

PROJECT SUMMARY (2 PAGES)

Project title: Open Knowledge Networks to Support Regulatory Best Available Science

Project initiation and completion dates: October 15, 2021 - June 1, 2023

Funding request: \$84,740 (\$159,040 in-kind; Total project \$243,780)

Project Management Team - all team labor is in-kind, see budget.

- **Paul Cereghino (NOAA Restoration Center)** Restoration Ecologist, paul.r.cereghino@noaa.gov, 206-948-6360 - project management, HEA modelling support, open knowledge platform development, liaison to project collaborators.
- **Stephanie Ehinger (NOAA Fisheries)** ESA Habitat Biologist, NOAA Fisheries, stephanie.ehinger@noaa.gov - South Puget Sound branch, project management, coordination with ESA-based in lieu fee system, USFWS, PSP, and USACE.
- **Josh Chamberlin (NOAA NW Fisheries Science Center)** Science team chair for independent science team, regional expert in juvenile salmonid habitat services.

Project Collaborators

- **Mary Bhuthimethee (NOAA Fisheries)** ESA Habitat Biologist, North Puget Sound branch coordination
- **Jason Toft (UW)** PSEMP Nearshore Workgroup Coordinator
- **Dawn Pucci (Island Lead Entity)** PSEMP Salmon Workgroup Coordinator
- **Tish Conway-Cranos (WDFW)** ESRP Science Program Lead
- **Jennifer Griffiths (WDFW)** Habitat Strategic Initiative Lead
- **Beth Sanderson & Peter Kiffney (NW Fisheries Science Center)** parallel internal NOAA analysis of habitat quantification models, supporting framework and analysis.
- **Ahren Stroming (PSP)** - state partner in developing a sound-wide mitigation system to use nearshore restoration to compensate for loss of shoreline ecosystem services.

This is a Category 2 Proposal, that addresses multiple “Priority Information Needs”:

1.1 What can we learn from ... watershed-scale habitat protections ... intended to meet salmon recovery goals? Our regulatory system is our primary landscape-scale protection program. We will learn about regulatory science needs as we attempt to quantify ecosystem services at the nexus of ecosystem degradation.

1.4 What does monitoring information tell us about ... land use policies and ... salmon recovery? How effective are ... land use policies in protecting habitat ...? We will use monitoring information to develop and refine regulatory approaches and tools that analyze how development actions affect critical habitat for species listed under the Endangered Species Act (ESA).

1.5 What does monitoring ... tell us about ... land conversion and ... ecological function ...? We will evaluate monitoring information for its use in regulatory support models to quantitatively describe lost ecological function from shoreline development.

3.1 What can monitoring ... tell us about ... processes that affect salmonids? Our work evaluates Puget Sound nearshore juvenile Chinook salmon rearing, as affected by shoreline development actions. We will evaluate monitoring and science products for how they support regulatory actions and where additional evidence is needed.

3.2.1 identification and quantification of impairments to natural processes We will explore strategies for using weighted-area models like Habitat Equivalency Analysis to account for process impacts with diffuse and episodic structural effects at a site and landscape scales.

3.2.2 inventory and characterization of habitat conditions. We will characterize improvements and adverse effects to habitat conditions for the purpose of characterizing their project-related change relative to specific regulatory authorities including the ESA and Magnuson Stevens Act..

Project Abstract

We need to consistently apply “best available science” to our regulatory decisions. The National Marine Fisheries Service has determined that continued degradation of shoreline habitat functions may adversely affect critical habitat for Puget Sound Chinook salmon and thereby reduce food availability for Southern Resident Killer Whales. We need transparent, consistent, and efficient ways to evaluate development proposals to prevent continued and incremental degradation of shoreline ecosystem habitat quality and quantity. Habitat service quantification tools support this transparency, consistency and efficiency.

Regulatory workgroups have scant funding to fill knowledge gaps and are under tremendous social and legal pressure to use best available science to protect ecosystems. Best available science evolves. New studies and monitoring data constantly advance our understanding of habitat functions. We need all of our evidence to be well organized and ready-to-use in making regulatory determinations. We need to understand how to guide new science to support better regulation.

We will prototype and test an efficient system for increasing communication between scientists and regulators, and making scientific evidence more useful for regulatory decisions. Our proposed approach will capture evidence from many sources, and organize that evidence so that it is useful for quantifying the effects of shoreline actions on protected ecosystem services. Quantification is important because it helps us think systematically about shoreline habitat functions, in a way that is accountable and transparent.

We propose a series of “science sprints” to prepare scientific evidence for use in regulatory systems and in quantitative tools. We will work with regulatory teams to understand their needs. We will work with our science community to organize available evidence to develop habitat service models being used to support Endangered Species Act consultations. We will clarify where new science can increase regulatory effectiveness.

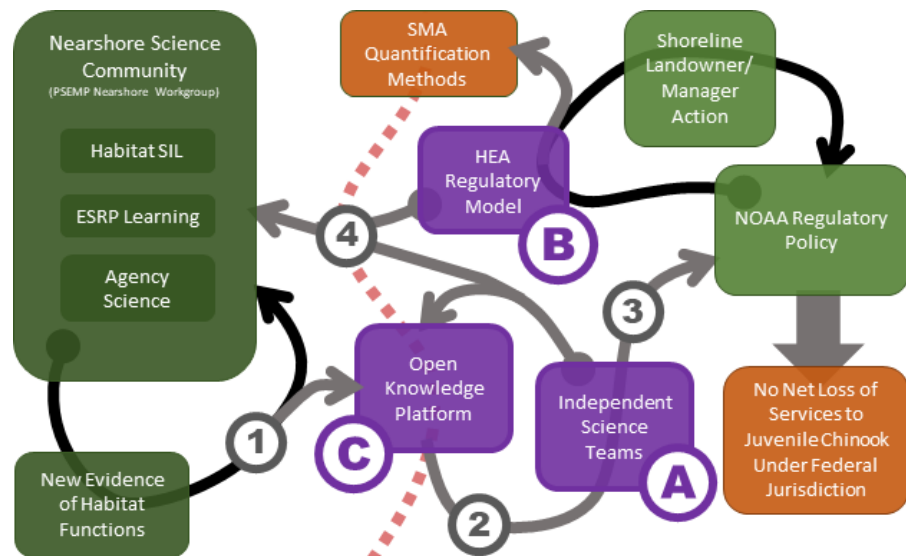
This award will support two six-month “science sprints”. Over each “sprint” we’ll pick an impactful topic and assemble an independent team of scientists to review best available science. Contract staff will support the team in rapidly assembling and synthesizing available evidence. Our project management team includes staff on the cutting edge of using ecosystem service quantification to implement the Endangered Species Act. We are strongly networked with the most experienced scientists in Puget Sound studying juvenile chinook habitat use on shorelines.

Best available science constantly evolves. Consistently bringing best available science to inform shoreline regulation is an ongoing effort requiring transparency, consistency, and fairness. Shoreline ecosystem functions are protected under state and federal law for the benefit of all citizens. The shoreline is literally on the front lines of sea level rise under climate change. Consistently applying best available science to each shoreline development proposal is necessary for the recovery of threatened and endangered salmon, and the economies and cultures that depend on them.

Objectives, Outputs, and Outcomes

We propose to build a prototype system for integrating new scientific findings into efficient regulatory models. These models quantify losses or gains in ecosystem services for the purpose of avoiding, minimizing or mitigating the adverse effects of development, thereby enabling recovery. Without good protection, restoration doesn't work. Our prototype uses the Endangered Species Act authorities to protect Chinook rearing functions in Puget Sound nearshore ecosystems (beaches, embayments and river deltas). Monitoring and ecological research informs regulation by clarifying how ecosystems provide services at multiple scales. Ecosystem recovery scientists continually generate new knowledge, but we lack robust systems for translating new knowledge into effective regulatory policies and protection. We propose an open knowledge platform and a mutually beneficial social process to link new knowledge about habitat services for Chinook salmon in the nearshore, in support of emerging ESA-driven conservation systems based on Habitat Equivalency Analysis (HEA).

Figure 1 - Conceptual schematic of our project. Our recovery science community on the left and regulatory systems on the right are isolated from each other (both in green on left and right). We propose three new elements ("outputs" in purple) to organize information flow between these isolated systems. Numbered grey arrows represent four objectives described below. We aim to influence both ESA policy and SMA implementation.



This project will revolve around three "outputs" or components that will be designed to achieve our four "objectives." Our overall intent is to increase uptake of best available science into regulatory work. We aim to reduce the loss of ecosystem services by efficiently enhancing existing programs. Our three outputs are: Science Sprints, HEA Regulatory Models and Open Knowledge Platform.

- A. **Science Sprints** - We will assemble independent science teams to organize evidence around selected topics. Each effort will evaluate new scientific evidence in relation to HEA quantification methods (Objective 2) to generate decision support for regulatory policy (Objective 3). In addition, we will identify where gaps in evidence affect regulatory policy to inform future work by the nearshore science community (Objective 4). We anticipate 2 sprints, and with each sprint we will improve our method to maximize cost-benefit of the process (described more in our approach.)
- B. **HEA Regulatory Models** - We will enhance and expand simple transparent regulatory models that describe development impacts on beaches, embayments and river deltas. These models are NOAA products, will be available

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on NOAAs web page for decision support in ESA implementation by NOAA as well as for use by applicants and partners. They are informed by best available science , developed by independent science team sprints (Objective 3), and the models will be structured to inform future research most likely to support implementation of existing regulations including the ESA (Objective 4)

- C. **Open Knowledge Platform - Establish a web-based platform to receive and organize documents and summaries from any partner in our network that can be easily adapted over time.** We must easily receive and store evidence from any partner (Objective 1), so that it is easily accessible by an independent science team (Objective 2) with the least overhead and transaction costs. Because of its unique capabilities we propose enhancement of the open-source wiki at <http://salishsearestoration.org> for these functions.

These outputs and objectives will be described further in our approach and engagement plan. We believe that using quantification of habitat services as a shared project will 1) accelerate NOAA progress towards no-net-loss of juvenile chinook shoreline rearing services, and 2) generate opportunities to support quantification under other no-net-loss authorities such as the Shoreline Management Act, which mandates quantification but has not operationalized methods after 50 years of implementation¹. Both of these outcomes are critical protection outcomes that make ecosystem recovery possible.

We believe that to achieve these outcomes, and develop an efficient and sustainable prototype, we must develop a process of organizing evidence that functions with a minimum of management. We propose a “lean management approach”, using continuous improvement and standard practices, and where science outputs are “pulled” by the needs of regulators (see [Isaai 2012](#)). A final project output will be a **process evaluation and proposal**, asking involved parties to support operating costs and sustain these activities beyond this grant.

Background

There is broad consensus that ecosystem protection is a requisite for effective restoration. Regulation of private development is the foundation of our protection systems. A recent analysis of Vital Signs mentioned “restoration” 45 times, “protection” 21 times, and “regulation” three times ([McManus 2020](#)). Regulatory systems are located at the nexus of ecosystem degradation. Regulation is underfunded, understaffed, under constant legal pressure, and as a consequence is often socially isolated. Our other recovery systems are by comparison well financed and collaborative. To further recovery, it is imperative to better connect regulatory systems with the other aspects of recovery. .

By late 2019, the National Marine Fisheries Service (NMFS) completed the review of 39 nearshore development proposals. NMFS determined that impacts from these 39 projects, together with the poor status, poor baseline conditions, and cumulative effects, were likely to jeopardize the future existence of Chinook salmon and Southern Resident Killer Whale.² NMFS used the Puget Sound Conservation calculator as a technical tool to aid with the long-term nearshore habitat impact aspect of the analysis.

¹ See [Kramer et al. 2010](#) for discussion

² As defined in [WCRO-2020-01361](#)

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At this point, this NMFS determination under the Endangered Species Act (ESA) is a critical springboard for quantification of ecosystem services. We are unaware of any Puget Sound jurisdiction that is quantifying shoreline ecosystem services or has established verifiable targets for no-net-loss under the Shoreline Management Act (SMA). We believe spatially explicit service quantification is a necessary backstop to create accountability for shoreline development under population growth and climate change.

Regulatory systems however, are not funded for scientific investigation or to organize and integrate new evidence. Regulatory innovation depends on ongoing recovery science supporting regulatory efforts. Regulators operate under precise limitations defined by statutes, rules and policies, and the legal definitions of words. The recovery science community generally does not understand these technical needs of regulators, and so recovery science is usually not organized to support regulatory processes.

By bringing integrated biophysical salmonid habitat science into regulatory systems on shorelines, this proposal directly and intrinsically addresses all three cross-cutting principles proposed by PSEMP, while acting at the nexus of ecosystem degradation, at a Sound-wide scale.

Integrating Biophysical and Social Sciences Perspectives - This proposal experiments with social systems for the purpose of productively organizing biological and physical science to support legal and social mechanisms, to increase the ecosystem stewardship capabilities in our nested social-ecological system. Our proposal directly integrates legal, policy, and science communities to increase application of scientific evidence to ecosystem protection.

Addressing Climate Change - Sea level rise (SLR) will have a dramatic effect on nearshore ecosystem processes and functions. Shorelines are less able to adjust to disturbance from SLR where shoreline development has reduced the resilience of biophysical systems. As climate change science comes into focus, new knowledge is likely to overwhelm regulatory systems. During one of our three proposed “science sprints” we will focus on developing strategies for incorporating likely sea level rise impacts into habitat service model assumptions.

Advancing Justice, Equity, Diversity, and Inclusion (JEDI): The shoreline ecosystems threatened by shoreline development are a public trust resource. Census data indicate that shoreline census blocks are disproportionately owned and controlled by households that identify as “white only”. Shoreline real estate represents the wealth of households with disproportionate economic power. Shoreline development for personal benefit disproportionately benefits white and economically privileged members of society while potentially degrading trust resources reserved for all citizens. In a region defined by 2,500 miles of shoreline and where subsistence fishing supports underserved communities and is a protected tribal treaty right, shoreline regulation is a foundational environmental justice issue.

Approach & Engagement Plan

We will develop four project “outputs” where engagement is deeply integrated into the fiber of our effort: **1) Science Sprints, 2) HEA Regulatory Models, 3) an Open Knowledge Platform, and 4) Process Evaluation.** We propose each output as a contract task.

OUTPUT A - Independent Science Sprints - We propose formation of independent science teams with interdisciplinary expertise in nearshore salmonid ecology to guide two “science sprints” to clarify aspects of best available science (BAS) to advance regulatory decision support models using Habitat Equivalency Analysis (HEA).

Science Teams (STs) will include 2-3 standing members with expertise in nearshore salmonid ecology and familiar with regulatory quantification approaches, including a ST chair who is part of the project management team. An additional 2-3 invitees will be recruited through the PSEMP Nearshore and Salmon Workgroups based on the selected topic. Each team will be supported by a contracted facilitator. ST participants may be offered a small stipend as necessary.

Each science team will organize available evidence on our open knowledge platform, deliberate over the weight of this evidence, and publish an independent opinion. This award supports a contract facilitator/science writer to support science team productivity. This award will support two science sprints beginning in the spring of 2022.

To define the scope of a science sprint we will consult informally with a small group of regulatory advisors to identify topics where synthesis of existing and new knowledge will maximize regulatory effectiveness (specifically Ecology, USACE, WDFW & USFWS, and selected local government contacts). The Project Team will compare the opportunities presented by emerging science to the needs of regulators, and announce a focal topic for each sprint. ST composition will depend on the selected topic, but will be interdisciplinary, competitively selected. We will use PSEMP nearshore and salmonid workgroups as our social network to support science team formation. An additional award may be offered to ST members that are uniquely positioned to gather and synthesize available evidence on a particular topic, augmenting facilitator effort. We anticipate our initial topic may focus on *variable use of river delta habitats by juvenile Chinook salmon?*

ST findings will be drafted by the chair and facilitator, may highlight important areas of uncertainty, will be publicized along with gathered evidence on our open knowledge platform, and shared through PSEMP Workgroups. Team findings will consider how knowledge would be best applied within the HEA framework, and identify where the HEA framework is unable to support quantification of observed ecological dynamics. The Project Team will present findings to regulators and report on the potential value of additional study of the topic in support of regulation.

The opinion of the STs are independent of NOAA regulatory policy, but deliberation will be organized by the chair and facilitator to provide the maximum utility for regulatory decision support, the development of service quantification models, and to meet the needs of regulatory agencies. We anticipate the use of the models to facilitate regulatory analysis and support the transparent review of complex evidence.

Consistent with our cross-cutting interest in climate change, one of our science sprints will focus on impacts of sea level rise (SLR). We anticipate that shoreline changes driven by SLR will directly affect the provision of nearshore habitat services.

OUTPUT B - HEA Regulatory Support Models - Habitat Equivalency Analysis is a simple weighted-area ecosystem service model incorporating discounted future value. A perfect habitat provides one unit of service per year per acre. Future services are discounted using economic logic. Relative service provision is captured in a per-acre service value describing how juvenile chinook salmon benefit from a habitat. Factors not well described on a per-acre basis are captured using multipliers that may consider landform or population-scale effects. HEA provides a simple method for describing the

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relative influence of diverse factors to establish reasonable and rational level of habitat services.

Existing HEA models have been published by NOAA as a decision support tool, to inform ESA consultations³. Current modules are focused on beach and embayment impacts. In-kind work is in contracting to expand to river deltas. Consistent with its ESA authority, NOAA is solely responsible for the model, the use of models during a consultation, and the resulting effects determination under ESA. With these tools a project applicant or jurisdiction can measure the likely service value impacts of an action, with that analysis providing a starting point for negotiating appropriate measures or alternatives. The calculator supports consistent consideration of project actions and setting, and allows us to define the scale of compensatory work if impacts cannot be avoided or minimized.

OUTPUT C - Open Knowledge Platform - Established in 2011 the wiki at <http://salishsearestoration.org> provides a unique set of services to the Puget Sound ecosystem community. It allows any partner working through a web browser interface, to contribute documents and notes to a shared knowledge base, and interact with similar material contributed by others. The system is searchable and transparent, with every edit by registered members tracked and recorded. It is built on the same resilient open-source software used and maintained for Wikipedia. It requires approximately \$500 dollars a year in operating resources to cover hosting and routine upgrades. Under this award we will upgrade this system to increase its usability to support active use by independent science teams. This upgrade will involve a contract with a private service provider to 1) consolidate management through a modern “wikifarm” service, 2) update the site “skin” to better support modern browsing platforms, and 3) improve the user experience to support easy categorization and WYSIWYG editing⁴. A wiki-based platform allows users to efficiently adjust and adapt the platform to a wide range of functions. The wiki enables collaborative cross-agency management of public information and evidence with a minimum of curation or cost. NOAA and WDFW will match upgrade costs supported by this grant, and NOAA will continue to provide quarterly user training and administrative support.

The platform will enable ST members, the facilitator, and PSEMP workgroups to upload and categorize evidence, and generate shared annotations and summaries, while making both grey and peer reviewed products and immediately accessible and citable by any audience including regulators. The flexible categorization and automation available in a wiki environment allows for adaptive structuring of knowledge. We can start building regulatory function with our “first touch” on a new piece of evidence. The improvements described allow for more intuitive use of this extremely efficient tool.

OUTPUT D - Process Evaluation - Each sprint will be evaluated using cost documentation, wiki production, and feedback from participants. The project team will produce an end-of-project evaluation of costs and make recommendations for ongoing work. This assessment will result in a proposal to the Puget Sound Federal Task Force, regulators, Align Grant Coordination Workgroup, ECB, and the PSEMP steering committee to continue best available science synthesis as an underlying function of science funding.

³ See [Puget Sound Nearshore Habitat Conservation Calculator](#)

⁴ “What you see is what you get”

SCOPE OF WORK

Leads: Paul Cereghino & Stephanie Ehinger
Title: Open Knowledge Networks to Support Regulatory Best Available Science
Initiate: October 15, 2021
Complete: June 1, 2023

#	Task Name & Description	Outputs & Deliverables	Due Date(s)	Budget
1	Science Sprints	Sprint 1 Sprint 2	12/31/2022 6/1/2023	\$77,440 award \$16,640 in-kind
2	HEA Regulatory Models	Framework HEA Models	6/1/2023	\$123,200 in-kind
3	Open Knowledge Platform	Improved Platform	6/30/2022	\$6,180 award \$5,760 in-kind
4	Process Evaluation	Evaluation & Proposal	6/1/2023	\$1,120 award \$13,440 in-kind
			Total	\$84,740 award \$159,040 in-kind

We anticipate two sprints with the proposed award level and available time frame. The budget is based on competitive contracting for the facilitator role. If we are able to secure agency labor, we will be able to include additional work in task 2 to expand HEA module updates.

Schedule

HEA Model work is ongoing, the framework is evaluated before the beginning of each sprint. Sprint outputs are delivered within the following quarter. Evaluation is both following sprints, and resulting in a final proposal.

		FFY 2022					FFY 2023	
		2021	2022				2023	
Task	Outputs	Oct-Dec	Jan-Mar	Apr-Jun	Jul-Aug	Sep-Dec	Jan-Mar	Apr- Jun
1	Sprint 1					Output		
1	Sprint 2							Report
2	Framework							Output
2	HEA Models							Output
3	OKP			Output				
4	Eval							Output

BUDGET & JUSTIFICATION

Budget Summary

A task breakdown and budget analyses are provided in support of this summary table. Determining precise rates prior to verification of funding, as described in the budget instructions, is not consistent with our contracting practices. All funding is for contracted services. For this internal estimate and proposal, we presume a \$140/hour loaded rate as an average rate across a consultant team, presuming that we will be unable to secure internal labor to support facilitation or writing. If we are able to secure internal labor, this will allow us to reduce labor costs and increase scope. We use a \$80/hour loaded rate for estimating in-kind labor costs. This proposed scope is part of a large body of work being undertaken by NOAA Restoration Center, NOAA NW Fisheries Science Center, and NOAA West Coast Region, as described in the final figure of the justification.

	ObjectClass	Job Classification	Rate	1. Science Teams		2. HEA Models		3. Platform		4. Evaluation		Grand Total	
				Units	Cost	Units	Cost	Units	Cost	Units	Cost	Units	Cost
Award	Subcontracts	Facilitator	\$140	496	\$69,440			16	\$2,240	8	\$1,120	520	\$72,800
		Science Team	\$1,000	8	\$8,000							8	\$8,000
		Web Contractor	\$60					64	\$3,840			64	\$3,840
		Hosting Contract	\$100					1	\$100			1	\$100
Award Total				504	\$77,440			81	\$6,180	8	\$1,120	593	\$84,740
Match	Salary	Cereghino	\$80	64	\$5,120	60	\$4,800	72	\$5,760	124	\$9,920	320	\$25,600
		Cereghino/Ehinger	\$80			32	\$2,560					32	\$2,560
		Project Team	\$80	144	\$11,520	48	\$3,840			44	\$3,520	236	\$18,880
	Subcontracts	HEA Contractors	\$12,000			1	\$12,000					1	\$12,000
			\$100,000			1	\$100,000					1	\$100,000
Match Total				208	\$16,640	142	\$123,200	72	\$5,760	168	\$13,440	590	\$159,040
Grand Total				712	\$94,080	142	\$123,200	153	\$11,940	176	\$14,560	1183	\$243,780

BUDGET & JUSTIFICATION

Budget Sub-Task Breakdown

For each task we identified sub-tasks, and estimated labor costs for completing each sub-task. Estimates were based on professional experience and past contracting costs. Actual labor costs may be more or less than estimated, and there is sufficient flexibility in the project breakdown to adjust approach and complete project outputs within the estimated cost. Sub-tasks 1b-h are repeated for each sprint. This initial award will enable future “science sprints” using increasingly refined methods.

Sub-Task Breakdown	Description
1a. Develop Standard	Define initial structure of a BAS output, weight of evidence classification, using a HEA framework
1b. Scope Sprint	Develop questions that define the scope of the science sprint
1c. Assemble Team	Identify and secure the services of 4-6 independent scientists and 3 peer reviewers to conduct sprint
1d. Gather Evidence	Assemble documents that describe evidence available within the scope of the sprint
1e. Deliberation	Evaluate evidence and organize in conceptual model and HEA Framework evaluating the weight of evidence
1f. Product Development	Draft an initial BAS product
1g. Peer Review	Conduct informal peer review, and through PSEMP workgroups
1h. Adapt Standard	Evaluate the sprint output standard, and adjust based on sprint experience
2a. Set HEA Framework	Establish framework for organizing scientific evidence relative to HEA methodology
2b. Adapt HEA Framework	Review draft sprint product and adjust HEA framework in response to actual evidence and deliberations
2c. HEA Model Improvement	Adapt HEA models through independent contracts to meet regulatory needs based on BAS
3a. Secure Contractor	Develop scope and secure web development capacity
3b. Upgrade Website	Upgrade Open Knowledge Platform in collaboration with wiki steward
4a. Evaluation Design	Define methods for capturing costs and benefits of science sprints
4b. Sprint Evaluation	Quantify costs and benefits of each sprint process, synthesize, prepare final proposal

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Budget Detail Description and Internal Estimate

The proposed award is based on a detailed cost estimate which estimates labor cost across sub-tasks. Our estimate is based on completing two sprints. Contracted services (in grey) are the whole of our funding request.

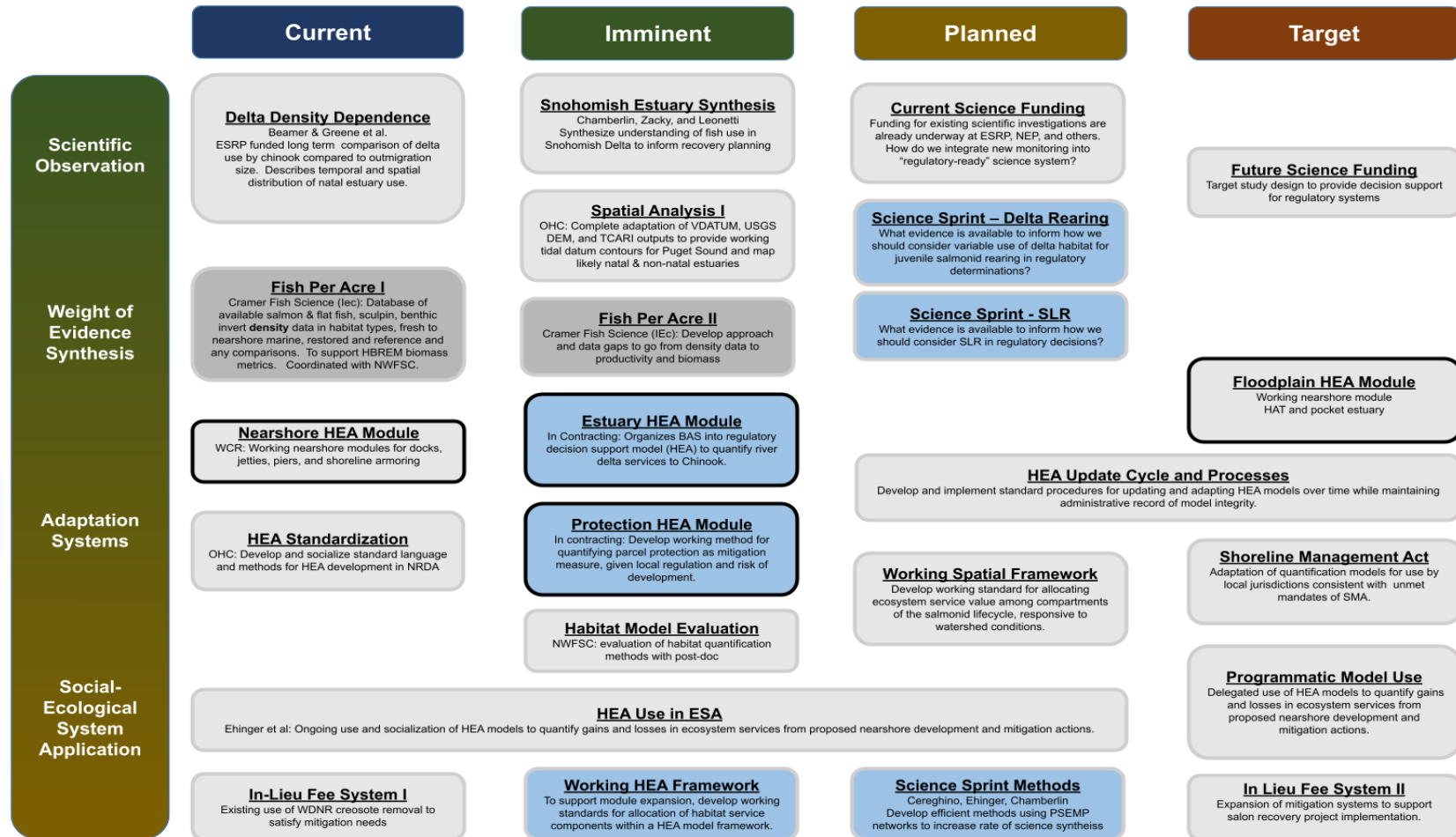
Task Breakdown	JobDescription	Description	Units	UnitName	UnitCost	Cost
1b. Scope Sprint	Facilitator	Attend meeting, write scoping statement for sprint	16	hours	\$140	\$2,240
1b. Scope Sprint	Project Team	Interviews with regulatory partners	16	hours	\$80	\$1,280
1b. Scope Sprint	Project Team	4h Work session to scope sprint & list names4	32	hours	\$80	\$2,560
1a. Develop Standard	Cereghino	draft standard product outline/framework	16	hours	\$80	\$1,280
1a. Develop Standard	Facilitator	2h kickoff MTG & revise standard product outline/framework	8	hours	\$140	\$1,120
1a. Develop Standard	Project Team	3 meetings to deliberate standard product	16	hours	\$80	\$1,280
1c. Assemble Team	Cereghino	Online form management for nominations	32	hours	\$80	\$2,560
1c. Assemble Team	Facilitator	PSEMP publicity (4), ranked list meeting & FU (4), make offer (16), stipend contract as necessary (16), project team contact (4)	96	hours	\$140	\$13,440
1c. Assemble Team	Project Team	Personal invitations to science candidates	16	hours	\$80	\$1,280
1c. Assemble Team	Science Team	Stipend (assume \$1000 x 4 per sprint)	8	stipend	\$1,000	\$8,000
1d. Gather Evidence	Facilitator	4h MTG, scope evidence, Secure PDFs, quick assess, upload, citation	88	hours	\$140	\$12,320
1e. Deliberation	Facilitator	2x4h MTGs, organize discussion, additional evidence gathering, annotation	104	hours	\$140	\$14,560
1e. Deliberation	Project Team	Feedback on scope of evidence	32	hours	\$80	\$2,560
1f. Product Development	Facilitator	prep, 4h MTG, draft product, draft final	136	hours	\$140	\$19,040
1f. Product Development	Project Team	Feedback on draft product	32	hours	\$80	\$2,560
1g. Peer Review	Facilitator	Facilitation of PSEMP-based "peer review", 4h MTG to respond, final draft revision	48	hours	\$140	\$6,720
1h. Adapt Standard	Cereghino	Draft/final standard revision	16	hours	\$80	\$1,280
1h. Adapt Standard	Project Team	Mtg Adjust standard defined at beginning of sprint	32	hours	\$80	\$2,560
4b. Sprint Evaluation	Cereghino	Survey and draft assessment	48	hours	\$80	\$3,840
2a. Set HEA Framework	Cereghino	HEA Framework	24	hours	\$80	\$1,920
2a. Set HEA Framework	Cereghino	HEA Presentation	16	hours	\$80	\$1,280
2a. Set HEA Framework	Cereghino	NOAA Internal HEA Framework review	12	hours	\$80	\$960
2a. Set HEA Framework	Cereghino	HEA Video Production	8	hours	\$80	\$640

BUDGET & JUSTIFICATION

2a. Set HEA Framework	Cereghino/Ehinger	review draft Science Product	32	hours	\$80	\$2,560
2a. Set HEA Framework	Project Team	3 meetings to define HEA framework	48	hours	\$80	\$3,840
2c. HEA Model Improvement	HEA Contractors	Existing Estuary Model Contract	1	contract	\$100,000	\$100,000
2c. HEA Model Improvement	HEA Contractors	Existing Protection Module Contract	1	contract	\$12,000	\$12,000
3a. Secure Contractor	Facilitator	Administration - advertize, select, financial	16	hours	\$140	\$2,240
3b. Upgrade Website	Cereghino	Scope of upgrade	8	hours	\$80	\$640
3b. Upgrade Website	Cereghino	QA/QC upgrades	24	hours	\$80	\$1,920
3b. Upgrade Website	Cereghino	Subcontractor technical oversight	24	hours	\$80	\$1,920
3b. Upgrade Website	Cereghino	Liaison with wiki steward	16	hours	\$80	\$1,280
3b. Upgrade Website	Web Contractor	Contract with wikifarm	1	contract	\$100	\$100
3b. Upgrade Website	Web Contractor	Consolidation and backup on wikifarm, domain, SSL	8	hours	\$60	\$480
3b. Upgrade Website	Web Contractor	Edit user interface install and test	16	hours	\$60	\$960
3b. Upgrade Website	Web Contractor	Category tools update and test	16	hours	\$60	\$960
3b. Upgrade Website	Web Contractor	Mobile skin install and troubleshoot	24	hours	\$60	\$1,440
4a. Evaluation Design	Cereghino	Draft method of measuring cost/benefits	16	hours	\$80	\$1,280
4a. Evaluation Design	Project Team	2 meetings to design cost-benefit evaluation method	12	hours	\$80	\$960
4b. Sprint Evaluation	Cereghino	Survey feedback process	40	hours	\$80	\$3,200
4b. Sprint Evaluation	Cereghino	Proposal development	20	hours	\$80	\$1,600
4b. Sprint Evaluation	Facilitator	Summarize metrics	8	hours	\$140	\$1,120

BUDGET & JUSTIFICATION

PROJECT CONTEXT - This project (with some of its components identified in blue) is positioned within a network of mutually reinforcing efforts among federal, state and local partners. We believe ecosystem service quantification is a pivotal component of ecosystem recovery, and a practical vehicle for adaptive management. The development of ecosystem service markets may be essential to stabilize habitat decline under population growth and climate change.



Paul Cereghino
Restoration Ecologist/Marine Habitat Specialist, NOAA Restoration Center
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PROFESSIONAL SUMMARY

I combine 32 years of diverse experience in public and private land management at multiple scales in the Salish Sea, including 18 years in regional restoration planning and implementation. I offer a unique combination of experience in field practicum, institutional development, and systems analysis to solve ecosystem stewardship challenges. I am the senior staff on the 6-person Puget Sound Team at NOAA's Restoration Center.

EDUCATION

Masters of Science, Ecosystem Sciences, College of Forest Resources, University of Washington, Seattle, Washington, 2001-2004

Bachelors of Arts and Sciences, Natural Sciences/Environmental Design, The Evergreen State College, Olympia, Washington, 1986-1992

HABITAT EQUIVALENCY AND SPATIAL ANALYSIS - 17 years of professional experience integrating GIS and HEA into consequential products that quantify ecosystem services.

- Developed complex HEA calculators and training resources, and facilitated training and peer-to-peer education to increase HEA capabilities across NOAA's Pacific Region.
- Developed habitat equivalency analyses to support damage assessment and restoration planning, leading to a \$9.3M settlement agreement in Port Angeles Harbor.

INTERAGENCY COORDINATION - Initiated and developed policy in support of interagency efforts including: PSNERP, Coordinated Investment, Floodplains by Design, The River Delta Workgroup (initiating Implementation Strategy development), Snohomish Estuary Monitoring, and the Align Grant Coordination Workgroup.

- Led analysis and facilitation of state-federal coordination opportunities, leading to development of the Align Grant Coordination Workgroup, leading subsequent efforts in budget and process coordination for Puget Sound funding programs.
- Provided key technical assistance in support of NOAA's participation in the Puget Sound Federal Task Force..
- Developed and maintained the Salish Sea Restoration Wiki as a platform for multiple partnerships over a decade of work.

NEARSHORE ECOSYSTEM PLANNING - extensive technical experience in interdisciplinary science, and policy development focused on Salish Sea shorelines.

- Represented NOAA at the Puget Sound Nearshore Ecosystem Restoration Project at technical and policy levels; primary author of Restoration and Protection Strategies.
- Developed Estuary and Salmon Restoration Program in collaboration with WDFW, leading innovations in contract consolidation, portfolio-based funding to reduce administrative effort, learning programs within capital budgets, and whole project budget analysis.
- Completed independent shoreline spatial analysis, developing and using best available data to describe the structures and processes of beaches, embayments, and river deltas, including pocket estuaries, predicting variable tidal prism, and habitat quantification methods.

Stephanie Ehinger
Biologist/ Habitat Quantification Ecologist for NOAA's Central & South Puget Sound Habitat
Office

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EDUCATION

Masters of Science (Diplom), Biology/Limnology University of Konstanz, Germany

Bachelors of Sciences (Vordiplom), majors: Microbiology & Botany University Goettingen, Germany

HABITAT EQUIVALENCY ANALYSIS - 7 years of professional experience developing habitat quantification tools in combination with Habitat Equivalency Analysis (HEA). The goal of these tools is to assess mitigation needs and aid with impact assessments as part of Endangered Species Act consultations

- In 2014, I lead a joint team on NOAA and US Army Corps of Engineers biologist in the development of the Puget Sound Nearshore Habitat Values Model
(https://archive.fisheries.noaa.gov/wcr/publications/habitat/critical_habitat/doc_nhvh_ea_model_working_draft_2015.pdf).
- In 2015, I led the completion of the RGP6 calculator based on the Nearshore Habitat Values Model and its implementation with an Endangered Species Act consultation. The RGP6 calculator is a mitigation tool that allows determining mitigation needed for the construction of residential overwater structures within the confines of a programmatic consultation. It is available on the US Army Corps of Engineers regulatory web page.
- In 2018 I began leading a new interagency team of US Fish and Wildlife Service and NOAA biologists in expanding and refining the Nearshore Habitat Values Model and building a user friendly interface that facilitates ESA consultations, the Puget Sound Conservation Calculator. The Puget Sound Conservation calculator is available on NOAA's web page and was used for the 2020 jeopardy adverse modification ESA consultation on a batch of 39 nearshore projects.
- Leading ongoing efforts to fill science gaps to refine the consistent application of the Conservation Calculator: Joint NOAA & Department of Ecology effort in refining backshore width for use with HEA.

INTERAGENCY COORDINATION

- Member of the steering committee for development of Chiavacci, S.J., and Pindilli, E.J., 2018, A database of biodiversity and habitat quantification tools used in market-based conservation: U.S. Geological Survey Fact Sheet 2018–3039, 4 p., <https://doi.org/10.3133/fs20183039>.
- I am the NOAA contact point for the implementation of the Memorandum of Understanding between NOAA, the US Fish and Wildlife Service and the Puget Sound Partnership for the Conservation Crediting Administration in Puget Sound Marine Nearshore Waters which makes use of the Conservation Calculator.
- I am a member a joint NOAA regulatory, restoration center, and science center team working on filling science gaps for implementation of NOAA's regulatory authorities.

PRESENTATIONS AND TRAINING

- National Mitigation Banking and Ecosystem Conference 2021: a) Panel Presenter "A New Conservation Marketplace in the Puget Sound"; b) Oral presentation "A New Tool Facilitating No Net Loss with Consultations: The Puget Sound Nearshore Conservation Calculator"
- Puget Sound Salmon Recovery Conference 2021 "A New Tool Facilitating Habitat Conservation: The Puget Sound Nearshore Conservation Calculator"
- Presenter at the Fall 2020 / Winter 2021 Conservation Banking Webinar Series

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Education

M.Sc., Aquatic and Fishery Sciences, University of Washington, Seattle WA	9/07 – 12/09
B.A., Marine Studies, Prescott College, Prescott AZ	8/01 – 12/04

Employment

Research Ecologist, NOAA Fisheries, NWFSC, Seattle, WA	03/16-pres
Research Fisheries Biologist, NOAA Fisheries, NWFSC, Seattle, WA	09/11-09/15
Fisheries Biologist (contractor), NOAA Fisheries, NWFSC, Seattle, WA	04/05-09/11
Research Associate, National Marine Fisheries Service, Seattle, WA	5/04 – 9/04

Research Interests

- The effects of life history diversity on movement patterns, feeding/growth, and survival in salmonids throughout freshwater, estuarine and nearshore marine habitats.
- Design, implementation, and evaluation of salmon restoration projects in river deltas and nearshore marine habitats.
- Evaluating fish/habitat interactions and their influence on behavior and growth

Selected Publications

Chamberlin, JW, J. Hall, T. Zackey, F. Leonetti, M. Rustay, and CR Rice. In press. Spatial and temporal variability in Chinook salmon abundance reflects opportunity to support life history diversity in an estuarine landscape. *Estuaries and Coasts*

Greene, C.M., E. Beamer, **J. Chamberlin**, G. Hood, M. Davis, K. Larsen, J. Anderson, R. Henderson, J. Hall, M. Pouley, T. Zackey, S. Hodgson, C. Ellings, and I. Woo. 2020. Landscape, density-dependent, and bioenergetic influences upon Chinook salmon in tidal delta habitats: Comparison of four Puget Sound estuaries. ESRP Report 13-1508.

Davis MJ, **Chamberlin JW**, Gardner JR, Connelly KA, Gamble MM, Beckman BR, Beauchamp DA. 2020. Variable prey consumption leads to distinct regional differences in Chinook salmon growth during the early marine critical period. *Marine Ecology Progress Series* 640:147-169.

Chamberlin, J., B. Beckman, C. Greene, C. Rice, and J. Hall. 2017. How relative size and abundance structures the relationship between size and individual growth in an otogenically piscivorous fish. *Ecology and Evolution* 7: 6981-6995.