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Introduction

In 2017-18 Clallam MRC hosted or participated in three larger public events and hosted numerous speakers at the monthly meetings. This report summarizes the educational outreach efforts performed by Clallam MRC to reach adult audience about current marine issues, such as climate change, shoreline armoring, stormwater runoff and the impact of free-running dogs on West Elwha Beach.

Public Events

Celebration of Science April 28

The successful Celebration of Science event in 2017 was repeated in 2018 under the title Celebration of Science and Technology. The free event took place Saturday April 28th between 10 am and 4 pm at the Port Angeles City Pier. Again this year Clallam MRC had one of numerous booths at the event celebrating the essential role science and technology play in our daily lives. The Clallam MRC booth displayed a large map of our projects along the Strait and general promotional material including a sign-up sheet for people interesting in volunteering for the MRC.

Figure 1. The map displaying the work done by the Clallam MRC

In additions to the booths there were poster displays, kid's activities and public presentations. The event was published in the Peninsula Daily News https://www.peninsuladailynews.com/life/drive-4-ur-school-fundraiser-plants-clinics-among-peninsula-activities/ . Several of the Clallam MRC members including Ed Bowlby, Jeff Ward, Lyn Muench and Peggy McClure volunteered staffing the booth. Unfortunately, inclement weather this year affected the participation of local residents.

Intern Celebration August 20

Since 2010 Clallam MRC has provided paid internships to high school and college students to work with scientists and other professionals on current environmental projects. For the last four years, the internships have been tied into the four major categories of Clallam MRC's projects: nearshore, water

quality, marine species, and education & outreach. The internships culminate in the Intern Celebration – a public event that showcases the interns and the work done by Clallam MRC.

In 2018 the Clallam MRC expanded the program through funding from the Northwest Strait Foundation to sponsor seven interns. The expansion has been possible through collaboration with the Jamestown S'Klallam and the Makah Tribes. The students were Lael Butler, Kennedy Cameron, Collin Boe, Rylan MacDonald, Cole Svec, Christopher Reis, and Griffin Hoins. During the public Intern Celebration event August 20th the students presented their projects to more than 40 local residents at Feiro Marine Life Center (Figure 2). The projects included green crab trapping and removal, kelp bed monitoring, West Elwha Beach stewardship, and pigeon guillemot monitoring. The four posters funded by the NWSC are submitted as separate files.

Figure 2. The audience at the 2018 Intern celebration

Dungeness River Festival September 27-28

At the 2018 festival the Clallam MRC booth was one of 20 booths staffed by local, state, federal, tribal and nonprofit entities active on the North Olympic Peninsula. The booths offered interactive nature exhibits and activities, as well as exhibits providing information on numerous environmental topics from the impacts of marine debris and failing septic systems to wildlife living in the Olympic National Park. The display at Clallam MRC's booth focused on the importance of good habitat and clean water for healthy shellfish populations. Live geoducks, Olympia and Pacific oysters provided a way to talk about water quality and other essentials of marine habitat. Many of the visitors were also interested in learning about the biology of geoducks. The geoducks were provided by Elisabeth Tobin from Jamestown S'Klallam Tribe and the Olympia and Pacific oysters were on loan from Feiro Marine Life Center. The booth also displayed the two posters made by the 2018 summer interns and a poster which summarized all the major Clallam MRC projects throughout the years.

Figure 3. The Clallam MRC booth display and the two 2018 intern posters displayed at the booth.

Clallam MRC members Alan Clark, Jeff Ward, Bob Vreeland, Peggy McClure and Ann Soule along with Clallam MRC staff staffed the booth during the event. The festival reached about 1,500 festival participants; an estimated 350 local residents came Thursday for the family and community evening and approximately 800 3-5 grade school students enjoyed the festival the following day along with their teachers, chaperons and other residents which made up the remaining 350 participants. This year students visiting each booth asked the following question of the booth presenters "What do you wish for the future of the Dungeness River?" After listening to the answer and coming up with their own answer each student received a stamp under the question printed on their festival passport. The question and the live shellfish provided a way to talk about water quality and other essentials of marine habitat, and the stamped passport offered a reminder to the student about both the geoduck and the importance of marine habitats.

Figure 4. The first wave of students

Figure 5. The MRC booth filled with interested students

Figure 6. More students at the MRC booth

Figure 7. Some of the students going between booths

The festival was featured in Sequim Gazette http://www.peninsuladailynews.com/entertainment/sequims-river-festival-celebrates-20-years/ and in Peninsula Daily News http://www.peninsuladailynews.com/life/photo-feting-20-years-of-river-education/. The festival was also featured on the Dungeness Audubon River Center website and blog http://dungenessrivercenter.org/dungeness-river-festival.

Speakers at Clallam MRC Meetings

Neah Bay October 16

Two speakers presented at the MRC meeting in Neah Bay. Thirteen residents and MRC members participated in the meeting.

Adrianne Akmajian, Marine Ecologist for the Makah Tribal Fisheries, gave a presentation highlighting two current projects: a comprehensive inventory of intertidal and near-shore species including aerial and ground surveys and European green crab trapping and assessment.

Figure 8. Adrianne Akmajian and Ryland MacDonald displaying a green crab caught in summer 2018.

The comprehensive inventory of species/ resource abundance and composition will create a baseline for monitoring effects of climate change or an oil spill. Aerial photos were taken of the Makah Reservation intertidal areas to map nearshore habitat and substrate types. On the ground surveys were then conducted to ground-truth the aerial photos and to identify the seaweeds and invertebrates. In summer 2017 tribal biologists used shoreline classifications to determine survey areas and using a random approach 29 rocky beach segments were surveyed. The surveys included vertical transects, recording presence/absence of seaweed and non-motile invertebrates within quadrats and recording counts of mobile invertebrates. They are currently in the process of analyzing the data.

In October 2017 the Makah Tribe in collaboration with Washington Sea Grant, Washington Department of Fish & Wildlife and US. Fish & Wildlife Service performed a trapping survey for green crab in a couple of tribal rivers. Unfortunately the two-day effort caught a total of 34 green crabs. In spring and summer 2018 the Makah Tribe conducted an extensive trapping and removal effort of the green crab (Figure 8).

Ray Colby, Water Quality Specialist for the Makah Tribal Fisheries, provided a brief summary of other current projects carried out by the Makah Tribe. One of these projects focuses on investigating whether climate and oceanic changes in their usual and accustomed areas are related to ocean acidification. This project is conducted in two phases and includes the use of stable isotope ratio analysis on carbonate powder samples to study ocean acidification. The first phase performs shell carbonate research on three targeted species (geoduck, California mussel, and sea scallop) representing the marine environments from the beach, the island, to the seawater depth of about 10 m. The second phase uses finfish otoliths (mainly rockfish and bottom fish) to investigate the effects of ocean acidification in the deep ocean (>300 m).

For the past few years, the Makah Tribe has been conducting studies to compare the fishing performance of their traditional halibut hook (called a čibu·d – pronounced “chi-bood”) to circle hooks commonly used in halibut fisheries. In 2015, the tribe found that while circle hooks catch more halibut, they also have a significantly greater rate of bycatch than the čibu·d. In 2017 the fishing performance of čibu·d made from brass, wood, stainless steel and plastic was evaluated. Using herring for bait, the tribe found the fishing performance was about the same for the plastic, steel and brass čibu·d, but not as good for the wood čibu·d. Since the plastic čibu·d was more economical to make and maintained a more consistent shape, it was used for the second phase of the study in August. Its fishing performance was compared to a circle hook during August. Results from the summer’s efforts will be analyzed this winter and submitted to a peer-reviewed publication.

Port Angeles March 19

One speaker presented at the MRC meeting in Port Angeles. Fifteen residents and MRC members participated in the meeting.

John Gussman gave a presentation on his recent work with drones. In 1982 John began his own business, Doubleclick Productions. One of his most rewarding projects was making "Return of the River", a feature length documentary about the Elwha River dam. The project took 4 years to complete and with the help of his partner Jessica Plumb, John produced an award winning film shown worldwide (Figure 9).

Figure 9. John Gussman and Jessica Plumb during filming of “Return of the River.”

For the last few years John has worked quite extensively using UAV drones for both still pictures and video, as well as aerial mapping work. He is FAA licensed and is insured to fly any commercial application for clients. John gave a summary of the different drones he has used through the years and what is currently on the market – from a “make it yourself” version costing around $10K in 2012 to present day state of the art drones. Currently, John is using a Phantom #3 drone which comes with a wide angle

camera. John showed examples of his aerial still pictures, aerial mapping and films taken with the drone. Surveying 40-50 acres for aerial mapping takes about 10 min to do. One of the latest short films John has made is “the Return of the Kings” which is available online. The presentation included a brief demo of flying the drone.

Port Angeles June 18

One speaker presented at the MRC meeting in Port Angeles. Twenty residents and MRC members participated in the meeting.

Al Bergstein gave a presentation on the law suit against the Army Corps of Engineers filed by Sound Action, WEC and Earthjustice. Al, a board member of Sound Action, began his presentation with a short introduction of Sound Action. Sound Action is a non-governmental organization primarily focused on reviewing every nearshore development permit issued by Washington Department of Fish and Wildlife (WDFW). Sound Action has one fulltime employee. In Washington State, the primary law governing nearshore habitat protection is called the Hydraulic Code, and any in-water development work requires a permit called an HPA which is under the jurisdiction of the WDFW. Unfortunately, there are significant gaps in the WDFW administration of the law with the department approving every permit, regardless of scale or impact. In Puget Sound more than a quarter of the natural shoreline has been lost to seawalls, bulkheads and other structures. Natural shorelines including soft sandy beaches provide crucial habitats for forage fish and armoring destroys that habitat. Today the majority of shoreline-armoring projects in Puget Sound get no federal review. Not by the U.S. Army Corps of Engineers or any other agency mandated to protect threatened and endangered species. That is why Sound Action along with other environmental groups has filed a lawsuit in U.S. District Court seeking to expand the environmental review of shoreline projects. Since the 1970s, the Seattle District of the Corps has defined its Clean Water Act (“CWA”) § 404 jurisdiction in the Puget Sound region to extend only up to the “mean higher high water” mark , which is an average of the higher of the two high water marks each tidal day observed over a nineteen-year period. Under the CWA’s implementing regulations, however, the Corps’ jurisdiction extends to the “high tide line” and this definition is used in all other states. Approximately one quarter of high tides in the Seattle District exceed the mean higher high water mark, meaning the Seattle District’s CWA jurisdictional marker is significantly below the high tide line. As a result of this, the majority of shoreline armoring projects in the Puget Sound region escape federal review under the CWA, which in turn means that such projects are not evaluated under other federal laws for the protection of environmental values, including the Endangered Species Act and National Environmental Policy Act.

Neah Bay July 20

Three speakers presented at the MRC meeting in Neah Bay. Seventeen residents and MRC members participated in the meeting.

Patricia Sternback, the Project Lead for the Makah Environmental Health, gave an update on the Warmhouse Beach Dump Superfund Site cleanup. The site lies within the Makah Indian Reservation and includes an inactive dump about 7 acres in size, with waste as deep as 20 ft. in some areas. Municipal and household solids and hazardous wastes were disposed of at the site from the 1970s until 2012. The dump was used by the Makah Air Force Station, Indian Health Services, US Coast Guard, the Makah Tribe, and other local and non-local residents and other entities such as the Cape Flattery School District. The site is within the Olympic National Marine Sanctuary which provides habitat for 29 species of marine mammals and 90 species of marine birds. The Makah Tribe has been monitoring surface

water, sediment and groundwater around the dump since 2001 and in 2009 the tribe petitioned EPA to conduct environmental assessments of the dump because of concerns about hazardous substances leaching out from the dump. In 2013 the site was listed on the Superfund National Priority List. The first step in the Superfund process after listing on the site is the remedial investigation. The Warmhouse Beach Dump is currently at this step which includes delineating the nature and extent of the contamination and assessing the risks to people and the environment. The following steps include the feasibility study which describes and compares cleanup alternatives, the proposed cleanup plan, the record of decision, remedial design, and finally remedial action cleanup of the site.

Katie Wrubel, Natural Resource Policy Analyst for the Makah Tribe, gave a presentation on the tribe's climate change project. The Makah Tribe views climate change as one of the biggest threats to their natural resources and the rich and unique biodiversity of their coastal lands and waters, their livelihoods, economy, and culture. In 2014 they commenced a climate change assessment and from the assessment the following lessons were learned: the dense, highly technical review of literature found that it was written by scientists for scientists, there was a lack of traditional and cultural knowledge expressed in the literature and there was a lack of planning relevancy. How does a vulnerability assessment translate into an adaptation plan? And how can an adaptation plan be implemented? Part of the assessment included a workshop with more than 20 core team members and advisors. One of the outcomes of the workshop was a climate adaption logic model (Figure 10).

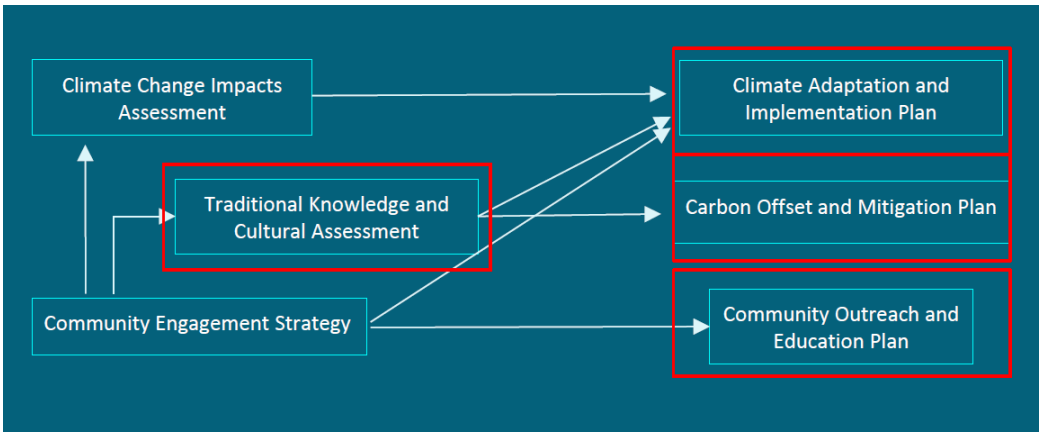

Figure 10. Makah Tribe's Climate Adaption Logic Model

The climate impacts assessment includes a review of current western science for consensus climate impacts relevant to Makah focusing on the following five sections: terrestrial, marine, aquatic, infrastructure, and health. Another task is a species vulnerability assessment in which they compile a 2-page description for each species' vulnerability to projected climate change impacts for the almost 100 species in the area. Finally they are conducting an assessment of Makah traditional ecological knowledge which includes interviewing Makah tribal members on how cultural activities have been impacted over time.

As part of climate adaptation and planning the Makah Tribal Council and tribal natural resource managers have prioritized early community outreach and engagement efforts in order to accomplish three goals: continually update and inform the tribal community about the Tribe's climate adaptation efforts; gather community input and priorities to inform the Makah Climate Adaptation Plan; and provide a series of educational events to engage the tribal community about projected climate change

impacts to our resources. The first community dinner was held in February 2017. Members of the climate change workgroup discussed ongoing and future work and people were asked to take the community survey. A total of 200 community members came to the event and 140 responded to the survey. Some of the main concerns were freshwater availability and impacts to fisheries.

Future community events are planned for 2018 and 2019. Next steps include traditional ecological knowledge assessment and community outreach efforts, climate change workgroup to discuss potential climate impacts internally and with tribal community, identify short-term and long-term strategies to build resilience, identify ways to reduce our impact and strategize how to secure funding resources to implement. Two climate adaptation strategies are currently underway: securing funds to alter fishing fleet engines to become more sustainable and emit less greenhouse gases and changing old woodstoves for newer, more efficient woodstoves for community members. Future strategies include scoping of water supply, carbon footprint analysis and carbon sequestration (restoring eelgrass, trees, and kelp habitats to store carbon).

Cole Svec, the Clallam MRC sponsored intern, gave a presentation on the Makah's green crab removal project. Green crabs were discovered near Neah Bay in fall 2017 and starting April 2018 the Makah Tribe initiated an intensive trapping effort. Currently the tribe is setting about 60 minnow and Fukui traps in areas of the Wa'atch and Tsoo-Yess rivers and along the shore of Neah Bay twice a month. Captured green crab are recorded by sex, color, size, location, missing limbs, and molt and pictures are taken before the crab is placed in a plastic bag and stored in a freezer. Between April 25th and July 7 a total of 581 green crabs have been captured (the total number of crabs after trapping July 20 was around 660). The majority of these crabs were male (about 69%). The trapping effort will continue until end of September. After completion of the 2018 trapping season the tribe will determine the abundance of green crab catch per unit effort and establish a plan for next year's trapping effort.

Port Angeles September 17

Three speakers presented at the MRC meeting in Port Angeles. Thirteen residents and MRC members participated in the meeting.

Tyson Minck Jim Waddell, Elizabeth Dunne gave a presentation on the current efforts to remove the dams on Snake River. The four dams on Snake River were constructed between 1962 and 1975 by the Corps of Engineers. The Bonneville Power Administration (BPA) is in charge of selling the electricity created by the dams. Since 2014 the numbers of customers and direct service industry loads have declined and currently the dams produce a surplus of electricity between 15 and 50%. So the BPA has to sell the electricity on the open market often at a loss.

In 2002 the Corps of Engineers published the "Improved Salmon Passage" the Final Lower Snake River Juvenile Salmon Migration Feasibility Report/Environmental Impact Statement. Four different alternatives to improve the salmon passage were evaluated in the report: 1) maintain existing conditions, 2) maximum transport of juvenile salmon, 3) major system improvements, and 4) dam beaching. Carrying out Alternatives 2 and 3 has failed to improve the salmon populations and the dams have reached their expected lifespan. Hence, breaching of the dams is the only alternative left. Often when people think about dam removal they expect a large price tag associated with the effort. This is not the case with the dams on Snake River. BPA can save $38-83 million dollars allocated for the 2019/2020 operation & maintenance fees and they can mitigate the cost of the breaching via the Endangered Species Act which will reduce the cost of beaching the dams to $0 for BPA. Breaching the

dams would involve making a notch in the earthen embankment section of each dam and let the river do the rest of the work (Figure 11).

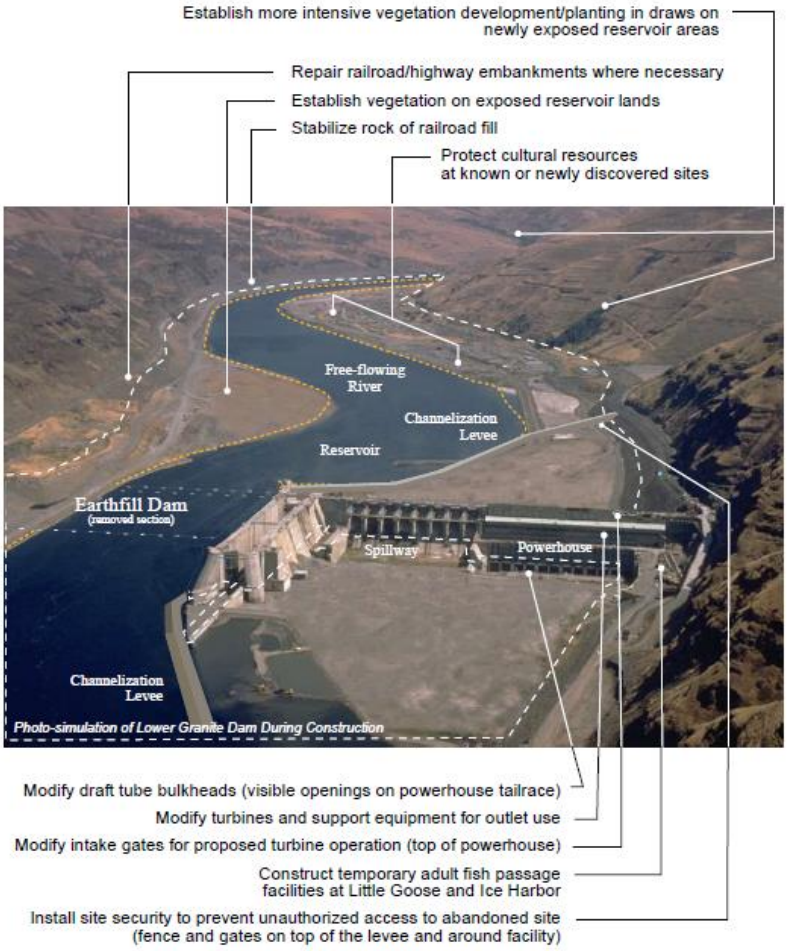

Figure 11. Proposed dam removal at the Lower Granite Dam

The decline in the resident Orca population has refocused the effort to have the dams removed. Each year these whales leave Puget Sound and travel south along the coast to feed. Historically Orcas would spend weeks each winter feeding on adult Chinook salmon in the Pacific, especially off the mouth of the Columbia. One of the biggest factors affecting Orca nutrition is the tremendous decline in Chinook salmon coming out of the Columbia/Snake River basin. On top of this the successful removal of the dams on Elwha River has proven that dam removal is possible. At the end of the presentation Tyler, Elizabeth and Jim encouraged the audience to share the information.