

San Juan Islands Conservation District's Eelgrass Restoration Project



Sediment core processing sieving for seeds in Padilla Bay.

Pictured left to right
 Niyah Reid *Research Assistant*¹, Nicole Burnett *Laboratory Manager*², Annabelle Quinlisk
*Research Assistant*¹, Dr. Sylvia Yang *Research Director*¹, Ian McBride *Research Assistant*¹,
 Mitch McCloskey *Project Manager*², and Sage Enright *Project Assistant*¹.
 1, Padilla Bay Research Reserve. 2, San Juan Islands Conservation District

Photo by: Heath Bohlmann, Padilla Bay Research Technician



Overview

Eelgrass Restoration Through Large Scale Seeding

Restoring declining eelgrass meadows, the San Juan Islands by employing a variety of seeding methods.

What We Are Doing

To restore eelgrass meadows through targeted seeding efforts, we aim to collect ½ million eelgrass seeds over the next three years and plant them at six project sites. Diverse and developing seeding methods will be employed to support successful planting operations under variable



A part of a flowering head containing seeds (left) collected by volunteers at fourth of July Beach (right)

Why This Is Important?

Eelgrass provides a fundamental and essential habitat for aquatic species that support the entire marine food chain. A seeding approach to eelgrass restoration provides greater opportunity for large scale restoration efforts that can be used regionally and globally.



Eelgrass Culture System (ECS) at Friday Harbor Laboratories

Community Involvement

The community helps to protect eelgrass by adopting mindful boating habits and sharing this knowledge with others. Volunteer opportunities with our program also provide hands-on ways to contribute to eelgrass conservation.

About The San Juan Islands Conservation District

The San Juan Islands Conservation District provides technical, financial and workforce assistance to implement conservation and restoration efforts for public and private landowners in the San Juan archipelago. Our work encompasses agricultural and forested working lands; riparian and nearshore marine habitats; and endangered species recovery.

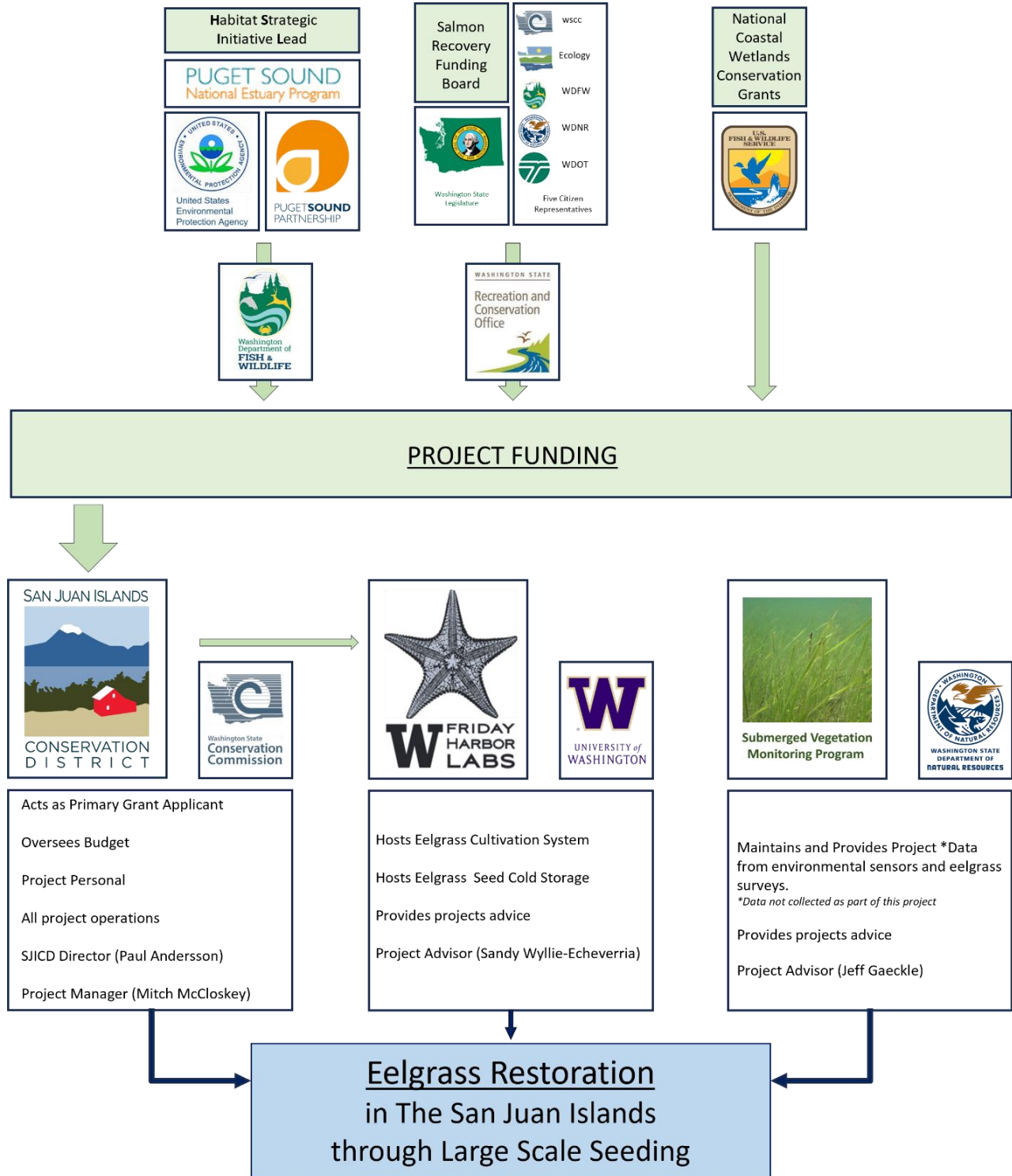
FOR MORE INFORMATION

www.sanjuanislandscd.org/eelgrass

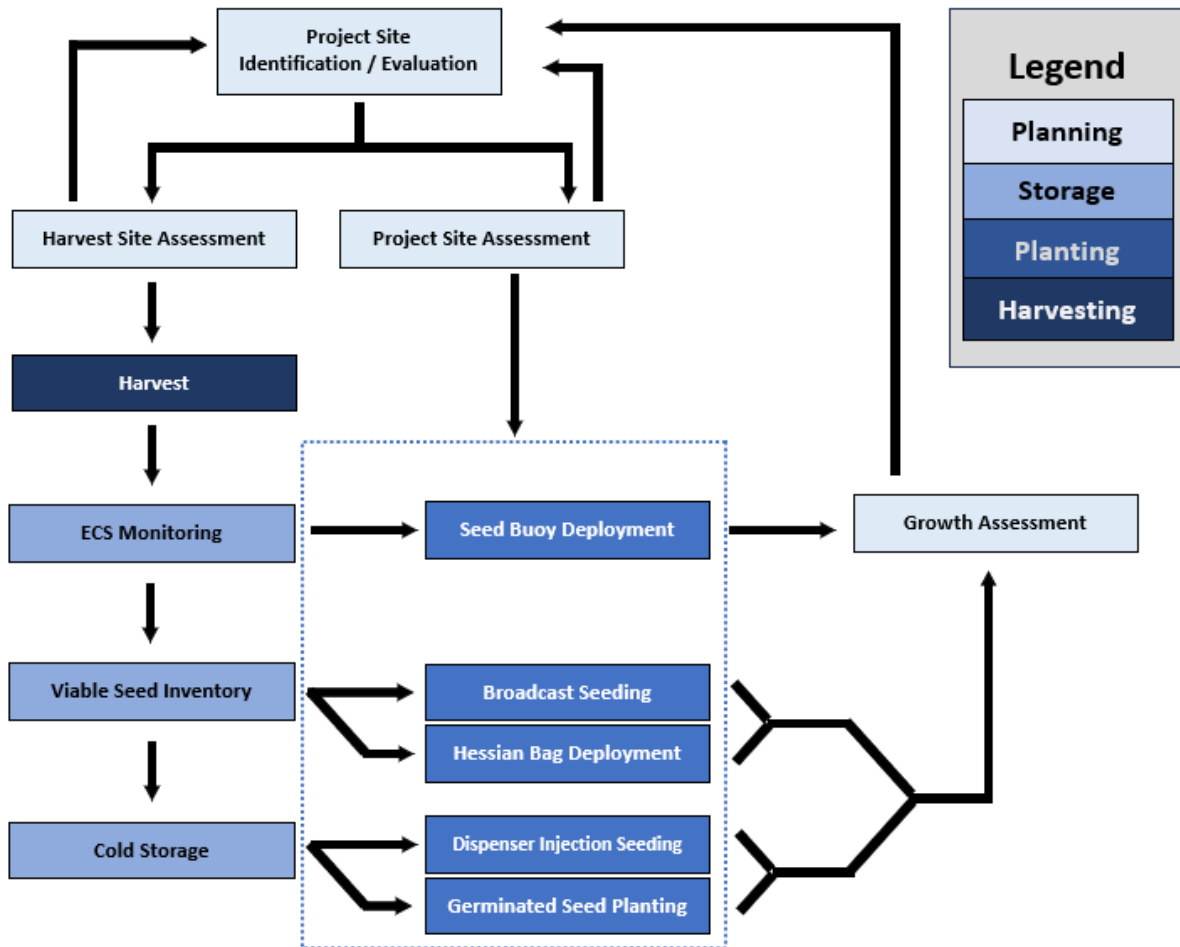
Mitch McCloskey, SJICD

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Funding & Partners



Steps For Restoration Success



An Adaptive Management Approach

Adaptive management guides our project, connecting all our efforts from planning to planting to help restore eelgrass effectively. In the planning phase, we identify the best sites and gather important environmental data with help from experts. During harvesting, we collect eelgrass seeds when they are most viable, using this data to improve our methods. The storage phase focuses on keeping these seeds viable under controlled conditions, monitoring factors like salinity and temperature closely. Planting then uses various techniques suited to each site's specific needs. This approach lets us adjust our methods based on ongoing results, ensuring our restoration efforts are both effective and responsive to the environment.

An Analytical & Adaptive Plan

Selecting Project Locations

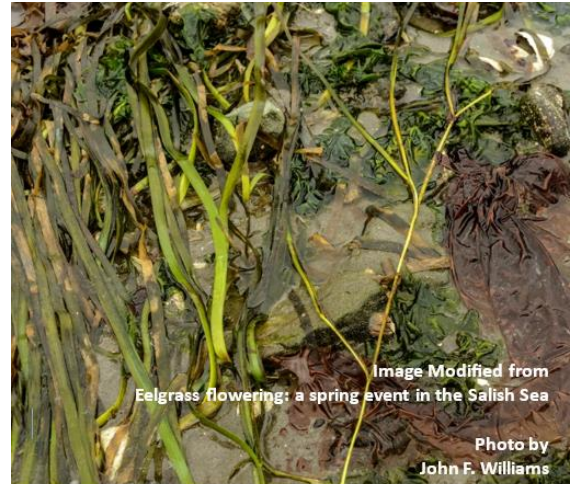
Our shift to an adaptive management framework is designed to enhance continuous evaluation and refinement of our project strategies, encompassing location, methodology, and timing decisions. This process integrates expert insights, health assessments of eelgrass meadows, relationships with local landowners, and site accessibility, along with consideration of recent environmental stressor removals. To support this adaptable approach, we are crafting tools that facilitate consistent and measurable decisions regarding the selection of eelgrass planting and harvesting sites and methods. Although some tools are currently in use, our goal is to amalgamate existing research and literature to refine these resources further, ensuring they are optimally tailored for our projects. Ongoing collaborations with researchers from Padilla Bay, WDFW, WDNR, and Friday Harbor Labs are crucial to the success of these initiatives, enabling us to continually improve and adapt our restoration techniques in response to dynamic environmental conditions.



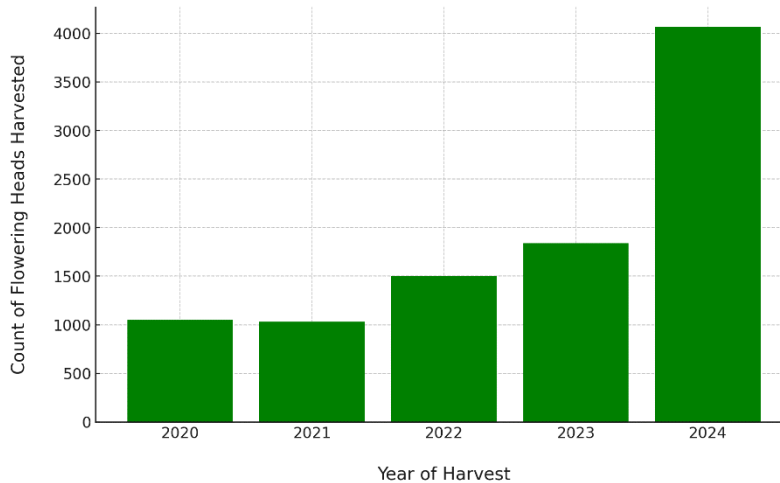
Harvest of Seeds From Donor Meadows

How we Harvest Eelgrass

In the San Juan Islands, our eelgrass harvesting methods are tailored to suit different environmental conditions, utilizing SCUBA diving for deeper waters, snorkeling for mid-depth areas, and wading for accessible intertidal zones. We conduct thorough assessments at each potential harvest site to identify areas with robust populations of eelgrass, particularly focusing on the optimal time for harvesting—after fertilization but before seed dispersal. This critical period typically occurs in late June or early July. We strategically harvest eelgrass at its reproductive peak, enhancing both the efficiency and sustainability of our efforts.



Flat eelgrass vegetative leaves on left compared with round-ish yellow branching flowering head on the right



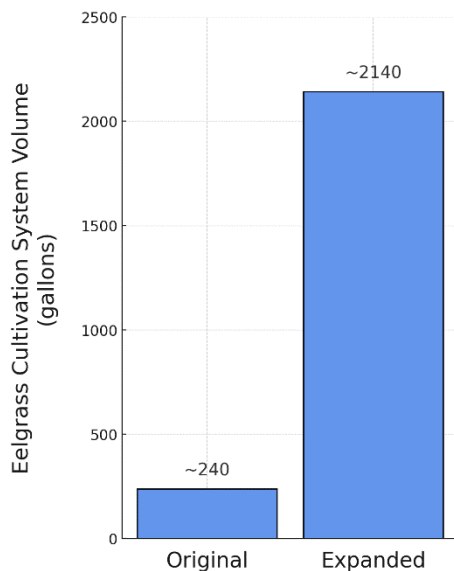
Continued Development of Harvest Practices

To ensure scalable and sustainable restoration, our project continuously seeks to expand and refine our harvesting practices. This expansion is essential for providing the seeds necessary for the growth of our initiatives. Historically, our efforts focused on collecting seeds from healthy intertidal meadows around the San Juan Islands. However, recent widespread declines in the islands' intertidal meadow health, have prompted us to develop partnerships that allow for the donation of seeds from other viable sources. This year SJICD partnered with the Padilla Bay Research Reserve to conduct pilot harvest trials, laying the groundwork for future large-scale, sustainable harvesting efforts. Additionally, SJICD collaborated with the Friday Harbor Labs Subtidal course to study the effectiveness of seed collection from the island's healthy subtidal meadows.

Seed Storage Facilities Expansion

The Eelgrass Cultivation System

After harvesting, the collected eelgrass flowers are carefully placed in our open system tanks at Friday Harbor Laboratories. Within these controlled environments, the seeds within the flowering heads are allowed to mature and naturally fall from the plants. In the fall, these seeds are then meticulously separated from the eelgrass, inventoried, and moved to cold storage in preparation for spring planting. Thanks to recent funding, we've significantly expanded our capacity to hold eelgrass by approximately nine times, enabling a substantial increase in our planting efforts.



Planned Seed Storage Solutions

This fall and winter, we plan to initiate the second phase of expanding our eelgrass cultivation system. We are also exploring innovative approaches to leverage winter storage, aiming to further enhance the sustained viability of collected seeds. As spring is ideal for the injection seeding method, it is crucial to maintain these seeds in cold storage throughout the winter. To achieve this, we plan to evolve our cultivation system into a semi-closed loop, incorporating an aquarium chiller and an ultraviolet light sterilizer. This upgrade will allow us to precisely control the temperature, keeping the seeds within the recommended storage range, and effectively combat the growth of pathogens that could otherwise diminish seed viability. Additionally, we will explore experimental treatments involving variable salinity and treatment with copper sulfate to further protect the seeds from potential pathogens.

Exploring Planting Methods

Dispenser Injection Seeding



A unique approach involves injecting seeds into the sediment mixed with a thickened paste made from natural seagrass meadow material. The sediment is prepared in advance to ensure it is free of larger particles and benthic animals and has the right consistency. Seeds, pre-soaked and mixed with the sediment paste just before planting, are injected into the substrate using sealant guns to ensure precise and even distribution.

Buoy Deployed Seeding



This method mimics natural seed dispersal by placing flowering plants from a donor site inside a pearl net bag. As the seeds mature, they fall through the net and settle on the seafloor at the restoration site. Buoys are attached to the bags and deployed on the same day the flowering heads are collected. These temporary buoys are placed carefully to avoid damaging existing habitats and adjusted in high-traffic areas to avoid interference with boat propellers.

Broadcast Seeding



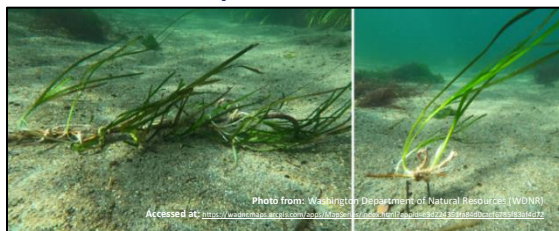
Seeds are scattered directly into the water along a transect line in this method. It is suitable for planting many seeds quickly and requires less labor than other methods. However, this approach tends to have lower germination rates and makes tracking progress more challenging.

Hessian Bags



Small fabric bags are used to plant seagrass seeds, aiming to create natural-looking clumps of seagrass rather than linear plantings. Growing in clumps is beneficial for seagrass meadows, especially during recolonization and high-stress periods. The bags, typically measuring 3 x 5 inches with 1 mm holes, are each seeded with 100 seeds.

Adult Transplants

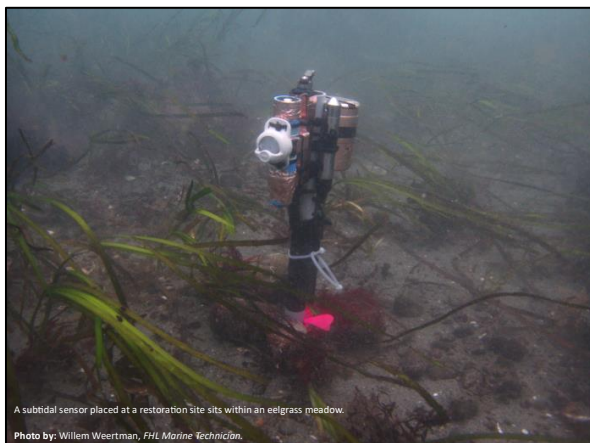
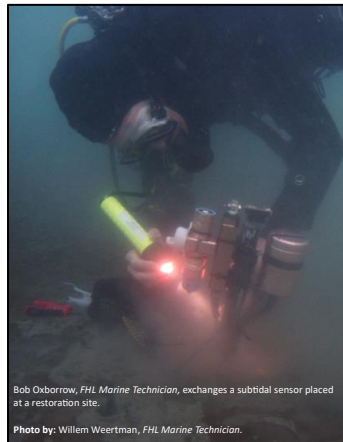


Mature eelgrass plants are transplanted into new areas, allowing them to propagate clonally. The Washington State DNR Seagrass Restoration Program provides detailed guidelines and examples of successful eelgrass transplants in their publications and presentations.

Monitoring Meadows

Eelgrass Meadow Health Monitoring

Our project has been able to leverage the work carried out by WDNR's Submerged Aquatic Vegetation Program as well as the work carried out by researchers Dr. Olivia Graham and Dr. Drew Harvell to get a full picture of eelgrass health around the islands to select our current test planting sites.



Working together to Evaluate restoration Success

Researchers from WNDR, WDFW, and FHL have launched a collaborative initiative focused on eelgrass restoration. our team will contribute to this effort by providing seeds for restoration trials and assisting with both the restoration process and monitoring activities. The collaboration aims to uncover the complex interactions among environmental, biological, and human-induced stressors that affect eelgrass health and viability. This involves detailed field surveys and laboratory analyses to assess factors such as water quality, sediment characteristics, and the impacts of human activities like boating and shoreline development. Drawing on data from multiple eelgrass beds, researchers are testing various restoration approaches, including different seeding densities, planting depths, and the use of protective structures. The goal is to identify the most effective methods under different environmental conditions to maximize restoration success. Based on the research findings, the team will develop comprehensive best practices for eelgrass restoration to guide and enhance future restoration efforts. This effort will launch in 2025.

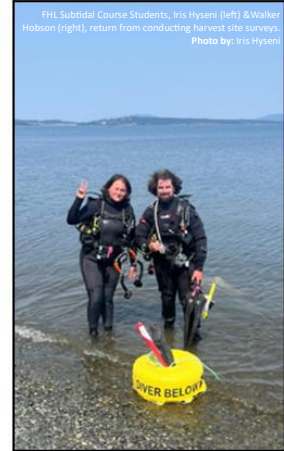
Flowering Partnerships

Cultivating Collaboration

As a conservation district, our role is to implement effective, science-informed restoration methods to ensure the success of our projects. Seed-based eelgrass restoration is a novel approach in Washington State, requiring ongoing research to refine and establish best practices. To achieve our goals, we have partnered with a diverse group of scientists, working collaboratively to deepen our understanding and enhance the effectiveness of our restoration efforts.

Student-Led Research by FHL's Subtidal Ecology Course

In 2024, our team partnered with the Subtidal Ecology Course at Friday Harbor Labs to support student-led research on optimizing subtidal eelgrass harvests in the San Juan Islands. Students examined how various methods and depths impacted harvesting effectiveness. The findings will help refine our operations, allowing us to use seeds from healthy meadows to revitalize struggling ones across the islands.



Pilot Harvests at Padilla Bay

In our pursuit of sourcing reliable intertidal eelgrass seeds, we have turned to alternative locations due to the island-wide decline of intertidal eelgrass. The expansive eelgrass meadow at Padilla Bay, the largest in the contiguous United States, predominantly consists of intertidal eelgrass. The dense and flourishing eelgrass in Padilla Bay significantly enhances the efficiency of our harvesting efforts. In 2024, SJICD partnered with Dr. Sylvia Yang and the Padilla Bay Research Reserve team to conduct pilot studies aimed at developing best practices for eelgrass harvesting. This collaboration seeks to establish a framework for utilizing Washington's healthy meadows to bolster ecosystems in distress. Looking ahead, SJICD intends to continue its partnership with the research reserve to support and facilitate restoration efforts in the San Juan Islands for the foreseeable future.

Project Partners and Collaborators



San Juan Islands Conservation District

District Director: Paul Andersson
Project Manager: Mitch McCloskey.
Project Assistant: Sage Enright



Friday Harbor Labs

Scientific Advisor: Dr. Sandy Wyllie-Echeverria
Student Volunteers: Will Mixon, Iris Hyseni, Avery Jenkins, Walker Hobson, and Raphie Drabe
Other Collaborators: Dr. Olivia Graham, Mike Ramsey and Kate Allhusen



Padilla Bay Research Reserve

Research Leads: Dr. Sylvia Yang, Ian McBride
Participating Staff and volunteers: Niyah Reid, Nicole Burnett, Annabelle Quinlisk, and Heath Bohlmann



Washington Department of Natural Resources

Advisor/Collaborator: Jeff Gaekle
GAECKLE



Washington Department of Fish and Wildlife

Collaborator: Wendel Raymond

Project Advisors

Thanks to following experts who have provided advice to our project team: Dr. Sandy Wyllie-Echeverria, Dr. Sylvia Yang, Dr. Jeff Gaekle, Dr. Wendel Raymond, Dr. Olivia Graham, & Dr. Tina Whitman

Thank you,

To all the contributors on this project. Their collective effort has brought us much closer to a feasible and scalable eelgrass restoration program in the San Juan Islands.

Project Funding Sources

Puget Sound National Estuary Program's
Habitat Strategic Initiative Lead



**Salmon Recovery
Funding Board**

USFW's
Costal Program



Thank you,

to all our project funding sources for investing into the restoration of eelgrass meadows surrounding the San Juan Islands.