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Kids on the Beach Project Report

Year 2

September 20, 2019

Mira Lutz Castle

Education Coordinator

SeaDoc Society

Table of Contents

Introduction

Kids on the Beach is a program that mobilizes students in central Skagit County to conduct authentic marine conservation research. Kids on the Beach (KOTB) launched in 2018 with Conway School, thanks to program initiation and advocacy by Pete Haase of the Skagit County Marine Resources Committee. It was made possible by funding from Skagit County Marine Resources Committee through a grant from the US Environmental Protection Agency through the Puget Sound Partnership and the Northwest Straits Commission. The mission of the program is to increase ocean literacy in middle school students in Skagit County schools with real, relevant, local experience in marine science and restoration.

We launch the project by reaching out for student help to answer questions about beach restoration effects. We issue a request for proposals along with instructions on proposal writing. Students then experience Next Generation Science Standards-based classroom lessons, scientist and citizen scientist-supported field work, data analysis, and a public presentation of research findings modeled after a scientific conference. At the end, students have conducted scientific research of their own design, generated data for use by the Washington Department of Fish and Wildlife (WDFW), and interpreted results to a public audience in a formal slideshow and/or poster presentation.

In its second year, KOTB expanded from one to two schools, including two Conway 8th grade classes led by Science Teacher, Ron Haywood, but adding two La Conner Middle School 8th grade classes led by Science Teacher, Bob Plank. We also provided a greater focus on Native Environmental Science, adding a new beach enhancement site on Swinomish Tribal lands, a new school with a 50% Swinomish Tribal Community student population, and the support of the Swinomish Department of Environmental Protection staff and the experience of indigenous ways of knowing being respected as equal to western science in resource management.

Together we asked whether Tribal beach enhancement efforts have increased forage fish, nearshore fish, and salmon use of shorelines in Fidalgo Bay and Lone Tree Point beaches and pocket estuary.

Program Goals

The goals of the 2019 KOTB program were as follows:

1) Increase ocean literacy in Skagit Co. 8th grade students through fish habitat and spawning research
2) Offer a hands-on scientific research project to support student prep for statewide science testing
3) Bring awareness to Indigenous Ways of Knowing and Native Environmental Science as respected, necessary tools for restoring the Salish Sea
4) Increase student engagement in science by requesting data useful to WDFW
5) Impart the importance of science communication through a student science symposium

Whether students reached these goals was measured by the following success criteria:

1) Pre- and post-project assessment score
2) Washington Comprehensive Assessment of Science student scores from 2018 (available August, 2019)
3) Awareness of the value of indigenous knowledge and Native Environmental Science
4) Student surf smelt and beach seine data accepted by WDFW.
5) Research presentation through slide show or poster at a student science symposium at Padilla Bay National Estuarine Research Reserve

Next Generation Science Standards (NGSS)

The NGSS are grade-specific science and engineering practices and cross-cutting concepts in physical, life, and earth and space science disciplines, designed to guide teaching science by doing science. The KOTB pilot project specifically addressed stability and change in an ecosystem within the Middle School Life Science (MS-LS) discipline. Specific standards used in this project are presented here.

MS-LS2-4 Construct an argument supported by empirical evidence that changes to physical or biological components of how an ecosystem affects populations.

MS-LS4D Biodiversity and Humans: What is biodiversity, how do humans affect it, and how does it affect humans?

Each of the following NGSS Practices were addressed in the course of this project:

- Asking questions and defining problems
- Planning and carrying out investigations
- Analyzing and interpreting data
- Using mathematics and computational thinking
- Constructing explanations and designing solutions
- Engaging in argument from evidence
- Obtaining, evaluating, and communicating information

Project Timeline

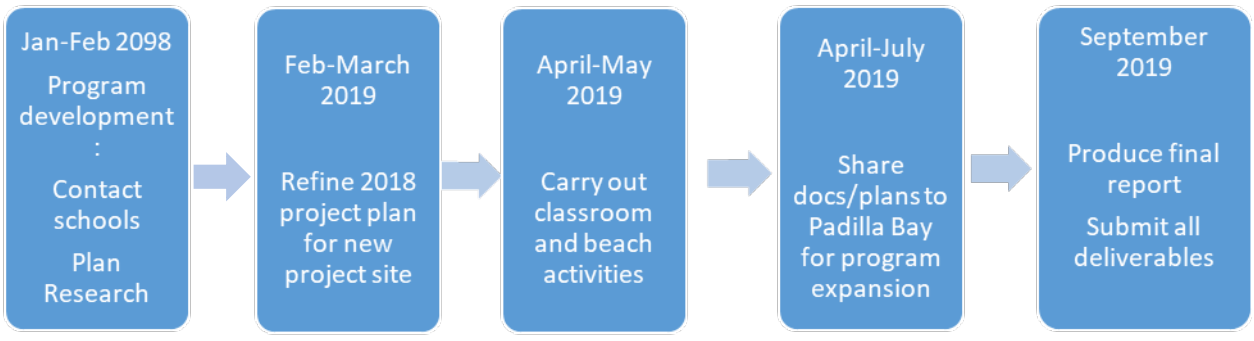


Figure 1: Project timeline

Project Summary

I visited both schools in mid-April to launch the KOTB Program along with Holli Watne, Padilla Bay National Estuarine Research Reserve (NERR) AmeriCorps staff. We introduced students to nearshore habitat requirements of forage fish and salmon, their place in the Salish Sea food web, and the importance of biodiversity to ecosystem resilience. We then illustrated beach enhancement efforts to restore fish habitat around the Salish Sea. At Conway we specifically focused on the Samish Tribe's restoration projects in Fidalgo Bay and at La Conner, the Swinomish Tribal Community's enhancements of the shoreline and spit at Lone Tree Point in Skagit Bay. Both beaches are important cultural resource sites and both were enhanced in the face of erosion from increased storm events in conjunction with sea level rise.

With an understanding of the interaction of a diverse shoreline and diverse fish populations, we relayed to the students the need to know whether beach enhancement efforts were increasing surf smelt spawning success or nearshore fish diversity and salmon use. We issued a Request for Proposals, offering a grant of $2,000 each to the best proposals to assess the effects of beach restoration on surf smelt spawning and on fish species diversity. At La Conner, emphasis was placed on the use of the pocket estuary by juvenile salmon.

All students were encouraged to inquire with their parents, grandparents, or other elders for knowledge of historical fish habitat management practices and to read the provided scientific literature on the respective sites. One well-supported and thought-out proposal, including a budget for supplies and lead scientist time, was chosen from each class.

Conway 8th grade
Samish Department of Natural Resources (DNR) began beach enhancement efforts in stages, starting in 2009 furthest north, then in 2014 just southward of the first site, and finally in 2017 in a stretch just north of the boat launch. Northward of Samish property there is rip-rap-armored beach without vegetation. Southward is beach that has been in a natural state for at least 50 years. Knowing of this restoration gradient, one class submitted procedures on how best to assess effects of beach enhancement on surf smelt egg mortality, and using available materials to survey spawning habitat for eggs. The other class submitted procedures on measuring nearshore fish diversity by beach seining in each restoration segment.

La Conner 8th grade
Beach enhancement led by Skagit River System Cooperative and Swinomish Department of Environmental Protection (DEP) at the Lone Tree Point site focused on restoring a higher elevation to the eroded spit. The spit creates the pocket estuary at the mouth of Lone Tree Creek, providing critical habitat for juvenile salmon and other fish and providing access to a historical pink salmon beach seining site for Swinomish fishermen.

Understanding the ecological and cultural value of this site, especially for harvesting pink salmon, students began to engage in this project, even with little to no class time devoted to this

content outside of my visits due to overlap with state testing in other subjects. Classes at La Conner required more of my support to prepare for their field research day, which I provided with extra classroom visits to help write procedures.

At Lone Tree Point, one previous survey by Skagit River System Cooperative showed no surf smelt eggs at Lone Tree Point beaches, though sites just north and south had spawning activity at varying times of the year. One La Conner class felt it valuable to survey this site to see if beach enhancement, increasing sand and gravel where cobble had been uncovered, encouraged spawning.

The other class succeeded in together writing a procedure to compare juvenile salmon presence inside vs. outside the pocket estuary by beach seining.

With the added access to expertise and equipment from the Swinomish DEP Water Quality team, students from each class also tested temperature, dissolved oxygen, and salinity at sites from the Lone Tree Creek mouth, through the pocket estuary, to the sea, learning how appropriate water quality is critical to salmon survival.

Research design and implementation

We guided students through proper research design and field journal preparation for data collection at the study sites. Students performed background research, priced the materials needed, wrote procedures and rationales, and constructed budgets for their proposals (Figure A-1). The small army of citizen scientist volunteers required for both the WDFW beach seining and surf smelt survey protocols reappeared and even expanded for year two of KOTB, bless their hearts. On field day all were welcomed at Fidalgo Bay by Samish Nation elder, Rosie Cayou James, and at Lone Tree Point by Swinomish elder, Raymond Mitchell, with words from their hearts about the importance of their land, natural resources, and the students' work.

Volunteers from Fidalgo Bay Aquatic Reserve Citizen Stewardship Committee, Washington Conservation Corp, Trail Tales, and Skagit County Marine Resources Committee all joined Samish DNR and Swinomish DEP in training students to collect and process sand and gravel samples to count surf smelt eggs (Figure 2), or assist them in seining for nearshore fish (Figure 3). The events were reported by the Skagit Valley Herald, the NW Straits Commission Newsletter, the Padilla Bay NERR newsletter, and the SeaDoc Society newsletter.

Figure 2: Smelt survey photos. Finding smelt eggs, separating eggs from sand and microscopy for egg mortality

Figure 3: Beach seining for nearshore fish diversity, Lone Tree Point (left) and Fidalgo Bay (right)
Photos by Mira Castle

Conway Results

Conway surf smelt surveyors combined this year's data with Conway student data from 2018 and historical WDFW surf smelt egg mortality records for this site. They ran linear regression

analyses to determine if there was a significant relationship between years since restoration and a) fish diversity (slideshow 1) or b) surf smelt egg mortality (slideshow 2).

La Conner Results

La Conner's surf smelt surveys corroborated with earlier studies by the Skagit River System Cooperative, finding no signs of spawning at Lone Tree Point beaches (slideshow 3 Surf Smelt). Students from each of the classes at La Conner found water quality data inside and outside the pocket estuary created by the spit at Lone Tree Point, to be within healthy limits according to the Swinomish Department of Environmental Protection Water Quality Parameters (slideshow 3 Water Quality). The fish diversity group ran a T-test to determine if there were more fish species and more fish abundance inside than outside the pocket estuary and found some interesting results (slideshow 3 Fish Diversity and Abundance). Though La Conner had less class time for the project, often low attendance rates during school visits, and no luck finding smelt eggs on the beach, as a whole class, we pulled together to derive meaning from what we did find. Including that not finding what you're looking for is also data!

Students created figures and calculated correlation coefficients and p-values, learning both scientific and translational language around these concepts to communicate their data to a broad audience. These were imbedded artfully into slideshows along with research summaries and several of the photos included in this report. All of the steps of their journey were recorded in the UC Berkeley Museum of Paleontology's How Science Works Web Interactive app.

Science Communication

Nervous but prepared students presented their research in a forum modeled after a scientific conference at Padilla Bay NERR's conference center (Figure 4). The conference was attended by many of the project volunteers, and members of the local marine science community. I could not have felt more inspired nor impressed by the depth of understanding communicated by these students to a sophisticated and mixed audience.

La Conner students overcame the challenge of having little class time to prepare, stepped up to cover missing presenters, and helped one another to tell the story that their data revealed with a true team spirit: the beaches at Lone Tree Point may be too exposed and armored for ideal surf smelt habitat. They recommended looking in June and October again and to continue to remove beach armoring. They showed that there was indeed more fish diversity in the pocket estuary and considered the enhancement to protect this sheltered refuge a success. They were particularly excited to report coho and chum fry using the lagoon, supporting a historic cultural fishery at this site.

Conway students' effort and time shown as they revealed a slight increase in fish diversity and smelt egg survival with a greater time since beach restoration. They recommended that the Samish "plant seeds of more plants like trees on the less-restored beaches to supply more defense against intense heat."

Figure 4: Top: Swinomish Tribal Community members present water quality data at Lone Tree Point. Bottom: Conway students explain the variations in fish diversity along the gradient of restoration sites in Fidalgo Bay.

Pre- and post-project survey results

Mira and Holli made a final visit to the classroom to congratulate students, administer a post-assessment, collect a sample of student journals, and ask for student and teacher feedback. Survey results indicated that this research improved student understanding of the process of science and Salish Sea habitats, increased their interest in science, and instilled a solid belief that

kids can do scientific research that can influence decisions about ecosystem management (Table 2, Figures 5-7).

Student feedback

Figure 5: Student ratings of the listed opinions by Conway, top, and La Conner, bottom.

One = disagree, 2 = no opinion, 3 = I agree! Red = Doing this research increased my interest in Science. Purple = I care about protecting Salish Sea wildlife and would like to meet other students who do, too. Blue = Kids can do scientific research that matters and influences decisions about ecosystem restoration.

Do you feel that this research experience helped prepare you for state science testing and for high school science classes?

"I do think this experience has helped me prepare for future tests because we got to go in first hand what it is like to be a scientist and be able to go through the whole process. We got to learn about how scientists make proposals and we got to see what it would be like to be a scientist." -Bryson H., Conway

"Yes. I think it helped prepare me to be exited and organized in a project. It helped me to learn to work with others and to know how to get something done in not a lot of time." -Eliza L., Conway

"I feel that it did help for the test and for high school because we now have actual experience with research that we will be doing in high school and on the test." -Morgan R., Conway

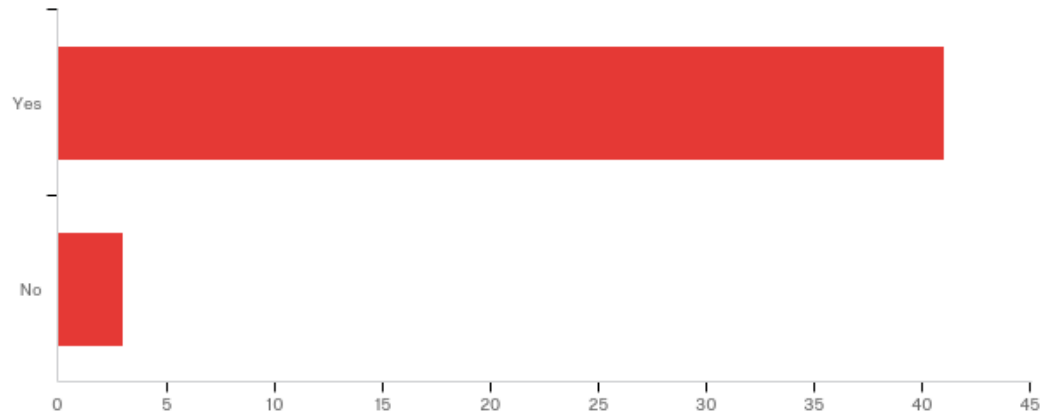
"I feel that this research project gave me experience and knowledge for High school because it gave me an idea of how data and math plays into the real world." -Jillian B., Conway

"I feel like it helped me see what I will be doing in high school science. This a cool real-life example of what we may be doing." - Kevin E., La Conner

"Yes. Now I know more about the procedure in science experiments." -Finn H., La Conner

"I think it did because I know how to properly collect and record data." -Josie H., La Conner

Would you recommend this experience to next year's 8th graders?



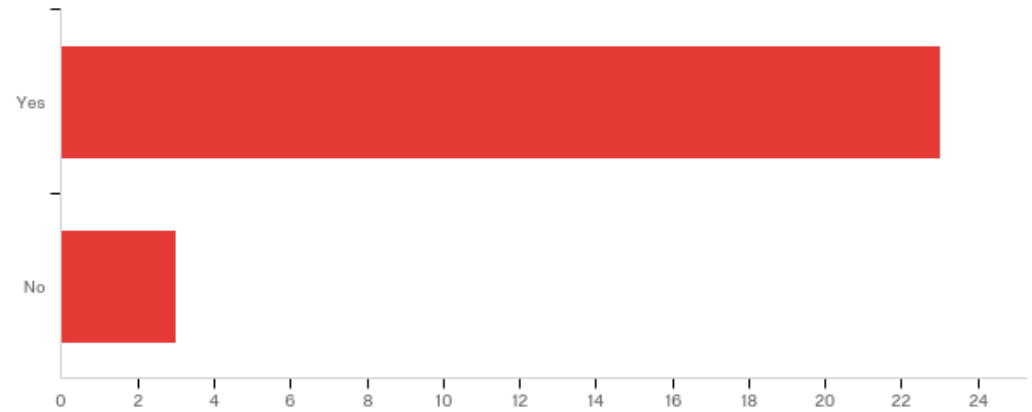


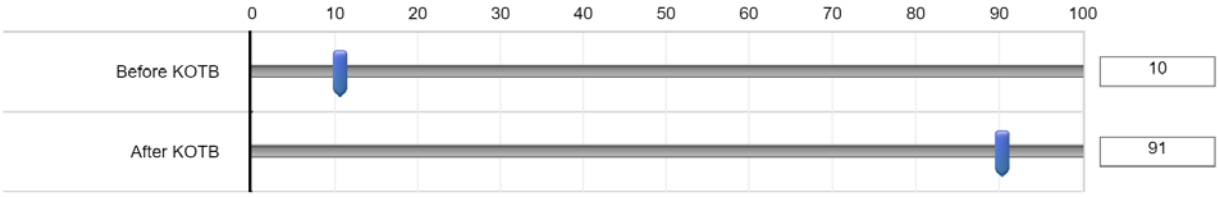
Figure 6: Count of students recommending this project to next year's eighth graders at Conway, top, and La Conner, bottom.

What was your favorite part of the fish research project?
"Being out on the field and doing research by hand." -

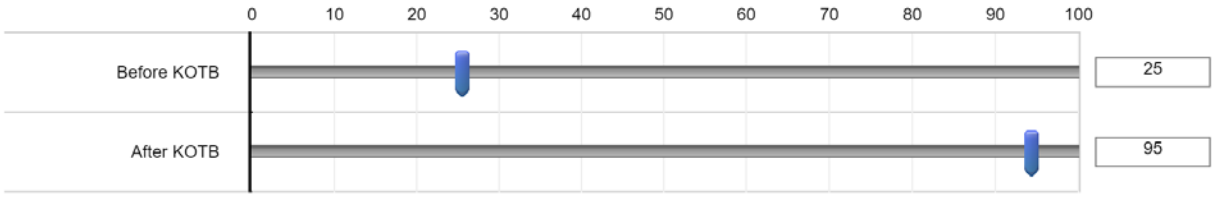
Teacher feedback

Ron Haywood of Conway wrote a letter to the Skagit County Commissioners about his experience with Kids on the Beach (Document A1). He also shared the following feedback.

Q1. Rate your students' awareness of Salish Sea wildlife ecosystem needs before vs. after experiencing the Kids on the Beach research project.



Q2. Rate your students' awareness of the role of science in ecosystem recovery before vs. after the Kids on the Beach research project.



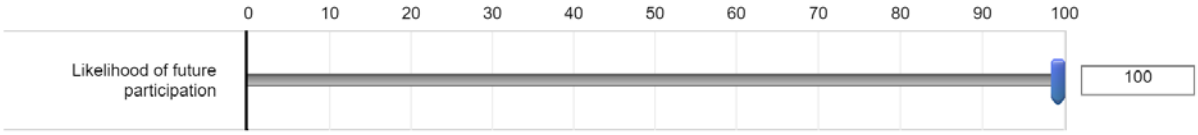
Q3.
Did participating in the Kids on the Beach project increase student interest and/or engagement in Science? Include additional input (optional).

- (●) Yes — Most students demonstrated focus and interest in the project. Much more engagement in KOTB than any other project in my classroom.
- ( ) No

Q4. Do you think experiencing the whole scientific process in the Kids on the Beach research project helped prepare students for the WCAS? Describe (optional).

- (●) Yes, this research project provided direct support for the state science test. — Students need to design their experiment including hypothesis and procedure, also data needed to be organized and analyzed with a conclusion which are necessary to understand parts of the state test.
- ( ) No, KOTB content was irrelevant to WCAS test items
- ( ) Somewhat

Q5.
Rate the likelihood that you would participate in the Kids on the Beach project again if given the chance.



Q6 - Please share any suggestions for improvements you have here. Thank you so much for helping ... Page

Please share any suggestions for improvements you have here. Thank you so m...

Possibly sharing results with other students from another part of the world. I'm sure there are other studies by middle school students of other ecosystems. It would be a very tall order and call for some major planning and videoconferencing but sharing the presentation with others would be very special. Also, maybe there is more the Samish or Swinomish could do to honor our work? Coordination with other groups for some tree planting might be awesome.

Figure 7: Results from post-KOTB teacher survey. Conway only, La Conner teacher did not complete the survey.

Student Post-assessment scores

Students from both schools showed growth in their understanding of the importance of the Salish Sea as one intact ecosystem, the role of forage fish in the ocean food web, and the effects of beach enhancement on fish habitat (Table 1).

Table 1: Average assessment scores before and after the research project for each class. Questions measured student knowledge about the Salish Sea as one ecosystem, food webs, and how restoration affects fish diversity or forage fish spawning. Percentages indicate number of students with correct answers.

	Pre-assmt average	Post assmt average
Conway	20%	70%
La Conner	10%	76%

Media coverage

Skagit Valley Herald's Kimberly Cauvel, covered the story of KOTB year 2 with her characteristically wonderful environmental research description and Scott Terrell's vibrant photographs. The Skagit Valley Herald photos and links to articles are found below.

Conway School eighth-graders Catie Couch (left) and Katelynn Hubbard react Wednesday at the prospect of handling a fish. The two gathered their courage and measured the fish during a youth program sponsored by the Skagit County Marine Resources Committee at the Fidalgo Bay RV Resort.

Scott Terrell / Skagit Valley Herald

Eighth grader Lexi Leiss (left) measures shrimp Thursday from a beach seine at Lone Tree Point on the Swinomish Reservation. Scott Terrell / Skagit Valley Herald

Partners for program expansion

Raegen Lee (background) pours seawater into a container for testing Thursday as Jensen Brooks asks a Question about her sample during an activity guided by the Swinomish Department of Environmental Protection.

Figure 6: Photos from the Skagit Valley Herald article, covering Kids on the Beach at Lone Tree Point. Photos by Scott Terrell, SVH.

Program Transition and Expansion

This project was conducted by the SeaDoc Society, which is transferring leadership of the program to the capable hands of Padilla Bay NERR for the 2019/2020 school year. Along with Conway, Padilla Bay has already brought on a school in Concrete and Bayview for projects, both in Fidalgo Bay and their sites in Padilla Bay. They will expand project focus to include surveys of invasive species (Batillaria snails) and eelgrass at their beaches. I have shared all project documents, resources, and contacts with Padilla Bay NERR to support the ongoing success of KOTB.

Acknowledgements

This program would not have been possible without the enthusiasm, trust, and patience of the two Science Teachers, Ron Haywood and Bob Plank, who believed in the value of authentic outdoor learning enough to add this involved project to their full schedules. The generous support of the Samish Indian Nation provided a formal, heartful greeting by elder, Rosie Cayou James to open our day at Fidalgo Bay Resort. Samish also donated the use of their land on Fidalgo Bay, their conference center on the site for microscopy and lunch shelter, and a Samish Department of Natural Resources staff member, Matt Castle, to lead the beach seining work. And the Swinomish Tribal Community Department of Environmental Protection, who arranged for opening words by elder, Raymond Mitchell and whose Water Quality staff, Nicole Casper and Andrea Pitz, arranged for the use of buildings at Thousand Trails Resort for gathering, microscopy, and lunch, and led water quality sampling and education. Thanks goes to the Skagit County MRC, especially Tracy Alker, for project oversite and funds allocation, to the NW Straits Commission and Foundation, the Puget Sound Partnership, and the US Environmental Protection Agency for granting funds to hire One Ocean Environmental and provide busing for Conway students. Finally, thanks belong to the army of volunteers for beach seining, including Paul Dinnel, Chris Brown, Darla Gay, Shirley Hoh, Jack Middleton, Don Coleman, Dennis Tucker, and Tom Richards, and for forage fishing, Pete Haase, Charlette Turman, Wayne Huseby, Tom Flanagan, Susan George, Lilya Jaeran, Brad Smith, Dale Fournier, Bob Weathers, Sara Holohan, Alison Lubecik, and Amy Eberlink, who were all rallied and wrangled by the Fidalgo Bay Aquatic Reserve Citizen Stewardship Committee, The Northwest Straits Foundation, Trail Tales, and Friends of Skagit Beaches. This was a shining example of what environmental scientists and citizen and student scientists can do together to heal the Salish Sea!

Figure 6: Die hard volunteers still standing after a brisk day with boisterous student scientists at Lone Tree Point, Swinomish Reservation.

Appendix A

Figure A1: Google Doc link: Sample winning research proposal by Conway with rubric score.

Table A1: KOTB Research Proposal Scoring Rubric with maps of research sites for each school

Kids on the Beach 2019 Research Proposal Scoring Rubric

0 = missing 1 = present, but poorly developed, lacking detail
2 = present and complete, but lacking clarity, thoroughness, or detail
3 = complete, articulate, thorough, and clear

Introduction-project background, including importance of forage fish or juvenile salmon in the ecosystem and a clear question to address	0	1	2	3
Research project rationale-why it is important to conduct this study	0	1	2	3
Procedure-Clear steps to completing the study with identified variables and replicate sampling	0	1	2	3
Budget-how the $2,000 will be spent in your proposed procedure	0	1	2	3
References cited	0	1	2	3
Total out of 15 possible points				

Document A1: Letter to Skagit County Commissioners by Conway Science Teacher, Ron Haywood in praise of Kids on the Beach.

A respectfully good morning to all,

I spoke at the MRC celebration on Tuesday June 18 and in hindsight, I feel the need to add a few more statements to my gushing positivity about the KOTB program since I feel I was not prepared for the event and left out some important items.

The overwhelming success of the KOTB is mostly due to the efforts, organization of resources, and masterful teaching of Mira Castle. Imagine dropping into 8th grade classes in the Spring when their lives are full of all the distractions regarding their last year in Middle School and moving up to High School. She energized them to believe in the importance of this work, that their data would be a part of the Database that Scientists use to make decisions, and focused their abilities to analyze the results and present publicly in front of scientists. An amazing feat!

Not many educators could successfully pull this off.....orchestrating such a high level Science Project from start to finish in only 3 weeks with students and presenting their work publicly at a Symposium. Her ability to guide this project, not with just one school as in last year but with two schools as La Conner participated this year with Conway, is remarkable and needs to be acknowledged.

In my entire teaching career, I have not seen or been a part of a project like this one and I actively search for new engaging projects for my students. In 3 weeks our students are exposed to the process of environmental science from asking questions to writing proposals, collecting data to analyzing results and the importance of communicating the results to the science community.

In conclusion, Mira Castle, KOTB and all the volunteers and organizations that helped make this a valuable and meaningful project have produced a project that I believe should be continued for years and possibly expand to other middle schools around the Salish Sea (and beyond?). I am extremely fortunate to have been a participant with my students in the 2 successful years of this Program and look forward to next year.

Thank-you again to the Puget Sound Partnerships, Northwest Straits Initiative and Skagit Marine Resources Committee, Sea Docs, and all the volunteers that helped make this outstanding project happen. Thank you for your time,
Sincerely,

Ron Haywood

The beauty of a living thing is not the atoms that go into it, but the way those atoms are put together.
-Carl Sagan

Ron Haywood
Middle School Science Teacher
Conway School
19710 State Route 534
Mt Vernon, WA 98274
Phone: 360-445-5785
Fax: 360-445-4511