SOUTH SLOUGH RESERVE MANAGEMENT COMMISSION

July 15, 2021

159th REGULAR MEETING 1:00 P.M. - 4:00 P.M.

*** Due to COVID-19 restrictions, this meeting will occur virtually. Commissioners will receive a link by email to join the meeting.

PUBLIC PARTICIPATION:
To receive the Zoom link, please email Katherine Andreasen, South Slough Reserve Administrative Assistant, at katherine.andreasen@dsl.state.or.us by noon on July 14. If you would like to testify, please provide your name, address, and organization/affiliation, if any. Testimony will be heard in the order that requests for the meeting link are received.

Written comments may be submitted until 12 p.m. on Wednesday, July 14, 2021 by emailing them to: katherine.andreasen@dsl.state.or.us

AGENDA

I. Call-to-Order

II. Introductions

III. Review of Meeting Minutes
    1. 158th regular meeting minutes from April 30, 2021

IV. Public Input*

V. Old Business
    1. Legislative Updates
    2. Land Acquisition Update

VI. New Business/Presentations
    1. Economic Contribution Study
    2. European Green Crab Research and Monitoring

VII. Information Reports
    1. Administration/Facilities
    2. Education
    3. Coastal Training
    4. Science
    5. Stewardship
    6. Friends of South Slough

VIII. Next scheduled meeting: Thursday, November 18, 2021 at 1pm

IX. Adjourn

*Limited to 5 minutes each unless arranged in advance of the meeting.
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The meeting was called to order at 9:04 a.m. by Vicki Walker Director of the Department of State Lands and Chair of the Commission.

INTRODUCTIONS

Meeting participants introduced themselves.
APPROVAL OF THE MINUTES OF THE PREVIOUS MEETING

Chair Walker asked if there was a motion to approve the minutes of the previous meeting. Commissioner Mays moved to approve and Commissioner Brainard seconded. The motion carried.

PUBLIC INPUT

There was no input from the public.

OLD BUSINESS

Legislative Updates

Senate Bill 126

Chair Walker introduced the two senate bills and then handed the agenda item to Bree Yednock.

At its December 3, 2020 meeting, the Management Commission approved a Legislative Concept (now Senate Bill 126) prepared by the Department of State Lands (DSL) and Reserve staff related to the management area of the South Slough National Estuarine Research Reserve (SSNERR). If successful, Senate Bill 126 will amend ORS 273.553 so that lands managed by the Reserve that are located north of Valino Island can be included in future expansions of the administrative boundary of the SSNERR. The bill does not change the SSNERR boundary, it only specifies the area that can be included within the boundary. Adjusting the SSNERR boundary requires a subsequent Federal process in coordination with the National Oceanic and Atmospheric Administration.

In early February South Slough Reserve hosted virtual information sessions to provide a summary of SB 126 for members of the public and local stakeholders and to answer questions. On February 8, SB 126 received a public hearing with the Senate Committee on Natural Resources and Wildfire Recovery. Director Walker testified in the hearing and Reserve Manager Bree Yednock attended the hearing to answer questions. Letters of support were submitted as testimony from the Confederated Tribes of Coos, Lower Umpqua, and Siuslaw Indians; the Coquille Indian Tribe; the League of Women Voters; and the Friends of South Slough. The Port of Coos Bay submitted a letter indicating they needed more time to review the bill.

On February 24, the Senate Committee on Natural Resources and Wildfire Recovery voted to move SB 126 to the floor for a vote. A joint letter of support was submitted, signed by DSL Director Walker and the Port of Coos Bay CEO
John Burns to state DSL and the Port of Coos Bay will enter into a Memorandum of Understanding (MOU) prior to the Reserve’s next formal boundary adjustment through NOAA. The MOU will outline the intention of the boundary adjustment and how the two entities will work together.

On March 17 SB 126 passed the Oregon Senate Chamber. The bill was carried by Senator Prozanski. On April 1, SB 126 had its first reading by the House and was referred to the House Committee on Agriculture and Natural Resources on April 7. A public hearing for SB 126 in the House Committee took place on April 27. Chair Walker explained that subsequently the bill will be moved to a work session, and she added that it looks like the Reserve is in good shape to move forward. An application for the Reserve boundary adjustment will follow the expected passage of the bill and this will involve additional opportunities for public engagement. Once the boundary adjustment is completed, the property will be eligible to acquire Federal dollars. Commissioner Wall congratulated the Reserve on the progress thus far.

**Senate Bill 5539**

Ms. Yednock continued her update with the progress on SB 5539. Senate Bill 5539 is the proposed budget for the Department of State Lands, including the South Slough Reserve, for the 2021-2023 biennium. Chair Walker commented that members of the Legislature are very supportive of the Reserve. On March 30 Director Walker presented an overview of the proposed budget to the Joint Committee on Ways and Means Subcommittee on Natural Resources. On March 31, SB 5539 received a public hearing with the Joint Committee on Ways and Means Subcommittee on Natural Resources. Letters of support were submitted by the Friends of South Slough and seven teachers across the state in support of funding South Slough Reserve’s programs.

Director Walker also gave a report during the budget hearing that emphasized the effort and documentation involved over two years that resulted in the recommendation of Director Walker to the Land Board on October 13, 2020 that DSL continue serving as the state partner to the South Slough National Estuarine Research Reserve. There were no objections from the Land Board.

**NEW BUSINESS**

**Wasson Uplands Restoration Plan**

Stewardship Coordinator Alice Yeates delivered a comprehensive report to the Commission regarding the restoration plan which seeks to enhance forest
health and reduce wildfire risk in the forested uplands of the Wasson Creek watershed managed by South Slough Reserve.

Since 2015, South Slough Reserve has been developing a holistic ridgetop to estuary restoration plan for the Wasson Creek Watershed. Prior to state ownership the lowlands of the watershed were drained and used as pastureland, while the upland forests were harvested with no forest management during regrowth. As a result, the lowlands have been colonized with invasive plants, such as reed canary grass, and there is no connection between the ditched channels and the floodplain. The upland forests are now overly dense with closed canopies, few large trees, and sparse understories.

The Reserve’s full restoration plan for the Wasson watershed consists of three main parts:

- Wasson Creek Channel Design
- Wasson Creek Vegetation Restoration Plan
- Wasson Uplands Restoration Plan

South Slough Reserve is requesting approval to begin implementing the Wasson Uplands Restoration Plan, which was recently updated through active engagement by a technical advisory team, grant-supported contractors, and Reserve staff. The plan’s completion coincides with a $64,203 funding opportunity from the US Fish and Wildlife Service to begin project implementation. South Slough Reserve is partnering with the Friends of South Slough who will receive and administer funds. Work is ongoing to complete the remaining parts of the full watershed restoration plan and will be presented to the Commission as they are completed.

The Wasson Uplands Restoration Plan includes the following goals:

- Conduct an inventory of upland ecological attributes in the Wasson Project Area, including tree species and general size, understory, and dead wood characteristics
- Prioritize upland stands in need of active restoration
- Develop stand-specific treatments to improve forest health and heterogeneity
- Incorporate the Wasson watershed into ongoing Port-Orford-cedar (Chamaecyparis lawsoniana) conservation actions
- Determine road/access needs for upper watershed restoration prescriptions and evaluate the potential for eliminating remnant logging roads
- Incorporate wildfire risk planning and identify strategies to support resilient ecosystems in the case of a fire disturbance
• Determine the potential for improving spawning habitat in Wasson Creek headwater tributaries

The Wasson Uplands Restoration Plan supports several research and stewardship goals in the South Slough Reserve’s 2017-2022 Management Plan. Alice Yeates concluded by saying if the plan is approved, outreach will be initiated to build community support. She has been in contact with the Tribes. Future developments discussed include plans to increase public access by re-establishing a trail system that is less steep, as well as utilizing the area for educational opportunities and promoting it as an important cultural resource. Commissioners discussed carbon sequestration options, as well as donations of downed wood to the tribes. Commissioner Chief Brainard offered to provide camas bulbs if they are needed for the restoration.

Chair Walker asked if there was a motion to approve the staff recommendation.

Commissioner Brainard moved to authorize staff to begin implementing the Wasson Uplands Restoration Plan with funding from the US Fish and Wildlife Service administered through the Friends of South Slough Reserve, Inc. and to seek additional funding for implementing the full plan. Commissioner Watts seconded the motion. The motion passed with no opposition.

Staff Presentation

Pampas Grass Removal Project – Alice and Deborah
_Raising Awareness Around Pampas Grass Removal_

Recent public media promotions, including KCBY TV and The World newspaper have featured the stewardship project to remove pampas grass led by Reserve Stewardship Coordinator, Dr. Alice Yeates.

Staff and volunteers continue to both map and remove invasive species from within Reserve managed lands. In January 2021 Reserve staff worked with the Coos Forest Protective Association (CFPA) to remove over 5000 pampas grass plants from around the Reserve. This effort was followed up by a media campaign, assisted by the Coos Watershed Association, asking for the removal of this species from landscaping along the Oregon Coast. Plants are ideally removed in early spring as the roots are easier to dig up and there is less chance of spreading seed. Staff are designing and testing an ArcGIS Collector...
project, which will standardize data collection and track invasive species management.

The presenters were thanked by the Commission for their great outreach.

Information Reports

Staff shared highlights and progress within their program areas.

Seasonal Education Specialist Daniel Dobrosielski has been developing virtual content for the Reserve. He created the “Watershed Investigations” video with help from other staff that is being used by teachers and students across the state.

The Friends of South Slough reported on their activities. Chair Walker thanked the Friends for their letters of support, and she said she greatly appreciated the many-tiered efforts of the FOSS Board on the behalf of the Reserve.

Next scheduled meeting: Thursday July 15, 2021, from 1 – 4 pm

ADJOURNMENT

A motion to adjourn was requested by the Chair. Commissioner Brainard moved and Commissioner Kronsteiner seconded. The meeting was adjourned at 11:11 a.m.
Old Business Agenda Item 1 – *Informational Item*

**Legislative Updates**

I. Senate Bill 126

Senate Bill 126 was submitted to the Oregon Legislature in 2021 to amend ORS 273.553 so that lands managed by the Reserve that are located north of Valino Island can be included in future expansions of the administrative boundary of the South Slough National Estuarine Research Reserve (SSNERR). The bill does not change the SSNERR boundary, it only specifies the area that can be included within its boundary. Adjusting the SSNERR boundary requires a subsequent Federal process in coordination with the National Oceanic and Atmospheric Administration.

A complete measure history was provided in the meeting materials of the Reserve Management Commission’s April 2021 meeting. Since then, the bill passed the final two milestones:

**May 20, 2021:** Senate Bill 126 passed the House. It was brought to the floor by Representative David Brock Smith. Representative Boomer Wright voiced his support for the bill and encouraged his fellow members to visit the Reserve. There were no opposing votes.

**June 1, 2021:** Governor Kate Brown signed the bill on June 1, 2021.

The law will go into effect on January 1, 2022.

II. Senate Bill 5539

Senate Bill 5539 was submitted to the Oregon Legislature’s 2021 session with the proposed budget for the Department of State Lands, including the South Slough Reserve, for the 2021-2023 biennium.

Work sessions were held in June by the Joint Committee on Ways and Means Subcommittee on Natural Resources. Senate Bill 5539 passed the Senate on June 16, and it passed the House on June 22.
Old Business Agenda Item 2 – Informational Item
Property Acquisition at the Visitor Center Entrance

The Reserve is working towards purchasing a 0.56-acre privately-owned property (Appendix A) at the entrance to the Visitor Center. This property is adjacent to the property along Seven Devils Road that the Reserve is purchasing from Coos County. The Reserve Management Commission approved purchasing both properties on November 15, 2019. The State Land Board approved the Department of State Lands (DSL) move forward with due diligence for both properties on June 9, 2020.

Because funding is currently not available, the Reserve Manager is working with on a Purchasing Option Agreement that would allow the Reserve time to securing funding for the purchase. The Friends of South Slough Reserve, Inc. (FOSS) is committed to assisting the Reserve with fundraising for the purchase. In June, the FOSS Board voted to provide $4,000 for a down payment and work to raising the remaining funds for a purchase by October 31, 2022. A letter outlining this commitment was sent to DSL Director Vicki Walker (Appendix B).
June 23, 2021

Vicki Walker, Director
Oregon Department of State Lands
775 Summer St NE
Salem OR 97301-1279

Dear Director Walker:

The Board of Friends of South Slough (FOSS) voted to provide $4,000 for the Department of State Lands to enter into an exclusive option agreement to purchase the 0.56-acre Rolin Block property located in T26S R14W Section 26, Tax Lot 500. We feel this option agreement is important to show the landowner that South Slough National Estuarine Research Reserve is serious about acquiring the property. Furthermore, FOSS has committed to partner with appropriate entities to raise additional funds for this acquisition. FOSS’s commitment on this purchase is valid through October 31, 2022.

Acquisition of this property would assist South Slough’s efforts to manage the entrance to the Visitor Center and trails, as this parcel abuts the entrance.

Thank you for your consideration of acquiring this parcel and FOSS’s support for this transaction. Board members of FOSS will be happy to discuss additional details of this commitment with you and your staff. Please contact President Christine Moffit with questions or concerns.

Sincerely,

Christine Moffit
President

Todd Buchholz
Vice President

FOSS is a nonprofit corporation dedicated to protecting the functions, values and processes of estuaries, and enhancing the work of the South Slough National Estuarine Research Reserve.

541-888-5558 x123; fossnerr@gmail.com
New Business Agenda Item 1 – *Informational item*

Economic Contribution Study

**Economic Contribution of South Slough Reserve**

A recently published study commissioned by the National Oceanic and Atmospheric Administration (NOAA) offered a glimpse into the significant economic contribution South Slough Reserve makes to the Coos County and Oregon economies.

South Slough Reserve was one of four National Estuarine Research Reserves included in the economist-led study, which sought to help NOAA and the national reserve system better understand, identify, and estimate the economic contribution of Reserves to their surrounding communities.

For the purpose of this study, the term economic contributions is defined as the gross change in economic activity in a defined geographic region – in other words, how money ripples through the economy. To evaluate the economic contribution of South Slough Reserve, the study looked at three measures:

- **Direct contributions**, such as the direct spending by the Reserve to local businesses and contractors to support its operations. The spending by Reserve visitors is also considered a direct contribution.

- **Indirect contributions**, which are the secondary effects of a Reserve’s expenditures. For example, a contractor working on a construction project at the Reserve spends money on supplies and labor to complete the project.

- **Induced contributions**, which are the tertiary effects of an expenditure. An example of this includes Reserve employees and contractors spending their earned income money in the local economy at places like restaurants, grocers, and retail stores.

**Data Collection and Calculation**

Staff at South Slough Reserve met with the project team several times over the course of the study and provided data related to the Reserve’s spending across a five-year period, as well as spending by the Friends of South Slough Reserve, Inc., a non-profit organization that supports programs at the Reserve.

Staff also provided direct counts of visitors that came to the Reserve in 2018 and 2019 to attend education programs, Reserve events, or to explore the Visitor Center. To estimate the economic contribution from visitor spending, the project team used data from existing visitor spending studies at similar natural areas.

The project team used an input-output economic model to calculate the indirect and induced contributions to the local economy resulting from the South Slough Reserve’s presence based on the direct expenditures and visitation data described above. The model estimated the Reserve’s contribution to local revenues and jobs.
Results for South Slough Reserve

Key findings from the study indicate South Slough Reserve strengthens Oregon’s coastal economy by supporting local industries and jobs:

- The Reserve contributes over $6.1 million in revenue annually to Coos County and supports about 65 jobs, helping build economic resilience.
- The Reserve brings in nearly 70 percent of its annual spending through grants that are invested locally—funding student internships in science and education and projects at the Reserve. For example, in 2020, the Reserve received nearly $1 million in funds from outside the local area through competitive federal and non-profit grant programs.
- The Reserve’s spending directly and indirectly supports jobs within the community. While the Reserve directly funds 18 staff, spending on staff salaries and local goods and services support over 56 jobs and inject $5.3 million into the economy.
- Visitors who come to the Reserve also support local businesses and jobs. Nearly 10,000 visitors come to the Reserve every year to hike, kayak, and attend events, and the money they spend on food, lodging, and retail, generates an estimated $850,000 in revenue and supports nearly 10 jobs.

Important Considerations

The full report includes the findings for the three additional Reserves that were included in the study and clearly shows that National Estuarine Research Reserves provide valuable economic contributions to their communities. While this study is important for improving our understanding of how Reserves enhance their surrounding economies, it does not reflect their total economic or intrinsic value. Reserves provide numerous ecosystem service values that result from research, stewardship, and other activities that protect and enhance estuaries and surrounding natural areas. Incorporating these benefits would result in a much higher total economic value.

For example, South Slough Reserve also contributes to a resilient economy by monitoring and managing healthy waterways, wetlands, and forests.

- The Reserve’s water quality monitoring program shows that having a protected reserve in the estuary results in clean water that, in turn, supports a thriving oyster aquaculture industry.
- The Reserve undertakes stewardship activities that help maintain and restore healthy coastal ecosystems to provide critical habitat for commercially and recreationally important fishery species such as salmon and Dungeness crabs.
- The Reserve’s research projects contribute to our understanding of how natural and human-built systems will respond to projected sea level rise and other impacts from climate change. This knowledge is being used to inform management decisions related to land use planning and sustainable development.

In addition to the economic contributions and benefits of South Slough Reserve, it is also important to recognize the long-term intrinsic value the Reserve has provided for its visitors and community. For
nearly 50 years, South Slough Reserve has offered place-based educational and recreational opportunities for all ages, resulting in positive impacts on the local community spanning generations. Staff regularly hear of these experiences from teachers who bring their classes for field trips; local contractors, volunteers, interns and partners who work on Reserve projects; scientists who contributed to restoration and research efforts; and visitors who come to hike the trails with their children and grandchildren to pass on the information they learned through their many visits to the Reserve. These experiences are impossible to quantify in dollars, but their value is undeniable.

Finally, we would like to acknowledge the roles of our invaluable community partners, like Friends of South Slough Reserve, the University of Oregon Institute of Marine Biology, and ecotourism company, South Coast Tours. These organizations help bring visitors and volunteers to South Slough Reserve, expanding awareness of the Reserve, and enhancing our economic contribution to the region.
Status of Green Crabs in Coos Bay: Monitoring Report 2020

Shon Schooler\textsuperscript{1}, Sylvia Yamada\textsuperscript{2}, and Kathy Andreasen\textsuperscript{3}
\textsuperscript{1}South Slough National Estuarine Research Reserve
\textsuperscript{2}Oregon State University

Introduction
The European green crab (\textit{Carcinus maenas}) has been transported around the world during the last century and has colonized many temperate coastlines (Behrens Yamada 2001). Numerous research studies have examined the biology and ecology of green crabs and have generally found the green crab to be an aggressive invader that has the potential to negatively impact native species, important estuarine and marine habitats, and fisheries (Behrens Yamada 2001; Howard et al., 2019; Malyshev \\& Quijo\'n, 2011; Garbary et al., 2014; Neckles, 2015; Matheson et al., 2016). The green crab is currently invading the west coast of North America. Greens crabs became established in the San Francisco estuary prior to 1989 (Behrens Yamada, 2001). Since then coastal currents have been seeding green crab larvae into estuaries of the Pacific Northwest, including Coos Bay (Behrens Yamada et al., 2015). In the past, this migration appears to be linked to strong northwards currents during El Niño years (Behrens Yamada et al., 2015), as indicated by a mixture of high abundance years, low abundance years, and extinction events. However, since 2016 the abundance of green crabs has been continuously increasing in Coos Bay and is now at levels where negative impacts are expected.

The purpose of this project is to monitor changes in green crab abundance and evaluate the young-of-the-year (YOTY) age class in the Coos Bay Estuary. The project goals are to: 1) examine change in green crab abundance (CPUE) among sites and over time, 2) examine the YOTY age class to assess size structure and determine whether recruitment is occurring from within Coos Bay.
Methods
At each of the 14 sites we set either six Fukui fish traps or six modified minnow traps during morning low tide and retrieved traps at low tide the following morning (24 hours). Fukui and minnow traps were baited with raw tuna enclosed in a plastic bait container and staked in place with a 20 inch steel rod. When traps were retrieved, the number of individuals of each crab species in each trap was recorded. Dungeness crabs (*Metacarcinus magister*), red rock crabs (*Cancer productus*), and shore crabs (*Hemigrapsus oregonensis* and *H. nudis*) were counted but not measured. When possible, we recorded water quality data (salinity, pH, temperature) at the trap site using a YSI hand-held meter. European green crabs (*Carcinus maenas*) were counted in the field and then brought back to the laboratory and measured for size (carapace width, mm), weight (g), and sex (m/f). Abdomen color and missing limbs were also recorded.

Results
We set 184 crab traps (156 Fukui, 24 minnow) at 14 sites in Coos Bay from February through October of 2020. We captured 858 green, 10 Oregon shore, 141 Dungeness, and 99 red rock crabs. Overall catch-per-unit-effort (CPUE) was 4.66 for green, 0.05 for Oregon shore, 0.76 for Dungeness, and 0.54 for red rock crabs. This includes data for all traps at all sites for all sampling dates from February thru October 2020.

Abundance among Coos Bay sites:
To better compare sites, we selected only sites sampled using Fukui traps during the summer months (May-August) (Table 1). The average CPUE was highly dependent on site. Green crabs were found at all sites, but were most common in the mid to upper estuary sites where adult Dungeness and red rock crabs were absent (Coos History Museum, Isthmus Slough). Red rock crabs were present only at sites lower in the estuary (Charleston Boat Basin, Empire Docks) and adult Dungeness crabs were most abundant at low and mid-estuary sites (Empire Docks, Indian Point N, Valino Island).

<table>
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<th>Site</th>
<th>Latitude</th>
<th>Longitude</th>
<th>CPUE Green (mean)</th>
<th>CPUE Red rock (mean)</th>
<th>CPUE Oregon shore (mean)</th>
<th>CPUE Dungeness (mean)</th>
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**Abundance over time:**

One objective is to look at changes in green crab abundance over time. If we look at mean green crab CPUE collected at all sites over all years during summer months (May through August) using Fukui traps we see a consistent increase in abundance since 2016 (Figure 1). We also see an increase in variability over that time.

Variability may be caused by habitat differences among sites. We detected this in the 2020 site data. We can also examine temporal trends at each site. We see that the temporal trend matches the 2020 trend with consistently more green crabs at mid to upper estuary sites (Figure 2).
It appears that green crabs tend to be more abundant in areas where adult Dungeness crabs are in low abundance. We can look at this directly by comparing the CPUE of the two crab species over time at the same 10 sites (Figure 3).
Figure 3. Mean green crab and Dungeness CPUE at 10 sites in Coos Bay over time trapped using Fukui traps from May – September 2004 through 2020. Note varying scale on y-axis.
Size Structure of the young-of-the-year age class:
Size distribution of YOTY crabs gives some insight into the recruitment source. A single tight bell-curve shaped distribution indicates that the larvae arrived in the estuary at approximately the same time, likely from the same location. Flat or double-humped distributions indicate that larvae may have arrived in more than one cohort, suggesting multiple sources. We examined the frequency distribution of YOTY green crabs using September 2020 minnow trap data. Minnow traps tend to capture smaller crabs, but some larger crabs can enter the traps. We removed data from crabs larger than 60mm carapace width as these are likely from the previous year’s recruitment (Figure 4).

![Crab size frequency distribution for YOTY green crabs sampled at four sites in Coos Bay in September 2020 using modified minnow traps.](image)

Discussion
We found that green crab abundance is generally continuing to increase throughout Coos Bay. However, abundance is highly variable with some sites increasing substantially and other sites changing very little. As green crab populations increase, we will likely see negative impacts on organisms, habitats, and fisheries (Grosholz et al., 2011).

Potential Impact on Eelgrass
Studies along the east coast of North America, where green crabs have been abundant for decades, have found that the increasing green crab populations have caused large declines in eelgrass meadows (Malyshev & Quijo´n, 2011; Garbary et al., 2014; Neckles, 2015; Matheson et al., 2016). A recent study along the coast of British Columbia found similar results (Howard et al., 2019). These studies found that green crabs destroy eelgrass meadows both directly, by eating eelgrass rhizomes, and indirectly, when digging for food (bioturbation). Observed negative impacts appear to start at
around 20 CPUE (although most studies measured crab abundance as a function of area (number per square meter), so direct comparisons are difficult). Since the Coos History Museum site has increased to 26.5 crabs per trap in 2020 from 11.3 crabs per trap in 2019, it is likely that eelgrass populations in the mid-upper area of Coos Bay are experiencing some negative impact from green crab foraging. Since eelgrass is an important foundational habitat for many marine and estuarine organisms, we expect to see flow-on impacts to these species as their habitat declines. For example, researchers in Newfoundland found a 10-fold decrease in abundance and biomass of fish in beach seines when comparing areas of eelgrass habitat destroyed by green crabs and nearby eelgrass meadows without green crabs (Matheson et al., 2016).

Potential Impact on Dungeness Crab

The greatest increase in green crab abundance is at mid to upper estuary sites where adult Dungeness and red rock crabs are absent or in low abundance. However, juvenile Dungeness crabs tend to forage in upper and mid estuary nursery sites. For example, in 2018 we captured over 200 juvenile Dungeness crabs per seine sample in both September and October in the upper reaches of South Slough (Sengstacken arm near Elliot Creek). Previous research has found that green crabs displace juvenile Dungeness crabs from desirable sheltered habitats, which increases their chance of being preyed upon (McDonald et al., 2001). Green crabs also consistently win nocturnal foraging trials over juvenile Dungeness crabs (McDonald et al., 2001). The authors conclude that green crabs could negatively impact the Dungeness crab fishery as green crabs encroach on juvenile Dungeness crab nursery habitat, such as what is currently happening in Coos Bay. In addition, a 2019 study conducted by South Slough National Estuarine Research Reserve researchers found that red rock crabs prefer to predate on juvenile Dungeness crabs over green crabs of the same size, indicating that predation by adult crabs might reduce green crab abundance, but will not necessarily be favorable to Dungeness crab populations (Heller and Schooler, unpublished data). As described above, as green crabs increase in abundance, they will also destroy eelgrass habitat, which is a favored habitat of juvenile Dungeness crabs.

Potential Impact on Bivalves

Green crabs are also known to negatively affect populations of clams, oysters, and mussels. Studies on the east coast of North America found that green crabs ate bivalve species including quahogs (*Mercenaria mercenaria*), eastern oysters (*Crassostrea virginica*), blue mussels (*Mytilus edulis*), and soft-shell clams (*Mya arenaria*) (Miron et al., 2005). They found predation on these species across a large range of sizes (0-40mm) with green crabs preferring to feed on mussels and clams.

Green crab self-recruitment in Coos Bay

The young-of-the-year size (YOTY) distribution did not indicate the presence of two size cohorts in 2020 indicating no evidence of two different recruitment sources. However, this does not mean self-recruitment in Coos Bay is not occurring as it is possible that the 2020 recruits are just from Coos Bay or that there is considerable size overlap of the YOTY crabs from two sources.
Conclusions
We are finding a consistent increase in green crab abundance in Coos Bay over the past five years. The Coos Bay waterfront appears to be a hotspot for green crabs, perhaps due to habitat structure and food availability. Green crab abundance is now in the range where we expect to observe negative effects. More research is needed to: 1) determine the potential impacts of green crabs on important estuarine fisheries, species, habitats, and food webs, 2) evaluate reasons for high variability in green crab abundance, 3) determine sources of recruitment of green crabs, and 4) identify and study management options.

Acknowledgements:
Numerous researchers, interns, and volunteers have assisted in the collection of these data including: Christine Geierman, Bree Yednock, Angela Doroff, Chris Carlson, Renee Heller, Luke Donaldson, Liam Hunt, Ian Rodger, Colin Williams, Thelonious Schooler, and many others…

References:
Appendix 1. Map of crab sampling sites.

Legend

Green crab sample sites

Trap type

- Fukui
- both
- minnow

TransPacific South
Kentuck Slough
Coos History Museum
Isthmus Slough
Empire Boat Ramp
Charleston Boat Basin
Metcalfe Marsh
Joe Ney Slough
Indian Point N
Valino Island
Schooler Slough

Hinch Bridge

Scale: 2 1 0 2 Miles
Administrative/Facilities Report

Staff: Bree Yednock, Reserve Manager
    Rebecca Muse, Operations Manager
    Michael Allman, Facilities Lead
    Jonathan Forth, Park Ranger Assistant
    Patrick Juarez, Procurement/Contract Assistant
    Katherine Andreasen, Administrative Assistant
    Ed Oswald, Information Systems Technician

COVID-19 Update

The Visitor Center remains closed to the public until at least September 1.

Administrative

Attached are the state budget reports for the 2019-2021 biennium through May 2021.

Spring has been in full swing at the Visitor Center and glimpses of normalcy coming as schools start to come back. Facility staff have continued working onsite as normal with extra cleaning and security rounds.

During the reporting period administrative and facilities staff continued work on three NOAA Procurement, Acquisition, and Construction (PAC) awards, which include a land acquisition and two construction grants.

The FY20 land acquisition PAC award will be used to purchase a 1.14-acre property at the entrance to the Visitor Center from Coos County. Reserve Manager Yednock has been coordinating with DSL Real Property staff to complete the purchase; closing is expected in July 2021.

NOAA processed and recommended NEPA special award conditions for the FY21 NOAA Procurement, Acquisition, and Construction grant for upgrades to the Visitor Center for the restroom renovation portion. There will only be minimal ground disturbance with this renovation that pertains to the walkways that will be added. The Reserve had previously received clearance from Confederated Tribes of the Coos, Lower Umpqua and Siuslaw Indians and the Coquille Indian Tribe for any work around the Visitor Center. This information was submitted to NOAA in June with hopes the special award condition can be cleared soon after the July 1 start date. This grant will cover a renovation of the Visitor Center to ensure ADA accessibility to the public restrooms as well as updates to multiple areas throughout the facility and updates of the
exhibits. Total Federal ask was $500,000. Work and planning will start July 2021 and will continue for 3 years.

Facilities

Facilities staff have continued to work onsite during the COVID-19 closure. Since the closure began in March 2020, there have been additional impacts to the trail system with more cleaning requirements than usual. Daily cleanings are still happening to the public restrooms to keep them open to the public. Staff are also working on the trail system doing the routine maintenance as everything starts to grow.

The FY19 PAC construction award from NOAA includes the expansion of the maintenance compound to support the addition of a pole barn to store our paddle crafts and add a RV host site. Due to delays from of COVID-19, management submitted a no-cost extension through the end of June 2022. Facilities staff have continued through the maze of DEQ processes to get the utilities hooked up for the RV site. DEQ has suggested that we complete a “lot consolidation” so that the utilities can be connected to the maintenance building instead of Spruce Ranch to avoid capacity issues in the future. Paperwork and the required fee were submitted in May and the county staff approved it in June. Staff have started the process to get the permits in place to start utility connections.

Staff have also started the process to get the pole barn built and are working through the quote process. We received the first round of quotes, and it was obvious that we were going to have to relook at the build plan and pare down the minimums to get within our budget. With the current fiscal and construction environment, prices have more than doubled on materials. Originally when we wrote the grant the prices for the pole barn were running around $40,000 and we always add 10% for inflation. The first round of quotes were in the $75,000 – 95,000 range. We have since sent out for an updated quote with a smaller build with hopes that the quotes will come in within our budgeted amount. A procurement was completed, and a signed contract is in place to update all the siding on the current maintenance building. This work has started and is scheduled to be finished in July 2021 despite delays caused by supply issues.

The FY20 PAC construction award from NOAA includes renovations to boardwalks/bridges and updates to the trail system including new kiosks and a hands-free, refillable water fountain at the Visitor Center. During the reporting period we were able to replace the Hidden Creek 9 bridge with a custom-built aluminum bridge by a local business. The custom bridge will solve multiple issues including having a non-slip surface, lower long-term maintenance, and a permeable surface where water and debris can go through
the walking surface. These changes recommended in the trail assessment conducted by the North Cascades National Park trails group. Facility staff also completed the work to the new transition from North Creek to Tunnel trail along with Coos Forest Protective Association crews. This made a drastic change to this area, and it is now more accessible and has a safer incline/decline for all hikers. Work on this transition was completed in May.

Facilities staff also worked on an unexpected classroom cleanup project during the last couple months at the Visitor Center. In April, facilities staff noticed that there were some issues with rodents accessing the ceiling space between the classroom ceiling and auditorium floor. Staff started digging into the issue to see what the damage was. We ended up using a pest control company to get them under control as well as hired an outside contractor to come in and remove all the material, debris, and spray for odors. During this process, we had to remove and replace several of the drop ceiling tiles due to damage. Staff have put the rooms back together and the education team is ready for their busy season in the classroom.
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**Total:** PERSONAL SERVICES

| 1,945,523 | 96,926 | 97,312 | 106,881 | 2,246,642 | 1,814,888 | 108,256 | -323,698 | -16.83% |

| INSTATE TRAVEL | 23,679 | 0 | 2,012 | 1,419 | 27,110 | 17,140 | 398 | -9,572 | -54.58% |
| OUT-OF-STATE TRAVEL | 3,225 | 0 | 0 | 0 | 3,225 | 7,975 | 0 | 4,750 | 59.55% |
| EMPLOYEE TRAINING | 1,849 | 0 | 0 | 0 | 1,849 | 9,365 | 0 | 7,516 | 80.26% |
| OFFICE EXPENSES | 5,656 | 312 | 653 | 275 | 6,896 | 24,170 | 0 | 17,274 | 71.47% |
| TELECOMM/TECH SVC AND SUPPLI | 11,990 | 406 | 0 | 9,756 | 22,152 | 16,363 | 0 | -5,789 | -35.38% |
| DATA PROCESSING | 0 | 0 | 0 | 0 | 0 | 583 | 0 | 583 | 100.00% |
| PUBLICITY & PUBLICATIONS | 0 | 0 | 0 | 50 | 50 | 542 | 0 | 492 | 90.77% |
| PROFESSIONAL SERVICES | 7,533 | 0 | 0 | 0 | 7,533 | 123,605 | 0 | 116,072 | 93.91% |
| IT PROFESSIONAL SERVICES | 384 | 0 | 0 | 384 | 0 | 0 | 0 | -384 | NA |
| ATTORNEY GENERAL LEGAL FEES | 2,740 | 0 | 321 | 3,067 | 8,810 | 0 | 3,743 | 54.97% |
| EMPLOYEE RECRUITMENT AND DE | 443 | 0 | 0 | 443 | 2,700 | 0 | 2,257 | 83.57% |
| DUES AND SUBSCRIPTIONS | 2,913 | 70 | 0 | 2,983 | 12 | 0 | -2,971 | -247.60% |
| FACILITIES RENT & TAXES | 42 | 0 | 0 | 42 | 51 | 0 | 9 | 16.45% |
| FUELS AND UTILITIES | 15,088 | 1,822 | 752 | 370 | 18,032 | 8,581 | 0 | -9,451 | -110.14% |
| FACILITIES MAINTENANCE | 36,517 | 67 | 1,063 | 0 | 37,847 | 29,881 | 64 | -7,702 | -25.72% |
| OTHER SERVICES AND SUPPLIES | 88,139 | 5,906 | 4,234 | 6,792 | 105,071 | 120,922 | 676 | 16,527 | 13.59% |
| EXPENDABLE PROPERTY $250-$500 | 8,072 | 0 | 0 | 0 | 8,072 | 3,752 | 0 | -4,320 | -115.15% |
| IT EXPENDABLE PROPERTY | 11,187 | 0 | 0 | 0 | 11,187 | 51,302 | 0 | 40,115 | 78.19% |

**Total:** SERVICES AND SUPPLIES

| 219,464 | 8,583 | 9,035 | 18,662 | 255,744 | 423,754 | 1,138 | 169,148 | 39.81% |
| OFFICE FURNITURE AND FIXTURES | 0 | 0 | 0 | 0 | 0 | 43,093 | 0 | 43,093 | 100.00% |
| DATA PROCESSING HARDWARE | 0 | 0 | 0 | 0 | 0 | 18,020 | 0 | 18,020 | 100.00% |
| OTHER CAPITAL OUTLAY | 0 | 0 | 0 | 6,175 | 6,175 | 0 | 0 | -6,175 | NA |

**Total:** CAPITAL OUTLAY

<p>| 0 | 0 | 0 | 6,175 | 6,175 | 61,113 | 0 | 54,938 | 89.90% |</p>
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<td>Biennium To Date</td>
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<td>0</td>
<td>0</td>
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<td>113,860</td>
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<td><strong>Grand Total: Expense</strong></td>
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<td>60,700</td>
<td>79,204</td>
<td>1,579,781</td>
<td>2,137,957</td>
<td>291,673</td>
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SSNERR Education Program Update

Staff:  Jaime Belanger, Education Coordinator/Lead
       Eric Dean, Education Specialist
       Deborah Rudd, Public Involvement Coordinator
       Daniel Dobrosielski, Seasonal Education Specialist

April 16 – June 30, 2021

The Reserve Visitor Center remained closed to visitors throughout this reporting period due to the COVID-19 pandemic. The health crisis continued to have an impact on education efforts. In-person education events were greatly reduced compared to an average spring season. Interpretive programs for small groups of up to 6 people were offered periodically and volunteers were able to assist with some efforts. The Reserve was also able to host watershed hikes from the Visitor Center for classes of up to 20 students, as well as work with student cohorts outdoors in their schoolyard or nearby habitats. Education staff continued teleworking whenever possible and followed COVID-19 safety guidelines when working on site or with public audiences. The team was also able to deliver some virtual programs during this time as well.

Staff training, innovations, and COVID-19 work

Deborah Rudd serves on several committees in her role as Public Involvement Coordinator including the 2022 South Coast Culture Tour Planning Meetings, Coos Watershed Mayfly Festival Planning Committee, DSL Multicultural Awareness Committee (MAC), liaison to Friends of South Slough Board (FOSS), Oregon Coast Regional Tourism Network and the South Slough Reserve Diversity, Equity and Inclusion Committee. During this time, Deborah participated in several professional trainings: DAS - CHRO - Creating a Transgender Inclusive Workplace, May 5, 2021. Mentor Training for New Beginning for Tribal Students part 1: Introduction to Indigenous History on May 11, 2021 and part 2: Mentoring Indigenous Students in STEM on May 20, 2021. DSL Records Management Training, June 22, 2021.
Jaime Belanger continued the steps needed for the Reserve to serve as a potential host site for an AmeriCorps member and is working with other staff to recruit a candidate by the end of July. A successful recruit will work to re-frame and establish an afterschool Estuary Explorers program. Jaime attended the Oregon Natural Resources Education Program (ONREP) Facilitators Summit, which was hosted virtually. She is working to install an exhibit about SWMP and other monitoring in the Reserve, as well as working with others to write an interpretive plan to inform the exhibit renovations that will be funded by the Reserve’s most recent PAC award. Jaime continues to participate in the NERRS Diversity, Equity, Inclusion and Justice (DEIJ) Strategic Committee and is serving on its Learning Team, as well as serving as the education sector representative on the NERRA Board and as a member of the Oregon Coast STEM Hub Leadership Council.

Along with a group of scientists and educators from Southern Oregon University, the Bureau of Land Management and the U.S. Fish and Wildlife Service, Eric Dean contributed to the development of a fire ecology curriculum for K-12 schools in southwestern Oregon. Samples can be found on the Southern Oregon Fire Ecology Education website with more modules set to be released by September. Eric worked with teachers in the summer 2021 TOTE workshop, offering a full day of learning about fire ecology and how to incorporate the curriculum in their classrooms. He also led in-person community education programs including nature hikes and guided birding excursions at the Millicoma Marsh Trail.

Daniel Dobrosielski updated the summer camp training binder and worked with the education interns to prepare them for working with summer programs safely and effectively. He continues to develop and apply his skills in video and graphic design for science outreach and communication products for the Reserve. He created a cartoon raccoon puppet of Lou the Jr Researcher, which he used to inspire children during the first summer camp. He put together a training for Reserve staff about how to create effective videos that engage the public. In addition to traditional nature hikes, this spring Daniel introduced a new interpretive program about nature journaling along the trails and waterways. Daniel is continuing to work to increase accessibility and inclusivity throughout our programming, especially our virtual content.
Education Program Metrics.
Since April 16, 2021, the Reserve held 32 education programs for 704 people of all ages from across the state and beyond. The Reserve offered both in-person and virtual programs that resulted in 1137 hours of learning. 88 hours were committed to program planning, reflection and post-program cleaning. The education team continued to meet the challenges of pandemic learning and adjust programs to offer distance learning, as well as adapt policies and procedures to reduce health risks during in-person programs. This summary accounts for all education, interpretation, training, and outreach provided directly by the Reserve’s education and stewardship staff.

These summary data are also submitted twice a year to NOAA, along with information about the presentations conducted by the science staff, as one of the required performance indicators to the National Estuarine Research Reserve’s performance measures database.

Visitation and Visitor Services
The Reserve Visitor Center building remained closed through this reporting period. The Reserve anticipates reopening on September 1, along with other state buildings. The trails and waterways remained open. The Reserve does not have the capacity to count the number of visitors who walk the trails or paddle in the slough, but staff members working on site are able to provide anecdotal information about visitation. Visitation to trails has increased as the daylight lengthens, and summer tourism season begins.

Formal Education & Training
The Reserve categorizes education program areas based on audiences and learning goals, aligning to state and federal categories. “Formal education” includes programs provided to pre-K-12 students, undergraduates, graduate students, classroom and pre-service teachers. Formal education for students and teachers were some of the most greatly reduced program areas during the pandemic. In-person programming for K-12 classes resumed at the end of March 2021, with new precautions to reduce health risks.
The education team led outdoor lessons on Reserve trails, in school yards and adjacent areas and other unique habitats in the region. 19 school programs provided 599 students with 842 hours of learning. The education coordinator presented a virtual tour of the Reserve and careers for over 300 students during Oregon STEM week in May.

10 Oregon teachers participated in 17 hours of a virtual and in-person Teachers on the Estuary “Local Climate Issues and Solutions” workshop offered by the Reserve in June. The training focused on sea level rise, fire ecology, warming oceans and solutions. These teachers will have the opportunity to request funds to carry out projects with their students in the fall.

**Community Education, Interpretive & Outreach Activities**

Community education is offered to all ages in a variety of places around the region. During the pandemic, these have been exclusively outdoors or virtual. The Reserve was able to continue in-person programs for small groups of general audiences throughout this period, offering 12 programs for 95 people, and 115 total hours of public programming. Programs ranged from citizen science project training to summer camp for kindergarten and first grade students.

The stewardship and public involvement coordinators worked together and with other staff on various initiatives, including an earth day event and National Trails Day event to initiate a trail stewardship program.

**Public Involvement**

**Volunteers/Internships**

A total of 31 volunteers, including 8 interns, put in 904.75 hours valued at $24,609 from April 16 through June 30, 2021. The program category breakdown included 652.25 research/stewardship, 245 education and 7.5 administration hours.

The Reserve Trail Stewards program is moving forward, 10 volunteers have been recruited and are in process of receiving training at various levels to assist Reserve staff with trail and grounds maintenance.
Reserve staff recruited 18 citizen science volunteers to conduct lamprey eDNA sampling this summer for the US Forest Service grant funded project. Ian Rodger has been hired as the Field Volunteer Technician. Public Involvement has been scheduling and vetting the new volunteers. By July 9, 2021 all lamprey volunteers will be trained and over 40 samples will be collected by the group from Waldport to Gold Beach. Additional sampling is being done in collaboration with CTCLUSI in Ten-mile Lake. Many of the volunteers represent partner agencies that are interested in using the training received as volunteers to better understand eDNA collection methods for their research efforts.

The local print shop, BNT, has been backlogged and is still working up a proof for review for T-shirts for volunteers/interns. The Reserve is paying for half the cost of the shirts out of the NOAA Education budget, with the Friends of South Slough donating the remaining funds.

This summer the Reserve is hosting a variety of students from around the country. Currently, all 10 summer interns have secured housing, which was a major obstacle due to a multitude of COVID restrictions. Two interns are local and the rest were able to secure additional funds through their sponsorship programs and/or their own funds to pay for short term rental housing and a few are being housed by the generosity of FOSS and other community members. Below is a list of their names, mentor, affiliation, project, and the dates they are serving.

<table>
<thead>
<tr>
<th>Intern Name</th>
<th>Mentor</th>
<th>Affiliation</th>
<th>Internship Program</th>
<th>Project Description</th>
<th>Dates here</th>
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<tr>
<td>Dodrill, Taylor</td>
<td>Shon</td>
<td>Portland State University</td>
<td>MAD Fellow</td>
<td>Harmful Algal Bloom Research</td>
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<td>Thomas, Reagan</td>
<td>Ali</td>
<td>Portland State University</td>
<td>REU</td>
<td>Eelgrass Sediment</td>
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<td>Jaime/Daniel</td>
<td>North Bend High School</td>
<td>FOSS</td>
<td>Summer Camp Youth Intern</td>
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<td>Jenni</td>
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<td>Marsh Sentinel Sites</td>
<td>June 1-Aug. 6</td>
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<td>Parvin, Lucas</td>
<td>Jaime</td>
<td>Oregon State University</td>
<td>OR Sea Grant</td>
<td>Science Education</td>
<td>June 22-Aug. 20</td>
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<td>Shon</td>
<td>Ventura College</td>
<td>REU</td>
<td>Green Crabs</td>
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<td>Sylves-Berry, Emma</td>
<td>Sabra</td>
<td>University of South Carolina</td>
<td>NOAA Hollings Scholar</td>
<td>Indigenous peoples in NERR Management</td>
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<td>Eric</td>
<td>Smith College</td>
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<td>Behm, Will</td>
<td>Keary</td>
<td>Middlebury College</td>
<td>NCCOS</td>
<td>GIS</td>
<td>July 30-Sept. 8</td>
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</table>
Outreach/Marketing

The South Slough Reserve spring/summer newsletter went out to 849 recipients on June 10.

Recruitment notices recently went out for the 11-month AmeriCorps Estuary Explorers Education Internship and the New Beginning for Tribal Students (NBTS) Fire Science Internship positions starting this fall. *Scroll to the bottom of the linked “Get Involved” page to view the descriptions.

The AmeriCorps position announcement was shared via Handshake, to over 122 approved universities, with both local Tribes, the Coos Hispanic Alliance, Latino Outdoors Google Jobs site, and all Reserve partners. Flyers are being posted around town in libraries and coffee shops.

The NBTS Fire Science Internship is open to SWOCC students for credit who self-identify as Native American. The NBTS will provide the student an additional $2,000 in funds to this FOSS-sponsored internship with a stipend of $1,200 (split between FOSS and Stewardship funds). The additional funding is provided to help the student overcome possible barriers to being able to participate. Training was also provided for those partnering with the program who will be mentoring Native American students.

Public Involvement staff have been working with DSL and NOAA/NERRA Communications staff, and Reserve Managers to share the results of the recent Pew Funded Economic study. A targeted effort to reach community stakeholders includes a communications brief to partners prior to the public press release followed by a social media campaign and pitches to relevant media. The primary goal is to build recognition of the South Slough Reserve’s value and economic contribution to local communities as well as to reinforce the qualitative economic benefits and to draw attention to the Reserve’s diverse education, recreation, research, and coastal management training opportunities.
FOSS Liaison Work

The Public Involvement Coordinator has been working with the FOSS Bookstore Committee to conduct a complete inventory and overhaul of the bookstore to better align with the needs of the Reserve’s education and outreach programs. The committee has been working to establish methods for staff to be able to request and or suggest inventory items to support programming. Inventory is being entered in the new “Square” device so that it can be available for sale when the Visitor Center re-opens. Other inventory that will be liquidated by FOSS is being sold or donated to local gift shop partners or will be sold at a future FOSS members discount sales event.
Coastal Training Program, January – March 2021

Sabra Comet, CTP Coordinator

CTP workshops and trainings

The Coastal Training Program is required by NOAA to complete at least five trainings per annual cycle; three trainings have been completed since the last update to the commission:

Introduction to Cultural Resources (Unclaimed Properties), May 18th. This two-hour webinar featured a group of Tribal Historic Preservation Officers and Cultural Resources staff lead by Kassandra Rippee, Tribal Historic Preservation Officer and Archaeologist at Coquille Indian Tribe. The other tribes represented were the Confederated Tribes of Grand Ronde, Klamath Modoc Yahoooskin (Klamath Falls Tribes), Confederated Tribes of Warm Springs, Confederated Tribes of Coos, Lower Umpqua, and Siuslaw Indians, Confederated Tribes of Siletz Indians, Cow Creek Band of Umpqua Tribes of Indians, and the Burns Paiute Tribe. The training was a follow-up to one provided to DSL staff in January; the Unclaimed Properties team asked for a training more specific to their duties handling items from estates that might fall under cultural resources/artifacts. A lengthy Q and A session concluded the training.

Tips and Tools for Facilitating Virtual Meetings, May 5th. This training is offered through the NOAA/OCM extension Digital Coast. The audience was primarily Oregon agency staff (including one staff from SSNERR), although it was open to national registrants. In one hour, the instructors explored several platforms for hosting virtual meetings as well as types of tools to better engage audiences, such as polling, closed captioning, brainstorm/whiteboards, etc.

Collecting eDNA data for Lamprey, June 15-July 15. This training, led by SSNERR staff Deborah Rudd and Ian Rodger, is an extension of the Reserve’s lamprey project studying the current range of various lamprey species in SSNERR and several nearby watersheds. The training audience is a mix of citizen scientists, natural resource managers, and agency personnel. At the end of the training, attendees are ready to collect samples and preserve them for storage until the entire batch is sent to a third-party lab for analysis at the end of the field season.

Together with the two trainings offered earlier in the fiscal year, these trainings fulfill NOAA’s base requirement for CTP in Fiscal Year 2020.

Diversity, Equity, and Inclusion (DEI) initiatives that address regional and local concerns, utilizing experiences across the national CTP network.

South Slough Diversity, Equity, and Inclusion Committee (SS DEIC): The SSDEIC has been building a Land Acknowledgement practice for SSNERR. Interviews with tribal representatives of Confederated Tribes of Coos, Lower Umpqua, and Siuslaw Indians and the Coquille Indian Tribe occurred earlier this year; the interview with the representative from the Confederated Tribes of Siletz Indians will be taking place soon. After all three tribes have been consulted there will be a follow up training with SSNERR staff.

A NOAA Hollings scholar, Emma Syvles-Berry, is being co-mentored between Sabra and another CTP coordinator at the Chesapeake Bay NERR; her project involves reviewing all NERR site management
plans (including SSNERR) for current partnerships with indigenous communities and Tribes. She is also interviewing NERRs staff, NOAA staff, and indigenous community/Tribal staff to understand what NERR/Tribal partnerships exist and where interest lies in future collaborations. Her report will be available at the end of the summer and will be used by SSNERR, other NERR sites, as well as NOAA/OCM staff.

**Technical Assistance**

**PSU Water and Human Interface**, May 4th. The CTP coordinator was a guest speaker in a Portland State University class (virtually) talking about water systems and human interactions. The students in charge of the Coos Bay area presented, asked questions about the local water sources and how watershed health has affected the local population, and what were major concerns for the near future.

**Canoe Fragment**, May 24th. Several years ago a canoe fragment was discovered in the creek in Sunset Bay State Park; after several years of preservation treatments the fragment is ready for permanent display. Usually all artifacts discovered on state park lands go to a museum in Eugene on University of Oregon (UO) property. However, several local tribes requested an exemption and the fragment be housed closer to Sunset Bay. After some discussion the SSNERR Visitor Center was contacted and asked if we would be able to house the artifact. On May 24th staff from State Parks, the Confederated Tribes of Coos, Lower Umpqua, and Siuslaw Indians, Confederated Tribes of Siletz Indians, Coquille Indian Tribe, UO, and SSNERR gathered at the Visitor Center to discuss what housing the artifact would entail, and if the space was a good fit. The CTP coordinator helped arrange the meeting and acted as facilitator for the discussion. Next steps include drafting a formal loan agreement between SSNERR and UO before the artifact is relocated.

**Sea Grant Association Panel**, June 24th. The CTP coordinator helped organize and participated in a documentary film several years ago (while employed at NOAA) titled “Can We Talk?” in which People of Color in STEM fields talked about challenges they have faced in their careers. She was asked to participate in a panel after the film was shown at the annual Sea Grant Association meeting.
SCIENCE and STEWARDSHIP PROGRAM UPDATE
May 1, 2021 – July 15, 2021

Staff:  Shon Schooler, Research Coordinator
        Alice Yeates, Stewardship Coordinator
        Ali Helms, Estuarine Monitoring Coordinator
        Jenni Schmitt, Watershed Monitoring Coordinator
        Keary Howley, GIS Specialist
        Adam DeMarzo, Monitoring Technician

MONITORING

NERRS System-Wide Monitoring Program (SWMP)
Ali Helms and Adam DeMarzo continued to operate the water quality, weather, and nutrient components of SWMP.

SWMP Data:
Science staff completed monthly field and lab work associated with the water quality, meteorological and nutrient long-term primary monitoring stations. This included monthly and quarterly station maintenance, data uploads, instrument cleanings and calibrations, and data submissions to the NERRS SWMP Centralized Data Management Office (CDMO). Quarterly submissions for water quality and meteorological data were submitted May 2021. Annual 2020 weather and water quality data submissions were completed April-June 2021. SWMP data submissions include data that have undergone several levels of quality assurance and quality control (QA/QC) procedures, metadata development, calibration and field logs, and instrument and sensor inventories. After annual data reviews are completed, datasets are authenticated, having undergone tertiary review and are now available as final authoritative data. SWMP data for the SSNERR and all other Reserves are accessible online at nerrsdata.org.

The science staff completed monthly weather station maintenance, data downloads, and field logs for May-July 2021 at Tom’s Creek marsh. The SWMP weather station (sostcmet) real-time data are available at nerrsdata.org/get/realTime.cfm.

Science staff relocated the Charleston Bridge SWMP station in Spring 2019 due to the failing pier infrastructure. The new site is a nearby piling with boat access only. Deployments at the station resumed May 2019. A telemetry package (Storm 3) provided from the CDMO for equipment upgrades is being prepared for installation at this new site.

The science staff completed monthly collection, processing, and analysis for Total Suspended Solids (TSS), a nutrient parameter added to the routine SWMP nutrient dataset, for a NERRS Science Collaborative Sediment Hydrodynamic Model project. TSS data collection will continue 2021-2025 with funds from the NERRS Science Collaborative project (Sutherland, UO): Buried or Fried? Understanding sedimentation
and temperature effects on native species restoration in the South Slough National Estuarine Research Reserve and the Coos estuary.

The science staff completed monthly field deployments, retrievals, and calibrations for three Coos estuary SWMP water quality stations located at Isthmus Slough, Catching Slough, and Coos River, and data were uploaded using the non-SWMP tool provided by the CDMO.

Real-Time Data: As a participant in the US Integrated Coastal Ocean Observing System (IOOS)/Northwest Association of Networked Ocean Observing System (NANOOS), we operate telemetry systems at all four of the core SWMP water quality stations and the weather station to provide real-time data available at nvs.nanoos.org/Explorer.

CDMO Data Management:
The Centralized Data Management Office (CDMO) is the technical support team dedicated to data management activities associated with the SWMP data collected at the 29 reserves. Recent activities of the CDMO include supporting data management for Sentinel Site vegetation monitoring datasets, releasing a new telemetry application for internal troubleshooting use, updating SWMP station images, and updating data management processes for older datasets allowing them to be included in Annual SWMP status reports. Staff attended the annual NERRS Technician Training Workshop held virtually in Spring 2021 hosted by the CDMO.

SWMP Status Reports:
The Reserve system developed tools for creating Annual Status Reports on water quality, nutrient, and weather summaries for each Reserve. The CDMO provides the R software package for download and updates files annually. The Reserve responded to Office for Coastal Management requests for updates for Reserve specific preferences for the status reporting software (last updated 2016) for running the 2020 reports, including options for parameter units and thresholds, how nutrient parameters are calculated, and station names and labels.

Estuary pH Monitoring:
Data analyses for the $pCO_2$ and pH time series (2015-2019) from the Valino Island station are being coordinated with datasets collected at the Charleston Bridge station for Caitlin Magel’s research (Postdoctoral researcher, University of Washington-Tacoma, Puget Sound Institute).

Bacteria Monitoring:
Staff continued monthly monitoring of fecal indicator bacteria (total coliforms and *Escherichia coli*) at the four SWMP nutrient monitoring stations. The bacteria data are of interest for the Coos Bay Estuary Data Source, Oregon Department of Environmental Quality for Total Maximum Daily Load standards and to Oregon Department of Agriculture as they conduct commercial and recreational shellfish bacteria assessments.
Volunteers from the Surfrider Foundation resumed use of the lab for their monthly monitoring of fecal indicator bacteria (*Enterococcus sp.*) at four local beach sites (Bastendorff Beach, Lighthouse Beach, and two Sunset Bay locations: Big Creek and Sunset Bay proper) in May 2021.

**Climate Reference Network:**
The NOAA Climate Reference Network station at Frederickson Marsh continued hourly data transmissions and staff completed maintenance for the station rain gauges. Annual station maintenance will be completed Summer 2021 by NOAA staff. Data are available for this station (OR Coos Bay 8 SW) at: ncdc.noaa.gov/crn/current-observations.

**SeagrassNet Monitoring:**
SSNERR science staff completed quarterly eelgrass sampling at Valino Island in May and July 2021 using the SeagrassNet sampling protocol. SeagrassNet is an international monitoring program established to document the status and health of seagrasses. Eelgrass has been declining at the permanent monitoring plots at Valino Island since 2016 and science staff and collaborators are working on projects and research proposals to understand factors that may be contributing to the declines in eelgrass in South Slough, eelgrass habitat suitability and restoration.

**Northwest Association of Networked Ocean Observing Systems (NANOOS):**
SSNERR is a participant in a partnership project that provides real-time water quality data for stakeholders in Oregon, Washington, and Alaska through the NANOOS Visualization System (NVS): nvs.nanoos.org.

The NANOOS 5-year award (FY21-25) to sustain the Pacific Northwest component of the US IOOS, including South Slough, OR Estuary Observations will begin Summer 2021. The progress report for Oregon estuary observations for 12/1/2020-5/31/2021 was submitted June 2021. A one-year no cost extension was granted for current NANOOS FY20 funds. Staff prepared and submitted the scope of work, budget, and budget justification for FY21 on 6/30/2021.

SSNERR partners with one of the local tribes, Confederated Tribes of Coos, Lower Umpqua, and Siuslaw Indians (CTCLUSI) to provide telemetry equipment for their North Spit BLM sonde station in lower Coos Bay. The data are available to end-users through the NANOOS Visualization System (http://nvs.nanoos.org).

**NERRS Sentinel Sites Monitoring:**
The NERRS Sentinel Sites program pairs the long-term SWMP water quality and water level data with physical and biological data quantifying other factors (e.g., marsh elevation, plant community, vertical accretion, soil salinity, groundwater level) to help interpret long-term changes in emergent marsh plant communities, eelgrass beds, and a Sitka spruce swamp.

Water level, temperature and salinity loggers were deployed into groundwater wells in January 2021 at the Winchester Sitka spruce swamp Sentinel Site station, set to collect
data every 30 minutes. The data loggers were temporarily pulled from wells in June to calibrate the salinity sensors and then redeployed.

Staff and interns collected vegetation data (trees, shrubs, herbaceous plants) in June. They collected sediment dynamic data at all marsh and swamp sites in June and early July. They conducted elevation surveys using NOAA-loaned RTK GPS equipment, and SSNERR Sprinter Levels at multiple sites to capture eelgrass elevation, deep-rod surface elevation table and benchmark stability, and elevation of Sitka spruce swamp vegetation plots and infrastructure. Eelgrass sentinel sites were monitored in Summer 2021 to collect data on eelgrass and macroalgae abundance (percent cover, density), canopy height, flowering shoots, and sediments.

In June, a SSNERR high-school volunteer and staff captured drone imagery of the Winchester Sitka spruce swamp Sentinel Site as an initial effort to include imagery analysis in regular monitoring for that site. Staff will look at trends in aerial coverage of Sitka spruce forest, color spectrum of healthy vs stressed trees, and track downed trees.

SSNERR Sentinel Site data is being used in a national project called “National Synthesis of Tidal Marsh Response to Sea Level Rise”. See partner project below for more details.

A tide gauge with water level sensor will be deployed in Winchester Creek, near the Hidden Creek marsh sentinel station to collect high-precision (mm) water level data to meet requirements of the South Slough’s Reserve Sentinel Sites project goals. Staff are working with NOAA tide gauge engineers and Yellow Spring Instruments for purchasing the Nile microwave radar sensor. Staff are planning tidal benchmark locations based on requirements for distance between marks.

**Wasson Watershed Monitoring:**
Science staff are completing baseline monitoring of the Wasson Creek lowlands, in preparation for anticipated restoration work. Groundwater levels are being continuously collected from groundwater wells at both Wasson Creek (19 locations) and Tom’s Creek (4 locations). Data is downloaded and wells are maintained quarterly.

In June 2021, a SSNERR high-school volunteer and staff captured drone imagery of Wasson Creek, Anderson Creek (a marsh restored in 2002), and Tom’s Creek marsh (a least-disturbed reference marsh) as part of an outreach product (Oregon Sea Grant’s “Oregon Science and Educators Alliance”, ORSEA). As part of the ORSEA program, SSNERR staff Jenni Schmitt was paired with several Oregon coast teachers to develop science and math curriculum based on SSNERR monitoring data.

**Anderson Creek Monitoring:**
In 2020, staff began a reassessment of Anderson Creek, the site of a wetland restoration project completed in 2002, with the goal of monitoring restoration effectiveness nearly 20 years later. This summer, SSNERR Hollings Scholar Petra Zuniga is working with Schmitt to characterize soils at this site to better understand how quickly soils at restored wetlands recover to resemble least-disturbed wetlands. Zuniga is analyzing soil texture,
carbon content, organic matter, and nutrients in soils. She will analyze her data in conjunction with groundwater level data (collected in 2020) and plant cover data (collected summer 2020).

**Indian Point Monitoring:**
Staff continue to monitor western lily populations and track changes to herbaceous, shrub, and tree cover metrics related to the restoration work. Staff continue to collect water level and temperature data of the groundwater at the restoration site and nearby control site in order to gauge how tree thinning affected groundwater levels in the treatment area. Groundwater data are retrieved and wells maintained quarterly. Staff, interns, and volunteers conducted annual lily population counts in early July.

**Lamprey Monitoring:**
South Slough watershed hosts at least two native species of lamprey; however, we do not have adequate data to evaluate the status of lamprey anywhere in the Coos watershed. In summer of 2018, staff and partners set up permanent plots at three locations on Winchester Creek to help determine status and long-term population trends of each species. These plots are now monitored annually in summer months (next scheduled for August 2021).

In addition, the Reserve is currently leading a citizen science project (funded from a USDA-USFS grant) that is mapping lamprey species distributions (Western brook and Pacific lampreys) in watersheds of Oregon’s south coast using environmental DNA (eDNA) methods. The project was on hold for 2020 due to COVID-19, but it is now moving forward with 12 volunteers expected to take 40 samples this summer. Schooler and Schmitt are part of a statewide Lamprey Technical Workgroup.

**RESEARCH**

**SSNERR Projects**

**Invasive European Green Crabs in the Coos Estuary:**
South Slough is leading the monitoring and research on European green crabs in the Coos Estuary, including South Slough. We have started our 2021 annual sampling of 10 sites around South Slough and Coos Bay including monthly sampling of juvenile crabs using crayfish traps from May to September and adult crabs using Fukui traps from June through August. The overall goals of the work are to: 1) compare the relative abundance of green crabs and native crabs in the estuary across years and locations, 2) examine linkages between environmental conditions and green crab abundance, 3) study the potential impacts of green crabs on native species, 4) better understand the life-cycle of green crabs in Oregon estuaries, and 5) generally reduce green crab abundance through consistent and repeated sampling. We are currently collaborating with a Masters student, Elissa Connolly-Randazzo (PSU, advisor Catherine de Rivera). She is using SSNERR green crab data to look at correlations among environmental conditions and green crab abundance in order to predict green crab abundance in habitats throughout Coos Bay.
DNA Methods to Monitor Invasive Species and Biodiversity in Estuarine Systems:
The Reserve is collaborating on a research project initially funded through the NERRS Science Collaborative to use DNA collected from environmental samples (known as eDNA) to characterize fish biodiversity in estuaries. The project includes researchers from University of New Hampshire and from the Great Bay (NH), Apalachicola (FL), He‘eia (HI), Hudson (NY), and Wells (ME) NERRs. In 2019 we created a sample design to look at the most effective method to use eDNA to annually monitor fish diversity in South Slough. However, we had difficulty with the metabarcoding analysis due to interference from bacterial DNA. We are currently waiting on final results of modified DNA analyses to determine the use of this method to monitor fish species presence and diversity in South Slough over time. Meanwhile, we have submitted a proposal to OceanKind to continue to investigate the use of eDNA to monitor estuarine fish communities (collaborating with Dr. Alison Watts of the University of New Hampshire).

Eelgrass Pilot Transplant at Valino Island, South Slough estuary:
Science staff began a pilot eelgrass transplant experiment July 20-22, 2020 to test eelgrass transplant survival and abundance along an elevation gradient and planting during different seasons, to understand the potential to restore eelgrass to South Slough. Staff and interns harvested eelgrass plants from Clam Island, Coos estuary and transplanted adult vegetative (20 shoots per plot) and flowering (3 shoots per plot) eelgrass shoots into 12 plots at Valino Island, South Slough estuary. There were 4, 0.25m² plots planted within each of 3 elevation transects (mid, low, and deep) in July 2020. Additional plots were transplanted in different seasons to test effects of planting season on eelgrass establishment. In September and December 2020, 12 plots were transplanted at the mid and low elevations and in March 2021, 9 plots were transplanted (3 per elevation). The plots will be monitored quarterly for shoot survival and density.

Preliminary trends from monitoring transplanted plots showed higher average percent cover and density for the lowest elevation transects. The deep plots had an average of 33 shoots per 0.25m², low elevation plots had 21 shoots per 0.25 m², and the mid elevation plots had 13 shoots per 0.25m². The highest elevation plots (mid) are decreasing in cover and density.

Margaret A. Davidson Fellow Research:
Three data modeling projects, prioritized by the Eelgrass Recovery Advisory Committee (established 2019 through a NSC Capacity Building project), to understand drivers of the eelgrass declines before implementing larger scale restoration projects, are utilizing SWMP weather and water quality data to understand what environmental factors may be contributing to the declines. These graduate students were partially supported by funds from the NERRS Margaret A. Davidson graduate research fellowship program.

Maria Jose Marin Jarrin, a graduate student from University of Oregon (Dave Sutherland’s lab) interested in connectivity between Coos Bay and South Slough estuary, and the role of water residence time on abundance of species like native oysters, crabs, and eelgrass. For eelgrass, she is exploring retention time of anomalously warm
air and water temperatures and low river discharge contributing to the eelgrass losses.

Winni Wang, a graduate student from Oregon State University (Mueller lab) who recently defended her PhD in Sept 2020, is applying MAXENT species distribution modeling to understand environmental drivers of the eelgrass declines. Keary Howley (GIS Specialist) has contributed GIS expertise related to the modeling package and other aspects of the project. Winni has completed runs of the model at 1-m resolution, testing the “before eelgrass declines/healthy eelgrass” 2005 eelgrass presence with 2010 environmental data and is running the model with 18 environmental parameters to compare eelgrass distribution during eelgrass declines in 2016 and after eelgrass declines in 2018.

Caitlin Magel, a graduate student from OSU who completed her PhD in Sept 2020 (Sally Hacker/Francis Chan labs) examined environmental “regime” relationships to predict eelgrass vulnerability. She showed summer eelgrass and macroalga biomass were negatively associated with water and air temperature, water column turbidity, and watershed disturbance, and eelgrass declines were likely caused by thermal stress, light limitation, and other effects associated with watershed disturbance. Macrophyte biomass was also positively associated with pH and dissolved oxygen (DO), through photosynthesis effects on water quality. Undergraduates from her lab will continue analysis of eelgrass seed samples she collected for her project.

Taylor Dodrill (Portland State University) is our 2020-2022 Margaret A. Davidson Graduate Fellow. She is conducting research that will help us predict the occurrence and negative effects of harmful algal blooms in South Slough and Coos Bay (and Tenmile Lakes). She started September 2020. Staff have assisted with monthly sampling at 4 sites in South Slough from November 2020 through June 2021. She is currently setting up a system (ELISA – Immuno-assay technique) at the Reserve for measuring toxins produced by algae (saxitoxin, domoic acid, microcystin) in water samples. As part of her Fellowship she is also collaborating with CTCLUSI (Confederated Tribes of Coos, Lower Umpqua, and Siuslaw Indians) natural resource managers to sample sites they are interested in. She is also conducting experiments on what triggers toxins to be expressed in algae at facilities at OIMB (Oregon Institute of Marine Biology). She regularly attends the South Slough Research fortnightly Zoom meetings.

Partner Projects

Partnership for Coastal Watersheds (PCW):
The PCW is a local group of civic-minded community members that includes representatives of South Slough Reserve, Coos County Planning Department, Cities of Coos Bay and North Bend (planning and city council), Coquille Indian Tribe, Confederated Tribes of the Coos, Lower Umpqua and Siuslaw Indians, South Coast Development Council, Stuntzner Engineering (planning), Coos Watershed Association, Department of Land Conservation and Development, Southwestern Oregon Community College, Oregon Department of Fish and Wildlife, Oregon State Parks, US Fish and
The PCW meets monthly. The PCW is currently working towards several goals concurrently:

- The group is steering the development of a coastal hazards vulnerability assessment for the Coos Bay area. Local organizations are seeking to understand their vulnerabilities to a range of local coastal hazards (e.g., sea level rise, ocean acidification, coastal erosion, etc.) and consider adaptation strategies that coordinate local responses to those threats. Work is being completed through FEMA Cooperating Technical Partners funding and by University of Oregon’s Institute for Policy Research and Engagement. Additional funding by the National Fish and Wildlife Foundation was awarded to Department of Land Conservation and Development to augment this coastal hazards work by focusing on adaptation planning. Currently the team has conducted listening sessions, surveys and interviews with stakeholders and organizations in the Coos Bay area. They’ve begun to assess how coastal hazards, in particular sea level rise and flooding, will affect social systems (at-risk populations, cultural resources, community centers, jobs and economy), built assets (Coos Bay commercial downtown, transportation network, school facilities, communication infrastructure, water and wastewater infrastructure), and natural resources (eelgrass, marsh, shellfish, forests). For each component, the team is characterizing the sensitivity and adaptive capacity.

- Developing and refining a restoration inventory for the Coos estuary. This project is identifying tidal wetlands that could benefit from restoration, as well as historically restored sites and reference wetlands that have remained relatively untouched. Funding for this project is from The PEW Charitable Trusts to Coos Watershed Association and work is being completed by Craig Cornu (Institute for Applied Ecology).

- Cornu is also leading a NOAA-funded project that is creating a model to enable our community to understand how much effect tidal wetland restoration might have on reducing storm and sea level rise-related flooding in the Coos Bay area. They will also model reduction or diminishment of flooding through restoring tidal wetlands in the system. Water can be dissipated or stored on the way down the watershed if some dikes are opened up. This project will model how much of a difference restoring those areas will make for high priority areas that are most prone to flooding (e.g., North Bend airport, parts of Highway 101).

- Continue to leverage the PCW collaborative process. The PCW continues to be a sounding board for researchers doing work around the Coos estuary. Most recently the group has been engaged by University of Oregon professor Dave Sutherland’s modeling work (see “Hydrodynamic Model of Coos estuary” below).

- For more on the PCW and its current work, visit their website: http://www.partnershipforcoastalwatersheds.org
Ocean Acidification (OA)
The Reserve is continuing to work with Caitlin Magel (University of Washington), Francis Chan, and Burke Hales (Oregon State University) on ocean acidification (OA) data analyses for Charleston Bridge and Valino Island sites. SAMI CO2 and SeapHOx sensors were deployed from 2016-2019, collecting 15-min time series data for partial pressure of carbon dioxide and pH.

The Tillamook Bay Ocean Acidification and Hypoxia (OAH) Monitoring OWEB project is continuing to establish baseline information on carbonate chemistry and spatiotemporal patterns of OAH in Tillamook Bay, OR. Collaborative partners include Oregon State University, Environmental Protection Agency, Oregon Department of Fish and Wildlife, and the South Slough Reserve. York Johnson (TEP and DEQ) leads fieldwork for SeaFet pH sensor deployments in Tillamook Bay with field deployments resuming Summer 2021.

Hydrodynamic Model of Coos Estuary:
A series of projects, led by Dr. David Sutherland (University of Oregon) have resulted in a hydrodynamic model for the Coos estuary to characterize present-day sediment distribution, surface and bottom salinity, sediment flux, and circulation and current patterns in the estuary. SSNERR is involved in collecting sediment data, providing data from water quality and Sentinel Site stations, selecting sampling sites, and facilitating end-user discussions between the project team, end-users (e.g., Coos County, Oregon Department of Fish and Wildlife, Oregon Department of Environmental Quality, Oregon Institute of Marine Biology, Coquille Indian Tribe, Confederated Tribes of the Coos, Lower Umpqua, and Siuslaw Indians, Department of State Lands), and other stakeholders through the Partnership for Coastal Watersheds. The newest suite of products are modeling scenarios by graduate student Maria Jose Marin Jarrin (See Margaret A. Davidson Fellow above).

The team’s current project (funded by the NERRS Science Collaborative) focuses on better understanding sediment and temperature effects on native oysters and eelgrass in the Coos estuary. Reserve staff are included on the project team to help coordinate engagement with end users and stakeholders, present results to regional and national audiences, provide local technical knowledge, collect monthly grab samples for Total Suspended Sediment (TSS) analysis, and assist with data acquisition as needed. In May, South Slough staff helped with a week-long effort to collect deep sediment cores in multiple parts of the Coos estuary. In late June, South Slough interns assisted with shallow core collection.

National Synthesis of Tidal Marsh Response to Sea Level Rise:
This recently funded NSC project is led by Chris Peter (Great Bay NERR, NH) in collaboration with team members across the Reserve system, including staff at South Slough Reserve. This project will be a national scale synthesis of marsh vegetation community data, leveraging our Sentinel Site and SWMP programs. The synthesis will examine shifts in species ranges, patterns of diversity across latitudes and biogeographic regions and quantify climate-induced shifts to marsh systems. SSNERR staff (Schmitt,
Yeates, Helms) have been informing technical team meetings and collating SSNERR Sentinel Site data to share with the project team for analysis.

**Native Olympia Oyster Collaborative (NOOC, [https://olympiaoysternet.ucdavis.edu](https://olympiaoysternet.ucdavis.edu)):** This collaborative group, formed through a NERRS Science Collaborative catalyst project led by Kerstin Wasson and April Ridlon (Elkhorn Slough NERR), completed a synthesis of success of past Olympia oyster restoration projects to share lessons learned and to identify the practices and environmental conditions that predict the best restoration outcomes. The NOOC published the Olympia oyster restoration synthesis summary and results in *Estuaries and Coasts* April 2021: *Conservation of Marine Foundation Species: Learning from Native Oyster Restoration from California to British Columbia*. The NOOC in partnership with The Pew Charitable Trusts is creating maps of current and historical oyster distributions across the range of the Olympia oyster to inform conservation and restoration strategies.

**Planet Pilot Project:**
Multiple state agencies in Oregon participated in a pilot project with Planet, a company that provides daily global satellite data. South Slough Reserve joined the pilot project led by Department of Land Conservation and Development’s Coastal Management Program to see how useful the products would be for eelgrass and kelp detection on Oregon’s coast. Oregon’s Department of Administrative Services (DAS) paid for the costs of the pilots and will review pilot results to assess suitability for a future subscription for Oregon agencies.

**Grant proposals**
South Slough staff collaborated with Dr. Chris Janousek (OSU) to submit a proposal to Oregon Sea Grant for assessing several historically restored tidal wetland sites in Oregon many years after restoration occurred. One site, Kunz Marsh, is a wetland restored in the South Slough Reserve in the mid 1990’s. The team submitted the full proposal in May 2021.

The Reserve collaborated with Scott Heppell (OSU), Fiona Tomas-Nash (OSU), and Steve Rumrill (ODFW) on an Oregon Sea Grant proposal submitted on 5/21/21 to understand the effects of eelgrass restoration on fish communities and whether restored eelgrass bed serve the same habitat function for fishes.

**Research Support**
SSNERR is a field location for Oregon Department of Fish and Wildlife’s adult mosquito abundance trapping program, to be used as a reference for comparison to restored marshes in the Coquille valley. Trapping began in June 2018 and is expected to continue through 2022. ODFW staff have also agreed to sample Wasson Creek for the SSNERR restoration project at SSNERR staff request. This sampling will help us understand the effect of marsh restoration projects on mosquito populations.
SSNERR has several sites that will be used for a collaborative project between OSU, Institute for Applied Ecology, and UO to model the impacts of sea level rise on West Coast tidal wetlands. The work is being funded by NOAA’s Ecological Effects of Sea Level Rise (EESLR) program.

In conjunction with the EESLR project listed above, the Reserve is collaborating on a NERR Science Collaborative (2020-2023) project that continues carbon flux research, called Phase 2 Blue Carbon Research. The project is being led by Craig Cornu (Institute of Applied Ecology) with numerous collaborators from Oregon State University, University of Oregon, Western Washington University, Pacific Northwest National Laboratory, and the Padilla Bay NERR. This research is primarily aimed at measuring methane emissions from estuarine wetlands along salinity, temperature, and land-use gradients. The study includes sites in South Slough and Coos Bay.

South Slough is assisting researchers on a collaborative 1-year project (2021-2022) funded by the NERR Science Collaborative titled “Developing and Integrating Social Measures of Estuarine Restoration Success”. Project collaborators are Paul Engelmeyer (Wetlands Conservancy), Catherine de Rivera and Melissa Haefner (Portland State University), and Edwin Grosholz and Julie Gonzalez (University of California Davis). Using South Slough NERR and The Wetlands Conservancy restoration projects as case studies, this project includes a three-pronged approach to improve estuarine restoration success. The team will: 1) synthesize long-term NERR monitoring data to derive commonly used ecological metrics and to compare these with manager and public perceptions of restoration success, 2) conduct focus groups to examine how the presence and outreach activities of South Slough NERR influence public perception of restoration, and 3) conduct interviews with managers involved in restoration to understand the efficacy of the ecological metrics used to determine restoration progress. The project will produce a summary of values and perceptions associated with estuarine restoration, recommendations for including social and ecological metrics in project design and assessment, and an assessment of the social value of a long-term NERR. This project will help to improve coastal restoration project design and should lead to more inclusive and effective communications surrounding estuarine restoration.

SSNERR has multiple forest plot sites that are part of the Forest Inventory Analysis (FIA) program (U.S. Forest Service), a congressionally mandated mission to collect, compile, summarize, and make available high-quality data on the forest resources of the United States. FIA plots are monitored every 10 years and SSNERR Stewardship Coordinator Alice Yeates assisted USFS field agents in their 2020 survey. Alice will continue to monitor these plots and set up additional plots using the same protocols. In addition to monitoring South Slough upland forests, we expect that researchers will be interested in adding value to these sites by sampling other variables in the future (for example: lichens, invertebrates, fuel loads).

We are continuing to work with Dr. Carolyn Tepolt of Woods Hole Oceanographic Institute by providing green crabs of selected sizes for an international genetic analysis.
The purpose of the project is to identify and track different genetic populations of green crabs along the west coast of North America. In 2018-2020 we collected and posted samples as per sampling protocols. Additional samples will be collected in summer 2021 and sent to her in fall 2021.

SSNERR staff have been working with Molly Keogh (post-doc student in Dr. Dave Sutherland’s lab) to collect monthly shallow sediment cores at multiple locations in South Slough and Coos Bay for analysis at Dr. Emily Eidam’s lab (UNC Chapel Hill). They also assisted with a week-long endeavor to collect dozens of deep cores in May 2021. The samples are shipped to Dr. Eidam’s lab to undergo isotope analysis for short term and long-term deposition rates. Results will help inform the sediment dynamics portion of the hydrodynamic model project (see Hydrodynamic Model of Coos Estuary under Partner Projects above).

SSNERR staff will work with Dr. Sam Chan (OSU) to assist a graduate student, Sarah Marten, on her Professional Masters of Natural Resources project. Marten is interested in researching reed canary grass in the upper Wasson valley, in conjunction with wildlife use and management. Marten is developing a research proposal to conduct work throughout 2011-2022.

STEWARDSHIP

Wasson and Upland Research:
Dr. Alice Yeates (Stewardship Coordinator) is working with a Technical Advisory Team to develop an uplands implementation strategy for using the acquired US Fish and Wildlife Service funds ($64,203) to start Wasson Creek forest management. The Team has identified the youngest forest stands and areas of greater fire risk for immediate action. Yeates is working with the 2021 Hollings Scholar (Anna Liang), the SSNERR education and outreach team and the DSL Communications Officer (Liane O’Neill) to develop an outreach and education strategy prior to implementation. Yeates is working with the SSNERR GIS Specialist (Keary Howley) to revise the channel design, based on recommendations from the Technical Advisory Team and to develop an implementation plan. Yeates continues to search for funding opportunities to implement the Wasson Creek Watershed Restoration Plan. Yeates and Liang have been locating and monitoring permanent forest plots, installed in 2011, and adding new forest plots to track changes within different forest management prescription areas, including the Wasson Creek restoration area.

Invasive Species:
Staff and volunteers continue to both map and remove invasive species from within Reserve managed lands. Yeates and Howley are designing and testing an ArcGIS Field Maps project, which will standardize data collection and track invasive species management. Staff continue to engage with local weed specialists; e.g. SSNERR and Coos Watershed Association coordinated social media campaigns during National Invasive Species Awareness Week (May 15th-21st). Yeates is working with the Public Involvement Coordinator (Deborah Rudd) and facilities staff (Jonathan Forth) to develop
a Trail Stewards Team which will, among other things, help with invasive plant management along Reserve trails. The inaugural event, held on National Trails Day (June 5th), bagged up 4 large trash bags of ivy. Forth is currently training Trail Steward Volunteers.

**Native, Endangered and Culturally Significant Species:**
See Indian Point Monitoring section above regarding the endangered western lily restoration.

Staff continue to consult partners from the Confederated Tribes of the Coos, Lower Umpqua, and Siuslaw Indians (CTCLUSI) and the Coquille Indian Tribe (CIT) on culturally significant plant management within the Reserve. Culturally significant species are included in the Wasson Restoration plan (e.g. bear grass, giant chain fern, camas, beaked hazel) and a camas trial is underway at Indian Point. A total of 175 camas bulbs were donated by CTCLUSI, 130 of which were planted as part of a trial examining the potential of establishing a camas meadow on Indian Point. Bulbs were planted in November 2020 at different densities and were either protected with PlantSkydd or open to deer browsing. The population was monitored by Yeates and a volunteer in February and May 2021. May surveys recorded 110 emerged bulits (85%), with evidence of browsing on 63% of unprotected and 14% of protected plants. The population will be assessed in 2022 before determining site suitability.

**Trash and Marine Debris:**
Staff continue to monitor sites as part of the Mission-Aransas NERR’s Nurdle Patrol program. Nurdle Patrol is a citizen science program that monitors coastlines and railroad lines for nurdles (plastic pellets forming the raw material used in the manufacture of plastic products). Staff continue to remove trash from within the Reserve and are developing a Trails Stewardship Team to assist with trash cleanup along Reserve trails.

**Fire Management:**
Science staff continue to develop a fire management plan and are working with the CTP Coordinator to develop a Fire Preparedness Workshop. The fire management plan aims to summarize the risks and benefits of fire in the landscape, run a spatial wildland fire analysis to guide forest management recommendations, and update the emergency response plan. Yeates is mentoring Hollings Scholar (Anna Liang) on a project examining fuel loads within different forest stand types. Yeates is in communication with OSU Extension Fire specialist (Dr. Chris Adlam) and OSU professors (Dr. Dominique Bachelet and Dr. Chris Still) to develop methods and collaborations to monitor moisture content across forest stands with different management histories.

**INTERNSHIPS**

**NOAA Ernest F. Hollings Scholars:**
Petra Zuniga (Amherst College, MA) is spending her summer interning at South Slough with Jenni Schmitt. Zuniga’s project is to characterize soils at Anderson Creek marsh,
which was restored from ditched pastureland back to a more natural wetland in 2002. Her project will assess how quickly soils at restored wetlands recover to resemble least-disturbed wetlands. Zuniga is analyzing soil texture, carbon content, organic matter, pH, and nutrients in soils. She will analyze her data in conjunction with groundwater level data (collected in 2020) and plant cover data (collected summer 2020).

Anna Liang (U. of Virginia, B.S. in Environmental Science) will work with Alice Yeates for her onsite internship. Liang’s project is to assess fuel loads and vegetation characteristics in forest plots throughout the Reserve. Liang will analyze the 2021 data along with any available 2011 data. Liang will assist with an outreach campaign informing the public on how the Wasson forest restoration work aims to reduce fire risk and how slash management strategies are designed to reduce risk associated with management actions.

Research Experience for Undergraduates (REU) Program (National Science Foundation): The OIMB REU Exploration of Marine Biology on the Oregon Coast program was cancelled for 2020 due to COVID-19, but the program has continued in 2021. The Reserve science program is mentoring two undergraduate students for the Summer 2021 OIMB REU program.

Reagan Thomas (Portland State University, OR) is working with Ali on understanding sediment dynamics of eelgrass habitats. He will be comparing sediment characteristics, including grain size, bulk density, porosity, organic matter, and carbon content, and elevation among sites with abundant eelgrass and sites with historically healthy eelgrass.

The 2-year college student, Jordan Pantoja (Ventura College, CA) is working with Shon on green crab research projects. He is assisting with green crab surveys in Coos Bay. For his internship project he is examining the effects of size and gender on green crab intraspecific predation (cannibalism) in order to better understand what regulates green crab abundance.

COMMITTEES AND WORKGROUPS

NERRS SWMP Oversight Committee: Shon Schooler continues to serve on the SWMP Oversight Committee. This committee provides oversight of SWMP plans and can intervene if SWMP protocols are not being met by individual Reserves.

NERRS SWMP Guidance Committee: Ali Helms serves on the SWMP Guidance Committee (current members: Dwight Trueblood, Mary Culver, Suzanne Shull, Chris Kinkade, Jennifer Harper, Joan Muller, Matt Ferner, Ali Helms, Robin Weber, and Steve Baird) formed in 2010 to provide strategic planning and oversight of the SWMP program.

NERRS Sentinel Site Application Module (SSAM-1) Oversight Committee:
Jenni Schmitt and Ali Helms are on this NERRS committee, which was formed to develop SSAM-1 outreach strategies, review outreach products from the Marsh Resilience (MARS) report card, integrate remote sensing/habitat mapping into Sentinel Sites, review Sentinel Site plans, develop Centralized Data Management Office (CDMO) data templates for vegetation and sediment data, and manage inventory of SSAM-1 equipment, capacity building and data acquisition. The group has most recently been focused on developing a funding strategy for the Sentinel Site program, including articulating expectations for minimum monitoring protocols to standardize datasets for site, regional and national synthesis, and justifying the need to financially support on-site monitoring, data analysis, and data maintenance and dissemination through Centralized Data Management Office (CDMO). A strategic concept related to this was brought in front of NERRS managers at their March 2021 meeting to elicit feedback.

**NERRS Sentinel Site Biomonitoring Workgroup:**
Jenni Schmitt is part of this workgroup, which develops and oversees implementation of national vegetation monitoring protocols and reviews vegetation monitoring datasets submitted to the CDMO.

**NERRS Sentinel Site Submerged Aquatic Vegetation (SAV) Biomonitoring and Mapping Workgroup:**
Ali Helms joined this workgroup Summer 2020 to develop and provide input on protocols for implementing national vegetation, mapping, and mudflat sediment dynamic monitoring in SAV (i.e. eelgrass) habitats. The workgroup is working on advancing SSAM SAV at the system level.

**NERRS Habitat Mapping and Change Classification Review Team:**
Jenni Schmitt is part of this team to apply a three-tiered review system for habitat mapping products submitted by each reserve. Habitat maps standardize the way high-resolution land cover data (wetland, aquatic, and upland habitats) are classified within the NERRS.

**NERRS Strategic Committee:**
Jenni Schmitt is on the NERRS Strategic Committee representing the Stewardship/GIS sector. The committee meets to review and discuss NERRS National Product proposals and NERRS Strategic Concepts and provide recommendations for moving forward.

**NERRS Stewardship/GIS DEIJ Workgroup**
Jenni Schmitt is part of this national workgroup, whose goal is to increase diversity, equity, and inclusion within Stewardship/GIS programs in the NERRS. Schmitt met with other workgroup members to provide a competitive small grant to Reserves to be able to test strategies to improve diversity, equity and inclusion at their reserves. The group was able to provide funding for two projects. They are also creating a strategy document to provide ideas and guidance to Stewardship/GIS sector members to use at their own reserves.
NERRS Bivalve Working Group:
Shon Schooler continues to serve on the NERRS Bivalve Working Group with Brandon Puckett, North Carolina NERR; Nikki Dix, Guana Tolomato NERR; Kerstin Wasson, Elkhorn Slough NERR; and Jeff Crooks, Tijuana NERR.

NERRS Restoration Monitoring Working Group
Jenni Schmitt is on this workgroup, which collaborates across Reserves to share restoration monitoring information, protocols and goals.

NERRS Upland Stewardship and Monitoring Working Group:
Alice Yeates is on the NERRS uplands working group which aims to enhance communication between Reserves and to share information on upland monitoring, management, research and outreach.

NERRS Indigenous Engagement Working Group:
Alice Yeates is on the NERRS indigenous engagement working group, which aims to improve engagement with indigenous peoples and communities in Reserve stewardship.

NERRS Coastal and Ocean Acidification (COA) workgroup:
Ali Helms participated in the NERRS COA workgroup, formed in December 2019, to share ideas, resources, best practices for monitoring, and partnerships to collaborate on ocean and estuarine acidification monitoring activities across the Reserve system. The workgroup is led by Kari St Laurent at the Delaware NERR and calls were held monthly.

Pacific and Estuarine Research Society (PERS) Board:
Jenni Schmitt is the Oregon at-large representative for PERS. PERS is the regional chapter of the Coastal and Estuarine Research Federation (CERF). The committee has meets regularly to plan the annual PERS conference.

Pacific Marine and Estuarine Fish Habitat Partnership (PMEP) Eelgrass Advisory Committee:
Ali Helms joined this regional workgroup in July 2020 for providing technical input and expertise from an Oregon perspective related to eelgrass habitats. The Committee reviewed drafts and provided input for an Eelgrass Restoration Techniques Synthesis Report published in May that was funded through The Pew Charitable Trusts and administered by the Friends of South Slough.

Oregon Lamprey Technical Workgroup:
Shon Schooler and Jenni Schmitt sit on this advisory committee of the Conservation Agreement for Pacific lamprey in Oregon. The group meets several times a year to discuss updates on conservation initiatives, subgroup updates (tagging, contaminants, ocean, engineering criteria, genetics/eDNA, BMPs for minimizing impacts during stream disturbing activities, and restoration), standardizing white paper formats, lamprey terminology and larval lamprey survey and salvage protocols.
**South Coast Lamprey Working Group:**
Jenni Schmitt and Shon Schooler are on the steering committee for this workgroup, which works to help identify key information for lamprey management at regional, state, and local scales and identify opportunities for future work.

**State of the Coast Advisory Committee:**
Jenni Schmitt is on the conference planning committee for this annual coastal conference hosted by Oregon Sea Grant.

**DSL GIS User’s Group:**
Keary Howley is the South Slough representatives of this team, which is tasked with identifying GIS and geospatial technology needs and solutions for DSL. The GIS User Group and the DSL IT team are developing and implementing an Enterprise GIS (EGIS) with the use of ArcGIS Portal. The EGIS will more efficiently allow access to authoritative GIS data across all DSL divisions, support DSL business processes, enable easy to use mobile data collection apps like ArcGIS Collector and Survey123, and provide web mapping capabilities for internal and public use. The first publicly accessible web map is due to come online by January 2021.

**Coos Watershed Association Technical Advisory Committee:**
Jenni Schmitt, Alice Yeates, Shon Schooler, and Ali Helms participate on this committee to provide technical feedback on a variety of upcoming or ongoing restoration projects.

**South Slough Safety Committee:**
Alice is the Science Program representative on the SSNERR Safety Committee. They are updating the Disaster Plan and Fire Safety/Evacuation Plan.

**Coastal Native Seed Partnership Committee:**
Alice is on the Coastal Native Seed Partnership Science Program steering committee, where the Reserve recently became a partner entity.

**Oregon Marine Science and Educator Alliance (ORSEA) Scientist:**
Jenni Schmitt was selected as a scientist to participate in an Oregon Sea Grant/National Science Foundation alliance between scientists and educators. This program connects math and science educators with scientists to create and pilot lessons centered around marine-focused anchoring phenomena. Schmitt is working with two teachers from Lincoln County to create lessons centered around South Slough wetlands restoration data.

**Diversity, Equity, Inclusion Committee:**
Alice Yeates is the Science Program representative on the DEI Committee. This committee is assessing and identifying ways to improve diversity, equity and inclusion in all areas of the Reserve. The committee is working on a road map to identify interest areas, deliverables and goals. The committee has consulted with CTCLUSI and CIT and reached out to the Confederated Tribes of the Siletz Indians to develop land acknowledgement statements which will be included in future communications.
Wild Rivers Land Trust: Conservation Committee:
Alice Yeates is on the Wild Rivers Land Trust board of directors and the associated Conservation Committee. The Wild Rivers Land Trust aims to conserve and steward natural spaces from Tenmile Lakes to Brookings, OR.