocean
   d. A bay where building and development are not allowed
   e. Not sure

2. What is a watershed?
   a. A tank to collect rainwater for gardening
   b. The area of land that drains into a body of water
   c. The top blades of eelgrass that shed rainwater
   d. All the animals that live in a single body of water
   e. Not sure

3. How are pipefish adapted to life in an eelgrass meadow?
   a. They look like eelgrass (thin and green), and are camouflaged.
   b. They can live with very little oxygen in the water.
   c. Because the eelgrass meadow is very dark, they have learned to give off their own light like fireflies.
   d. They close up their shells to keep from drying out.
   e. Not sure

4. Why is detritus important in an estuary?
   a. It is food for many animals.
   b. It gives the water its beautiful blue color.
   c. It captures sunlight energy and turns it into food for animals.
   d. All of the above
   e. Not sure

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*(Turn over for side two)*
5. Why are estuaries important to salmon?
   a. Adult salmon eat the estuary eelgrass.
   b. Young salmon find food, shelter, and a place to adapt to salt water.
   c. Salmon lay their eggs on eelgrass in the estuary.
   d. They hide in the mud at low tide.
   e. Not sure

6. How do phytoplankton get their energy?
   a. They eat zooplankton
   b. They eat dead stuff
   c. They use the sun’s energy to make food
   d. They eat baby salmon
   e. Not sure

7. Have people built cities on estuaries?
   a. Yes – most of the world’s largest cities are on estuaries.
   b. No – estuaries are protected from building.
   c. No – mud around estuaries is too soft to build on.
   d. Not sure

8. Do you live in the watershed of an estuary?
   a. Yes
   b. No
   c. Not sure

9. What is the most important thing you learned at Padilla Bay Reserve?
   __________________________________________________________
   __________________________________________________________
   __________________________________________________________
   __________________________________________________________
   __________________________________________________________
   __________________________________________________________
Dear Teacher,

You are receiving this survey because in the summer of 2009 you participated in a teacher workshop at Padilla Bay Reserve. It should take about 10-20 minutes of your time. We would like to know how you have used your training in the past year. Please take a moment to briefly answer the questions below. Thank you for your time and dedication to teaching about our local environment.

Name: ________________________________________________

1. Describe briefly the estuary studies you have conducted with your students.

2. What kinds of activities did your estuary studies include? (check all that apply)
   _____ Lessons and activities I created myself.
   _____ Lessons and activities from the Padilla Bay website and curriculum
   _____ Lessons and activities from other resources presented at the Padilla Bay Workshop
   _____ A field trip to an estuary
   _____ A test
   _____ Journaling or other writing activity
   _____ Other (please describe)

3. Through our participation with Padilla Bay Reserve, I believe students are showing improved: (check all that apply)
   _____ Interest and enthusiasm for the environment
   _____ Content knowledge, including the interconnectedness of humans and nature
   _____ Stewardship behavior
   _____ Interest in science or science activities
   _____ Other (please explain)
4. Through our participation with Padilla Bay Reserve, I have evidence that students are showing improved: (check all that apply)
   ____ Interest and enthusiasm for the environment
   ____ Content knowledge, including the interconnectedness of humans and nature
   ____ Stewardship behavior
   ____ Interest in science or science activities
   ____ Other (please explain)

4b. If you stated that you have evidence of student improvement, please describe the type of evidence you have (test, written work, student quotes, observation, projects, etc).

4c. Would you be willing to be contacted to share some of these examples with Padilla Bay?
   ___ Yes
   ___ No

5. Now that you've used the lesson plan(s) that you created as a result of the workshop, would you recommend making any changes?
   ___ Yes
   ___ No

5b. If yes, are you willing to be contacted to share these changes with Padilla Bay and other teachers via the Padilla Bay web site?
   ___ Yes
   ___ No

6. Has your experience with Padilla Bay Reserve made you more comfortable teaching about estuaries or the environment? Please explain.
7. How did you share information from the Padilla Bay 2009 Teacher workshop with other teachers and colleagues? Please describe who you shared information with, how you shared it, and approximately with how many people.

8. Remember the concept of Meaningful Watershed Experience (MWE)? As required by our grant we described it as one possible framework for designing estuary studies. Please tell us if your estuary lessons included the following aspects of MWE. Of course we know that MWE is not a measure of the quality of your lessons. We just want to know if it’s something you picked up and used.

My estuary lessons (please mark your responses for each line):

<table>
<thead>
<tr>
<th>Make a direct connection to the marine or estuarine environment. Experiences demonstrate to students that local actions can impact the greater marine environment.</th>
<th>Yes</th>
<th>No</th>
<th>Unsure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Are an integral part of the instructional program. The experience is a part of the curriculum being taught in the classroom.</td>
<td>Yes</td>
<td>No</td>
<td>Unsure</td>
</tr>
<tr>
<td>Part of sustained activity. It includes preparation, an outdoor experience, analysis, and reporting.</td>
<td>Yes</td>
<td>No</td>
<td>Unsure</td>
</tr>
<tr>
<td>Reflects an integrated approach to learning. Other disciplines besides science (art, history, English, economics) are incorporated.</td>
<td>Yes</td>
<td>No</td>
<td>Unsure</td>
</tr>
<tr>
<td>Projects involve external sharing and communication. Students share what they have learned with each other and the community (i.e., newsletters, journals, community presentations, letters).</td>
<td>Yes</td>
<td>No</td>
<td>Unsure</td>
</tr>
</tbody>
</table>

8b. Is there anything else you would like to tell us about how your lessons addressed the MWE guidelines?

9. Is there anything else you’d like us to know about your experience with Padilla Bay Reserve?

Thank you