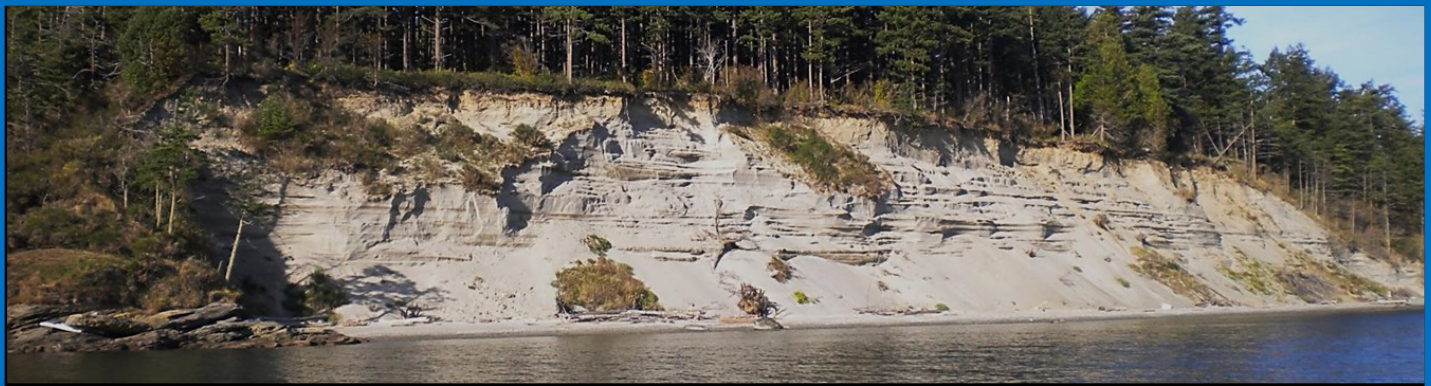




Healthy Beaches for People and Fish:

***Protecting shorelines from the impacts of
armoring today and rising seas tomorrow***

**Final Project Report
to WDFW and the U.S. EPA.**



Prepared by: Friends of the San Juans
April 2014



Healthy Beaches for People and Fish

The goal of the *Healthy Beaches for People and Fish: Protecting shorelines from the impacts of armoring today and rising seas tomorrow* project is to improve the long-term protection of nearshore marine ecosystems by developing new technical tools and identifying management strategies that specifically address sea level rise and the cumulative impacts of shoreline armoring.

The *Healthy Beaches for People and Fish* project was completed in 2014 by Friends of the San Juans in partnership with Coastal Geologic Services, Salish Sea Biological and the Washington Department of Fish and Wildlife. The technical advisory group that guided the project approach and work consisted of representatives from the University of Washington, United States Geological Survey, Puget Sound Partnership, Skagit River Systems Cooperative, Samish Indian Nation, San Juan County Public Works, San Juan County Salmon Recovery Lead Entity, The Tulalip Tribes, Padilla Bay National Estuarine Research Reserve and the Washington State Departments of Ecology, Natural Resources and Fish and Wildlife.

The project contained four distinct research areas that informed management recommendations:

- A legal review of existing local, state and federal shoreline regulations and their ability to address sea level rise and cumulative impacts;
- Sea level rise vulnerability assessment for San Juan County;
- Forage fish spawning habitat research; and
- Surveys of coastal managers, regulators and researchers.

Reports and data products associated with this project can be found online at www.sanjuans.org/NearshoreStudies.htm and include:

Friends of the San Juans. 2014. *Healthy Beaches for People and Fish: Protecting shorelines from the impacts of armoring today and rising seas tomorrow*. Final Report to WDFW and the U.S. EPA. Friday Harbor, Washington.

Loring, K. 2013. *Addressing Sea Level Rise and Cumulative Ecological Impacts in San Juan County Washington Through Improved Implementation and Effective Amendment of Local, State, and Federal Laws*. Friends of the San Juans. Friday Harbor, Washington.

MacLennan, A. and J. Waggoner. 2013. *Sea Level Rise Vulnerability Assessment for San Juan County, Washington*. Prepared by Coastal Geologic Services for Friends of the San Juans.

Whitman, T., D. Penttila, K. Krueger, P. Dionne, K. Pierce Jr., and T. Quinn. 2014. *Tidal elevation of surf smelt spawn habitat study for San Juan County Washington*. Friends of the San Juans, Salish Sea Biological and Washington Department of Fish and Wildlife.

Whitman, T. and S. Hawkins. 2013. *The impacts of shoreline armoring on beach spawning forage fish habitat in San Juan County, Washington*. Friends of the San Juans. Friday Harbor, Washington.

This project has been funded in part by the United States Environmental Protection Agency under assistance agreement PC 00J29801 to Washington Department of Fish and Wildlife. The contents of this document do not necessarily reflect the views and policies of the Environmental Protection Agency, nor does mention of trade names or commercial products constitute endorsement or recommendation for use. Match funding for the project was provided by the Bullitt Foundation and the North Pacific Landscape Conservation Cooperative. In kind match provided by Friends of the San Juans, Coastal Geologic Services, Salish Sea Biological and technical advisory group participants.

Introduction

Shoreline modification through hard armoring poses a high risk to the long-term health of nearshore ecosystems in the Salish Sea, through its impacts to habitat and habitat forming processes. These nearshore areas play a critical role for species including those listed under the federal Endangered Species Act (Southern Resident Orca, Marbled Murrelet, Stellar sea lion, and Chinook salmon). All of these listed species rely directly or indirectly upon forage fish for their survival; forage fish provide the trophic connection between zooplankton and larger fish, birds and mammals, including the target recovery species Chinook salmon and Orca. Forage fish are especially vulnerable to shoreline development. Shoreline modifications like bulkheads can bury or cause scouring of the habitat that beach spawning forage fish (surf smelt and Pacific sand lance) need for incubating their eggs. In addition, shoreline modifications can impede natural erosion and thus prevent the supply and transport of sediment that is essential to maintain beaches into the future.

Current shoreline management programs at the local, state, and federal level are not holding the line against the incremental impacts that shoreline development causes to beach habitat and habitat forming processes. Nearly one-third of the Puget Sound basin's 2,500 miles is already armored, and every year an additional one to two miles of shoreline is covered with armoring. In the absence of a concerted preservation effort, this trend is anticipated to continue as increasing shoreline development and rising sea levels increase demand for armoring across the region. The cumulative effects of hardened shorelines will result in beaches that are less resilient or adaptable to climate change impacts, resulting in the loss of beach habitat and depleted forage fish populations.

With our improved knowledge of sea level rise and a significant portion of shorelines yet to be developed, now is the time to develop and test new long-term, process-based approaches to habitat protection. With its combination of extensive shoreline length; diversity of shoreline types; intact, high quality habitat; and approximately 30% of privately owned shoreline tax parcels remaining to be developed, San Juan County (SJC) provides an excellent location to apply innovative research tools and protection strategies that can then be shared throughout the Puget Sound.

The interdisciplinary and collaborative Healthy Beaches for People and Fish Project fills knowledge gaps, offers methods applicable to other jurisdictions, and informs management of cumulative impacts and sea level rise across the region. While conducted for San Juan County, project findings and management recommendations have applications across Puget Sound. The target audience of the project is shoreline managers. Project results include a legal review of existing regulations; sea level rise inundation and erosion rate models, maps and vulnerability assessment for property, infrastructure and structures for San Juan County; new research on the vertical distribution of surf smelt spawn in San Juan County; an analysis of armor impacts to forage fish habitat in San Juan County; and linked management recommendations applicable locally and sound wide. Results can be applied to infrastructure, habitat and property protection planning in San Juan County and inform long-term habitat protection efforts across Puget Sound and the Salish Sea.



Background

The cumulative impacts of developing rising shorelines constitute a regional problem that may need to be addressed at the local, state and federal levels. Unless habitat protection efforts are significantly improved, the cumulative impacts of shoreline alterations and rising sea levels will impede the long-term success of Puget Sound marine ecosystem recovery efforts.

Several entities have highlighted the threats posed by the cumulative effects of shoreline development and climate change in the Salish Sea. The Marine Resources Committee's Marine Stewardship Area Plan and the San Juan Islands Accountability Oversight Group's Action Agenda (San Juan County and Puget Sound Partnership) identified cumulative impacts and climate change as two of the top three threats to the San Juans' marine ecosystems. To address these threats, both plans recommend more technical information on likely impacts and specific areas of vulnerability, as well as improving implementation of and compliance with existing regulations. In 2008, the San Juan Initiative, a two-year ecosystem based management process that included both agency and community members, also highlighted the need to make significant improvements to nearshore habitat protection programs. In addition, the Puget Sound Partnership's Biennial Science Work Plan emphasizes the need to connect new science with management priorities (especially on the topic of shoreline armoring) as well as the importance of protecting and conserving intact nearshore marine ecosystems.

Despite widespread recognition of the ineffectiveness of current habitat protection programs, a significant portion of the resources allocated to marine ecosystem recovery in the Puget Sound remain focused on habitat restoration. For example, review of shoreline permits in San Juan County from 1972-2010 found that the inclusion of protective language in both the Critical Areas and Shoreline Master Program sections of code in the late 1990's made no difference in either the rate or number of permits for new docks over eelgrass or new armoring at known forage fish spawning beaches. In addition, the Washington State Department of Fish and Wildlife recently conducted an internal review of its shoreline permit process under the Hydraulic Code. Results found that even in cases where protection provisions were included in permit authorizations, and compliance with provisions by developers was high, projects still failed to meet no net loss objectives for saltwater habitats of special concern.

Restoration efforts will not achieve recovery goals until existing protection programs are successful. For example, the recovery plan for Puget Sound Chinook salmon is based on the assumption that current protection efforts are functioning, and that the restoration actions emphasized in the plan will result in net gains to habitat. Long-term protection of existing intact shorelines, through improved effectiveness of existing regulations, regulatory reform and voluntary conservation programs, is the most cost-efficient and ecologically-effective approach to improving marine health in the region.

The goal of this project is to achieve long-term protection of nearshore ecosystems by creating new technical tools and adaptive management strategies to specifically address cumulative impacts and sea level rise within existing regulatory frameworks. Project results will be applied to improved management of infrastructure, permit and plan review and salmon recovery efforts in San Juan County, with transferability to all coastal communities in Puget Sound. Application of results to improved regulatory protection in San Juan County and beyond will lead to improved ecosystem resiliency in the face of climate change impacts.

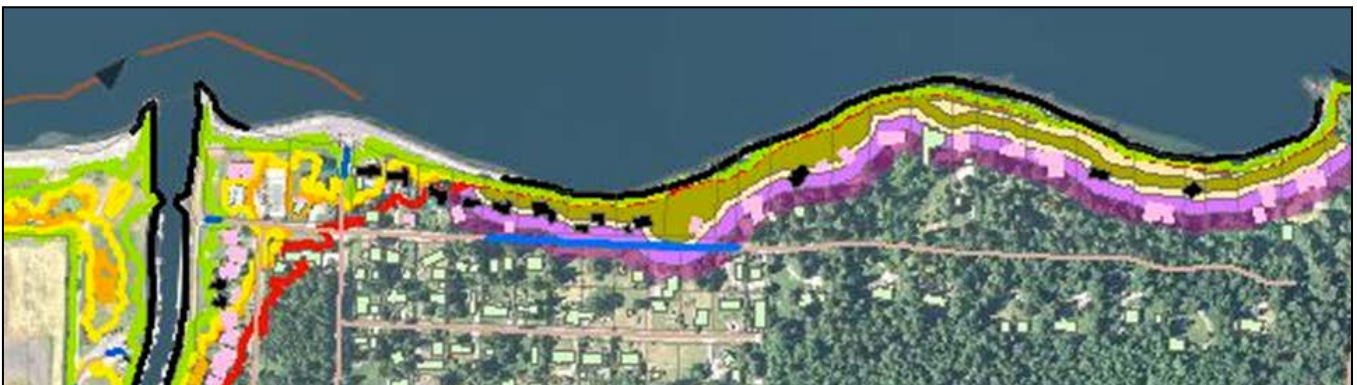
Project Approach

The *Healthy Beaches for People and Fish: Protecting shorelines from armoring today and rising seas tomorrow* project is to improve the long-term protection of nearshore marine ecosystems by developing new technical tools and identifying management strategies that specifically address sea level rise and the cumulative impacts of shoreline armoring. The analyses were organized into the following primary tasks:

1. A legal review of existing regulations and policies and their ability to address sea level rise and cumulative impacts,
2. A sea level rise vulnerability assessment for San Juan County,
3. New field research into the tidal elevation (vertical distribution) of surf smelt spawning habitat,
4. Evaluation of the impacts of shoreline armoring on beach spawning forage fish habitat in San Juan County,
5. Surveys with coastal managers, regulators and researchers, and
6. Development of linked management strategies to improve long-term shoreline protection from the threat of incremental development and rising sea levels.

A summary of each of the project's main research elements are provided below, followed by a discussion of overall management recommendations.

Detailed information on each element can be found within the final reports, available online at www.sanjuans.org/NearshoreStudies.htm.



Legal Review

The regulatory review element of the Healthy Beaches for People and Fish Project explored existing federal, state, and local laws and regulations and other legal doctrines that authorize or compel the inclusion of sea level rise and cumulative impacts analyses into planning and permitting processes. The regulatory review concludes with recommendations for improved implementation of the existing Washington Shoreline Management Act, enforcement of the state's fiduciary responsibility to protect public trust interest in nearshore areas and the federal government's duty to protect tribal fishing rights, and non-legal approaches like conservation easements and revised taxation schemes that reward shoreline property owners for retaining natural shorelines. For a summary of the laws and non-legal options explored in the regulatory review, see Table 1. Regulatory Review Scope.

Table 1. Regulatory Review Scope

<i>Federal Law</i>	<i>State & Local Law</i>	<i>Other Legal Authority</i>	<i>Non-legal Options</i>
Clean Water Act (1972)	Aquatic Lands Law (1984)- DNR	Public Trust Doctrine- state has trustee duty to protect public resources	Conservation easements
Coastal Zone Mgmt. Act (1972)	Growth Mgmt. Act (1990) and Critical Areas Ordinances	Rolling Easements	Tax incentives for retaining natural shorelines
Endangered Species Act (1973)	Hydraulic Code (1943)- WDFW	Tribal Treaty Rights	Funding/programs to relocate public infrastructure
National Environmental Policy Act (1970)	State Environmental policy Act (1971)		Funding/programs to purchase at risk private property
National Flood Insurance Act (1968)	Shoreline Management Act (1971)		

Key Findings of the regulatory review:

- Few federal, state, or local laws or regulations expressly address the need to perform sea level rise analyses.
- Despite the lack of specific language addressing sea level rise, existing laws do offer sufficient authority and mandates to protect our state's public resources from the cumulative impacts of armoring as sea levels rise toward upland development.
- Those laws also offer the authority for local jurisdictions and non-profit organizations to design financial incentives to protect natural shorelines through taxation programs and conservation easements.



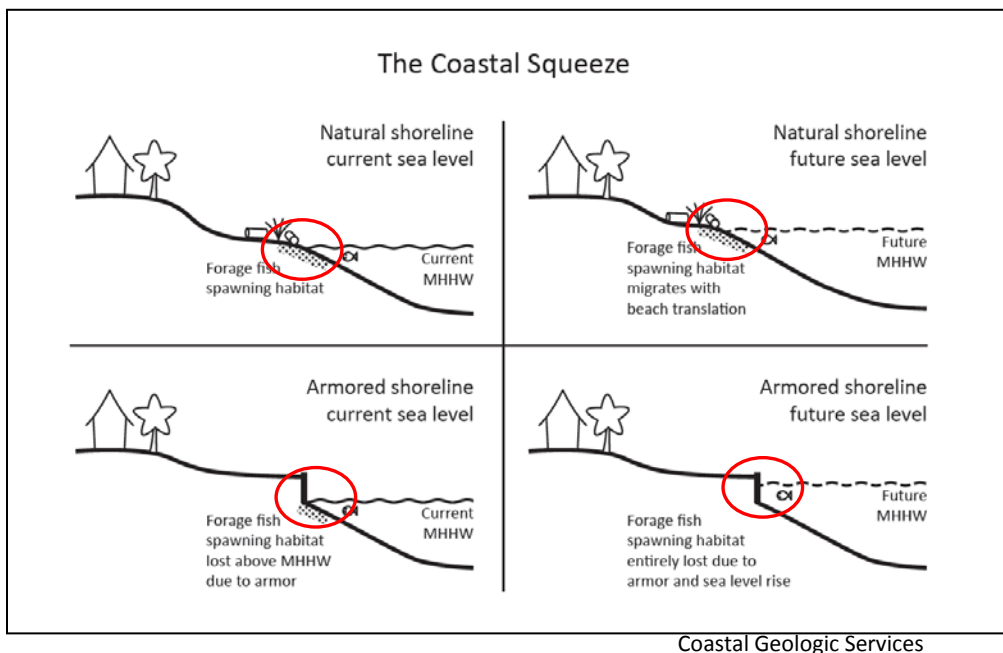
Sea Level Rise Vulnerability Assessment for San Juan County

At more than 400 total miles of marine coastline, San Juan County has more shoreline than any other county in the contiguous United States, and is comprised of almost all major coastal landform types (shoretypes) found in the region (excluding large delta systems) including bedrock shores, pocket beaches, feeder bluffs, transport zones, barrier beaches and embayments. The range of shoretypes found in the county provides an opportunity to explore the variable climate change impacts across different landforms and how different areas may require different management approaches.

The County's shorelines include 158 miles of non-bedrock, or "soft," shores that may be subject to increasing change with rising sea levels. While these beaches and bluffs are valued waterfront real estate for people, they also provide critical habitat for wildlife and fish, including ESA listed salmon populations. Additional human values associated with nearshore areas include recreation and tourism, economic, aesthetic, cultural and spiritual values.

How a shoreline responds to rising sea levels depends on multiple factors including shoretype, topography (upland and bathymetry), sediment supply, and space for the shorelines to migrate landward and thereby adjust to the new water levels. Anticipated impacts include bluffs that erode more rapidly, increase in high water events, and habitat loss due to the coastal squeeze in areas bounded by armoring or bedrock (see Figure 2).

Figure 2. The coastal squeeze- likely impacts to forage fish spawning habitat at modified shores



The objective of the sea level rise vulnerability assessment for San Juan County was to attain greater understanding of the areas within San Juan County that are vulnerable to sea level rise. With this knowledge, resource managers and planners in this coastal county can develop a sea level rise adaptation strategy for San Juan County and increase the effectiveness of existing management approaches. In addition, these results can be used to identify additional long-term restoration and conservation targets throughout the County.

Results of the sea level rise vulnerability assessment includes a GIS tool that integrates erosion with inundation to better understand future conditions. The assessment mapped the model's results to

assess structures, infrastructure and habitat vulnerable to erosion and inundation hazards; and identified appropriate management strategies. The vulnerability assessment facilitates planning by greatly enhancing understanding of likely sea level rise impacts and areas of vulnerability. A detailed error analysis of the model was conducted and is included in the final report.

San Juan County shorelines were modeled and mapped to identify areas vulnerable to seal level rise impacts. Two planning time frames, 2050 and 2100, along with two sea level rise projection horizons, moderate and high, were used (NAS 2012). Both flood and erosion hazard areas were assessed.

Table 2. Moderate and High Sea Level Rise Projections by the National Research Council (NAS 2012)

<i>Sea Level Rise Projections</i>	<i>Year 2050</i>	<i>Year 2100</i>
Moderate (IPCC A1B) Scenario	0.54 ft.	2.03 ft.
High (IPCC A1F1) Scenario	1.57 ft.	4.69 ft.

(From: MacLennan et al. 2013)

Inundation mapping applied moderate and high sea level rise projections from the National Research Council for both 2050 and 2100 to the documented highest observed water level (HOWL) for Friday Harbor, which is located 3.1 feet above mean higher high water. The inundation or ‘bathtub’ model, linked shoreline to topography data, creating contours for each of the time and projection scenarios which were then used to assess vulnerable infrastructures and structures.

The erosion modelling approach included an evaluation of historic erosion rates, stratified by shoretype, orientation and exposure (fetch) for a subset of 52 non-bedrock shoreforms in San Juan County. Historic erosion rates for the period 1960 to 2009 ranged from a maximum rate of -0.91/year for the most erosive feeder bluff to +0.61 for the most accretionary barrier beach. Average historic erosion rates by shoretype ranged from 2 inches for pocket beaches, 3 inches per year for transport zones and just under 6 inches per year for feeder bluffs.

Table 3. Average historic change rates (ft/yr) of geomorphic shoretypes sorted by exposure category

<i>Exposure</i>	<i>Feeder Bluffs</i>	<i>Barrier Beaches</i>	<i>Transport Zones</i>	<i>Pocket Beaches</i>
<i>< 5miles</i>	-0.394	0.009	-0.126	-0.121
<i>>5 miles</i>	-0.623	0.114	-0.330	-0.215

(From: MacLennan et al. 2013)

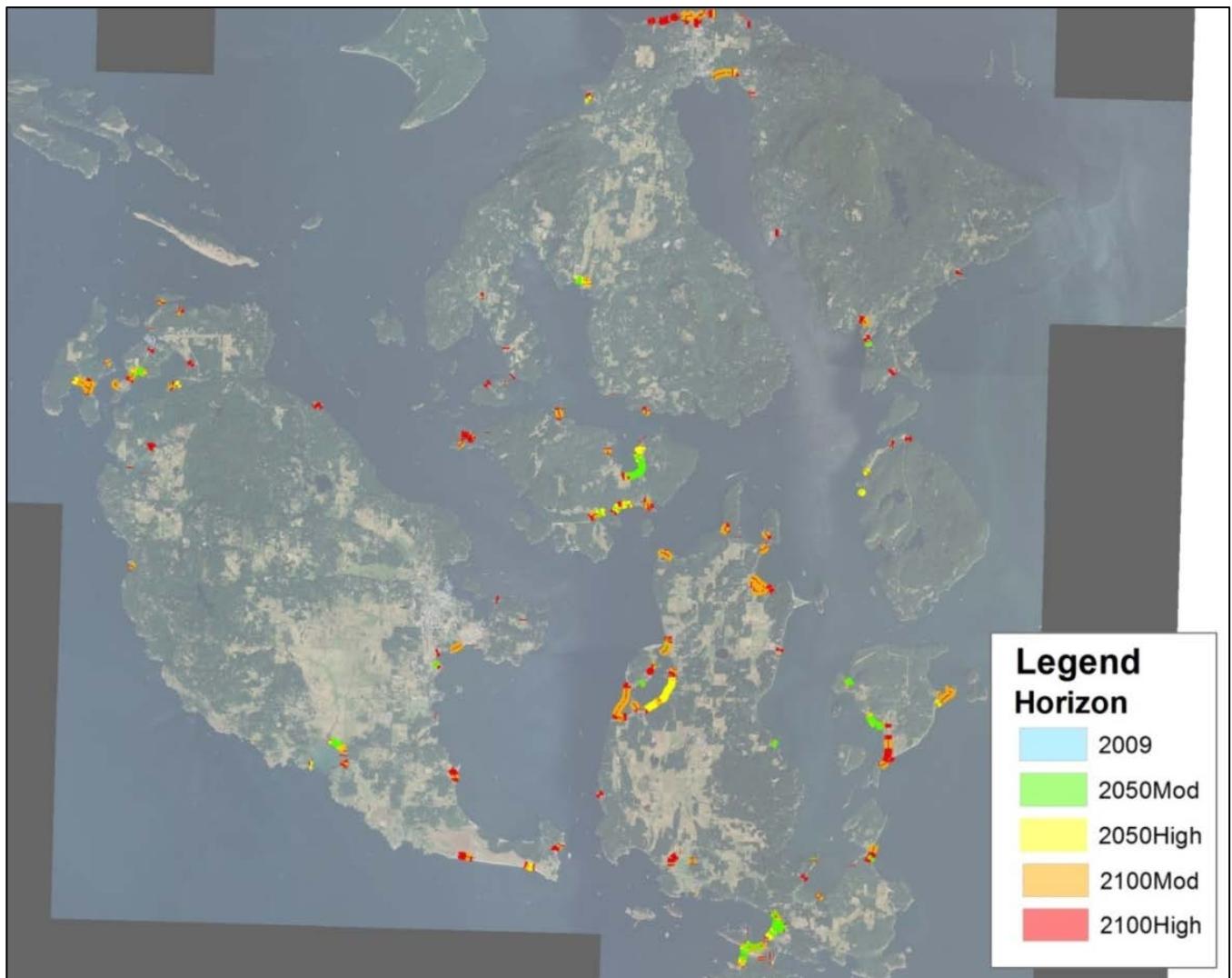
Calculated background erosion rates were then applied with a multiplier to capture likely increases in erosion rates due to impacts of climate change, to project future erosion rates by shoreform (and orientation and exposure) using moderate and high sea level rise projections for both 2050 and 2100. Estimated future erosion rates ranged from a total of 8 to 155 feet, a rate of 3 to 21 inches per year, depending on shoretype, exposure, time horizon and moderate or high sea level rise projection.

Impacts to infrastructure (roads), structures (mostly residential), and habitat (wetlands and beaches) were then ranked for flood hazard, erosion hazard, and areas susceptible to both impact types. Results inform coastal management, local engineering works and related planning efforts. The model can also form the basis for more in-depth sea level rise strategy development and resilience or adaptation planning.

Key Findings of the Sea Level Rise Vulnerability Assessment:

- There is significant risk to public and private roads from sea level rise inundation (20 miles) and erosion (10 miles) hazards; see Figure 3 below for a map of vulnerable roads in the county.
- There is significant risk to primarily residential shoreline structures from sea level rise erosion and/or flood hazards (over 1,200 structures).
- Priority habitats and places are also vulnerable to sea level rise, including parks, forage fish spawning beaches and coastal wetlands.

Figure 3. San Juan County roads vulnerable to sea level impacts (erosion and inundation combined)



Forage Fish Spawning Habitat Research

Forage fish play a key role in marine food webs, with a small number of species providing the trophic connection between zooplankton and larger fishes, squids, seabirds and marine mammals, including ESA listed species such as Chinook salmon and the marbled murrelet. Beach spawning forage fish, such as surf smelt (*Hypomesus pretiosus*) and Pacific sand lance (*Ammodytes hexapterus*), are threatened by land use activities along shorelines, where development is also concentrated.

Forage fish spawning areas in San Juan County (SJC) and throughout Puget Sound are especially vulnerable to the impacts of shoreline armoring. Sea level rise is expected to exacerbate the impacts of shoreline armoring on forage fish spawning habitat. In addition, sea level rise and other implications of climate change such as increased storminess are anticipated to result in the increased demand for new shoreline armoring, which will further compound forage fish spawning habitat loss and degrade the nearshore sediment sources or feeder bluffs that sustain nearshore habitats.

The Healthy Beaches for People and Fish Project completed two assessments of forage fish spawning habitat: 1) new field research on the vertical distribution of incubating surf smelt eggs, and 2) an ARC GIS based analysis of forage fish spawning habitat, shoreline development patterns and shoreline armoring. Both forage fish spawning habitat research elements improve understanding and evaluation of the likely cumulative impacts of armor and vulnerability to rising sea levels.

Tidal Elevation of Surf Smelt Spawn in San Juan County Study

The surf smelt, *Hypomesus pretiosus*, is an important “forage fish” link in the local marine food webs of the Puget Sound/Salish Sea basin. It is an obligate upper intertidal spawner on mixed sand-gravel beaches, and is presently estimated to use about 10% of the total shoreline of the Puget Sound basin for spawning. Conservation of this marine forage fish’s critical spawning habitat has been used as a defining tool for the conservation of intact, natural shorelines in Washington State for many years. State regulations like the Hydraulic Code Rules expressly identify the need to protect surf smelt, along with similar language pertaining to companion shoreline-spawning forage fish species, the Pacific sand lance (*Ammodytes*) and the Pacific herring (*Clupea*).

Surf smelt spawning habitat was not documented within San Juan County by any state resource agency until 1989, although local residents likely knew of its spawning activity many years prior to that time. Subsequent surf smelt spawning habitat surveys by WDFW (1990s) and Friends of the San Juans (2002-2004) mapped approximately 10 miles of surf smelt spawning habitat within San Juan County, across 76 individual geomorphic shoreform units. A map of the known distribution of surf smelt spawning sites in San Juan County can be found at Figure 4. While year-round data do not exist for most sites, those sites that were surveyed extensively, Blind Bay, Shaw Island (WDFW) and Westcott Bay, San Juan Island (FSJ), verify virtually year-round spawning activity.

Most assessment of surf smelt spawning habitat in Puget Sound has been limited to a presence/absence mapping function; these surveys document site use and linear shoreline extent of spawning habitat distribution. The goal of this tidal elevation of surf smelt spawn study was to improve understanding of the vertical egg distribution of incubating surf smelt eggs across multiple regions, sites and seasons. Surf smelt eggs were sampled across the beach profile at previously documented, known spawning sites.

An improved understanding of the vertical extent of intertidal habitat utilized by surf smelt has direct application to the management of forage fish habitat, including project and plan level development review; better quantification of cumulative effects and likely impacts of rising sea levels; and restoration and protection project design and effectiveness monitoring.

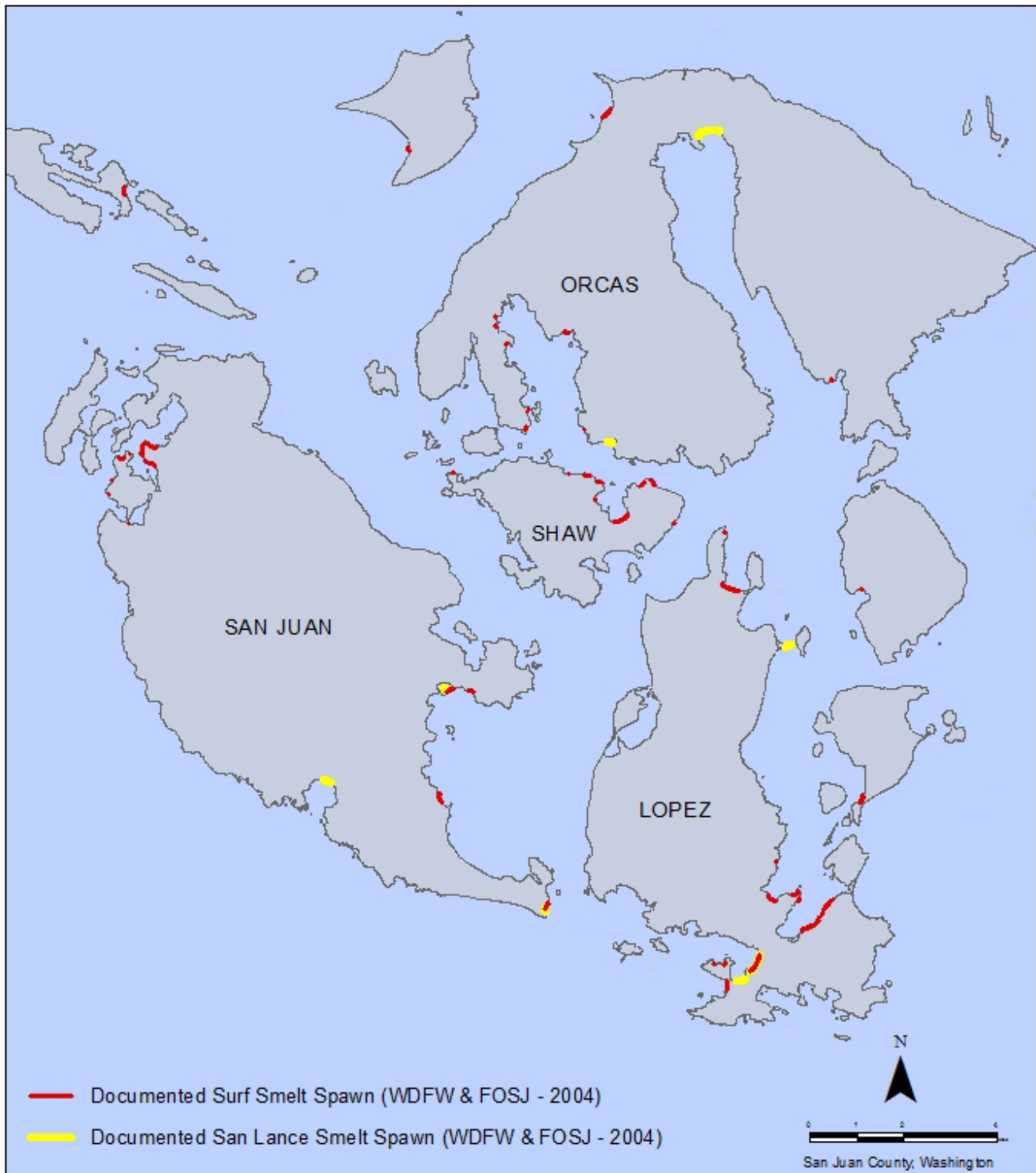
Surf smelt spawning has been documented for 72 unique shoreforms in San Juan County. Field surveys were conducted at a total of 39 previously documented spawning locations across 50 dates between September 2012 and September 2013. Incubating eggs were discovered on just 11 of those field dates, with just 9 dates and 15 sites (20% of total known smelt sites) yielding egg densities high enough to support collection of vertical egg distribution data transects.

Key findings of the tidal elevation of surf smelt spawn study:

- Surf smelt eggs can be found at variable tidal elevations across a beach face, reflecting differences in substrate conditions as well as the timing of spawn events in relation to water levels at the time; eggs were observed in samples from elevations ranging from as low as 3.7 feet to as high as 9.2 feet MLLW.
- The majority of eggs occurred in the upper intertidal zone; over 80% occurred in the upper third of the beach, at or above 6.2 feet.
- Over 30% of the eggs occurred at or above M.H.H.W.
- Extensive field reconnaissance surveys of known spawning sites in San Juan County for the purposes of this research also resulted in the unanticipated finding that smelt spawning activity at known “year-round” sites within San Juan County appears depressed in both time and space, most notably throughout the winter months.



Figure 4. Known Forage Fish Spawning Sites in San Juan County



**This map does not include seven spawning beaches that were documented in 2013/2014.*

The Impacts of Shoreline Armoring on Forage Fish Spawning Habitat in San Juan County

Friends of the San Juans led an ARC GIS assessment of the specific impacts of shoreline armoring on the upper intertidal sand and gravel beach habitats required by two key forage fish in the Puget Sound region, surf smelt and Pacific sand lance. The objective of this research was to improve understanding of cumulative effects and inform habitat protection and restoration efforts. The approach completed an ARC GIS analysis of the spatial relationships between shoreline armoring, documented forage fish spawning habitat and development patterns in San Juan County, focusing on known impacts to habitat including direct burial, sediment supply and transport, riparian vegetation and sea level rise.

Key findings of the spatial analysis of armor impacts to forage fish spawn habitat include:

- Residential bulkheads and public shoreline roads are the primary source of shoreline armoring in San Juan County.
- Of the 10 miles of documented beach-spawning forage fish habitat mapped in San Juan County, 15% is already impacted by armoring.
- Direct burial of a portion of the upper extent of the spawning habitat zone occurs in over 90% of documented spawn sites; coincident with shoreline armoring in San Juan County, 11 acres of habitat are currently buried (13%).
- Armored spawning beaches at feeder bluffs, pocket beaches and rocky shores had significantly less overhanging marine riparian vegetation present than unarmored spawn sites.
- Coastal sediment supply processes that form and maintain spawning beaches in drift cells with documented forage fish have been impacted, through armored feeder bluffs that limit sediment supply to the system and armoring located below mean sea level, which prevents sediment transport alongshore.
- Rising sea levels at armored spawning sites will limit landward translation of beach habitat, resulting in an additional loss of three acres of documented spawn habitat.
- The majority of shoreline parcels in San Juan County are primarily held in private ownership for residential use.
- One-third of the private, developable shoreline properties are not yet developed with a residence, providing an opportunity to reduce future demand for armoring through expanded buffers and/or setbacks.
- There is a strong relationship between building setback distance and the presence of shoreline armoring (75% of developed parcels with armor have structures located within 100 feet while just 6% of armored shores occur on parcels with the primary structure located within 200 feet of the shoreline).
- Inclusion of forage fish spawning habitat protection policies and language in San Juan County's Critical Areas Ordinance and Shoreline Master Program in the late 1990s did not result in a reduction in either the number or rate of shoreline armoring permits.

Relevant permit trends (pre/post CAO & SMP updates in late 1990s) include:

- exemption rates for new bulkheads are essentially unchanged;
- substantial development permits for new bulkheads have increased slightly;
- exemptions rates for repair/replacement of bulkheads have doubled; and

- code violations rates associated with armoring have doubled.

Communication with Coastal Managers, Regulators, Researchers, and Conservationists

Input from shoreline scientists, managers, planners, policy makers, regulators and non-governmental organizations on the management strategies component of the Healthy Beaches for People and Fish Project was collected through a variety of methods including one-on-one stakeholder interviews, shoreline manager and planner conference sessions, interaction with the project's technical advisory group and focus group meetings with shoreline science and policy experts.

Stakeholder Interviews

A graduate student from UW's Evans School of Public Affairs examined public policy approaches to address the interrelated issues of sea level rise and the cumulative effects of shoreline armoring by conducting one-on-one interviews with 28 local and regional managers, regulators, planners, elected officials and scientists. Stakeholders represent the following areas: state (12), local (11), regional, including federal (3) and tribal (3) agencies; their professions can be categorized as: scientist/engineer (12), elected official (1), policy manager (10) and permitter/regulator (6).

Interviews were conducted one-on-one, either in person, by phone, or via internet conference. The interviews focused on ways to amend or improve the effectiveness of existing environmental laws and regulations, including ways to improve the permitting process for shoreline development within the county. They also examined new approaches that the county could introduce to better adapt to sea level rise. Common interviewee recommendations include: new or expanded education programs and setback requirements, better interagency collaboration, and revisions to the county Shoreline Management Program and the state Hydraulic code.

Key findings from the stakeholder interviews included:

- All participants felt that too little was being done to address the impacts of sea level rise and cumulative effects.
- Most participants completed their shoreline management work without an established sea level rise policy (or if one existed it set broad policies that had not yet been translated to impact day to day actions).
- Participants noted that multiple approaches, including regulatory (HPA, SMP) and voluntary (incentives and education) action, would be essential to improving long-term shoreline management.

Interview participants provided many specific recommendations that informed overall project management recommendations, including recommendations to bolster jurisdictions' perceived ability to "just say no" to requests for new armor. Additional regulatory strategies included improving the effectiveness of existing rules through increased and consistent enforcement and implementation. Participants almost uniformly identified major flaws in the Hydraulic Code's ability to protect local resources, as well as opportunities to strengthen Shoreline Master Programs, especially in the area of expanded setbacks and restrictions on armoring. The lack of a federal role in shoreline armor review and permitting was also identified as a limitation to current protection frameworks; solutions included expanded U.S. Army Corps of Engineers jurisdiction as well as revisions to the National Floodplain Insurance Act. Non-regulatory recommendations highlighted the need for additional technical data, creative taxation and tax incentives, and improved awareness, especially among elected officials and vulnerable shoreline property owners.

Shoreline Manager and Planner Conference Sessions

The project included presentations at multiple conferences, including the San Juan County Marine Managers Workshop (2013), the Washington Chapter of the American Planning Association's Annual Conference (2013), the Salish Sea Conference (2014), the emerging science workshop of the Salish Sea Shoreline Forum (2014) and the Climate Change: the Rules are Changing Continuing Legal Education Course (2014). The marine managers workshop is an annual conference hosted by the San Juan County Marine Resources Committee and the Northwest Straits Foundation that brings together planners and managers with jurisdiction over the marine shorelands and waters of the county, as well as some cross-archipelago staff and elected representatives of the Islands Trust, the local planning and governing organization for the Gulf island of British Columbia, Canada. Participants at the Washington Chapter of the American Planning Association's annual conference included county and city planners from across Puget Sound, as well as representatives of Washington Sea Grant, University of Washington and state resource agencies.

Key findings from the conference session surveys with planners and managers included:

Governmental role:

- Only federal agencies have formal policies related to sea level rise, and even these are broad policies without detailed implementation frameworks.
- Sea level rise is not explicitly addressed in any participating local jurisdiction's plans or policies (cities, counties).
- Some efforts at raising awareness and education are in place but are not well coordinated.

Opportunities:

- Develop and implement adaptation strategies/plans (funds and technical support needed).
- Relocate public infrastructure at risk, especially roads.
- Increase education, especially with decision makers and affected shoreline property owners.

Barriers:

- Current legal, social and economic frameworks seen as having a response that actually promotes armoring (protect at all costs).
- Lack of urgency to problem.
- Lack of political will (and associated legal and financial pressure).



Focus Group Work Sessions

Project team members also presented results and held interactive meetings with key stakeholders that included San Juan County land use professionals (Public Works, Development and Planning, Parks, Land Bank, GIS), Tribes (Samish Indian Nation), and regional nongovernmental organizations active in shoreline protection (FutureWise, EarthJustice, Sierra Club, Whidbey Environmental Action Network and SoundAction). Meetings raised awareness of major research elements and new data and technical tools, and held in-depth discussions of key findings and management recommendations.

Technical Advisory Group

The multidisciplinary technical team for this project participated in a review of the project's research elements as well as in the development of management recommendations. Following completion of technical project elements, the group convened for a two-day workshop to review research results and develop management recommendations. Management strategies were based on outcomes of the project's technical elements and manager surveys as well as the professional expertise, experience and perspective of the diverse advisory group membership. Management discussions focused primarily on regulatory effectiveness and the reduction of shoreline armoring, but also included non-regulatory approaches including research, education, voluntary stewardship and restoration.



Management Recommendations

Management recommendations were derived from key findings of the technical elements of the project (regulatory review, sea level rise vulnerability assessment, forage fish spawning habitat analysis, and interviews and surveys conducted with managers, and shoreline research and policy experts); and by members of the technical advisory group and work sessions with county, tribal and non-governmental stakeholders. Management strategies are organized into regulatory and non-regulatory categories including:

1. Regulatory
 - Effectiveness
 - Reform
2. Non-regulatory
 - Stewardship (voluntary protection)
 - Research and Education
 - Restoration

In general, participants in management and policy discussions agreed that insufficient attention has been paid to protecting intact habitat and processes and that greater efforts have instead focused on developing shorelines and attempts to restore them. Most of the project participants identified regulatory management recommendations (both reform and effectiveness) as a higher priority than non-regulatory approaches. Of the non-regulatory recommendations, habitat restoration actions received the highest rankings, followed by stewardship (voluntary protection), research, education and lastly, habitat enhancement. While the focus of recommended management strategies was regulatory, there was also broad recognition that a full suite of protection strategies, voluntary and compulsory, will be required if efforts to reverse the incremental loss of shoreline function are to be successful.

Regulatory Management Recommendations

The project organized regulatory management recommendations into two categories - regulatory effectiveness and regulatory reform - to clarify which actions can be taken within existing legal frameworks (effectiveness) and which actions may require changes to the underlying laws or policies themselves (reform).

Regulatory Effectiveness

Top regulatory effectiveness management recommendations focused heavily on actions related to the Shoreline Master Program and the topic of shoreline armoring. The Shoreline Master Program was seen as having the largest potential impact, in the short term, on improved long-term protection of marine shorelines.

Specific strategies for the San Juan County's Shoreline Master Program Update included:

- Only allow armoring when threat to primary structure is imminent and only as a last resort;
- Limit new development in areas vulnerable to the impacts of rising sea levels by requiring larger buffers and setbacks;
- Ensure that sea level rise is explicitly addressed at the plan and project level;
- Require (and monitor and adaptively manage) full mitigation for all armoring projects;
- Clarify the criteria for armoring exemptions;

- Require Department of Ecology review for all shoreline armoring permits (repair, replace or new);
- Require a conditional use permit for all new shoreline armoring permits at the County level (eliminate the exemption option at the county level) ;
- Better utilize state agency technical expertise in permit decisions (and engage this assistance early in the process); and
- Improve technical accuracy of Ordinary High Water Mark delineation (use Dept. Ecology expertise).

Strategies to improve regulatory effectiveness in long-term shoreline habitat protection also covered other areas of local, state and federal law including:

- Improve enforcement, including contractor responsibility and ecological restoration;
- Apply the public trust doctrine to protect marine shorelines and enforce state's fiduciary responsibility to protect the public trust;
- Improve coordination among local jurisdictions and agencies, including tribal and federal as well as state agencies; and
- Explore more formal tribal role in permitting (hydraulic project approval and shoreline master program).

Regulatory Reform

Top regulatory reform management recommendations focused heavily on two areas of Washington State law: the Hydraulic Code and the Shoreline Management Act. Project participants broadly agreed that the Hydraulic Code had not been implemented effectively to protect habitat, and that the Shoreline Management Act offered opportunities to achieve that goal. The following sections identify regulatory reform recommendations that came out of project discussions.

Hydraulic Code Reform:

- Clarify Washington Department of Fish and Wildlife (WDFW) authority to protect fish life by denying permits for development that would harm fish;
- Clarify WDFW authority to evaluate sea level rise and cumulative impacts when reviewing applications for shoreline development; and
- Merge state and local marine shoreline permit review processes so that counties and Ecology incorporate WDFW biological expertise into their review of permit applications under Shoreline Master Programs, removing WDFW regulatory review of marine projects.

Note: There was not consensus regarding this recommendation and members of the technical advisory group from the Washington Department of Fish and Wildlife were among those who did not support a recommendation to deemphasize WDFW regulatory oversight of marine shorelines in favor of local regulatory oversight.

Shoreline Management Act reform:

- Require a shoreline permit for all armor projects;
- Prevent new armor on forage fish spawn sites or feeder bluffs;
- Require setbacks on marine shorelines large enough to limit requests for armoring for new development; and

- Require a full exploration of all alternatives to new armoring, including relocation of development where feasible.

Additional regulatory reform strategies:

- Revise national floodplain insurance to incorporate the increased risk of damage as sea levels rise;
- Require that real estate disclosures identify any risks associated with sea level rise;
- Update zoning to prevent new development in vulnerable areas; and
- Apply rolling easements to prevent fortification on public lands.

“Do NOT depend on altruism to protect critical habitats of any kind, anywhere at any time, but rather on solid regulations, steadfastly enforced” – Technical Team Participant

Non-Regulatory Management Recommendations

The Healthy Beaches for People and Fish Project also identified and developed non-regulatory management strategies to improve long-term protection of healthy marine shorelines from cumulative impacts in the face of rising sea levels. Voluntary strategies are organized into stewardship, research and education, and restoration categories.

Stewardship

The project participants identified easements and acquisitions as top actions but also identified the need for expanded stewardship incentive programs.

Stewardship management recommendations:

- Targeted easements and acquisitions of shoreline property to protect intact habitat;
- Expanded stewardship incentive programs, including financial incentives;
- Provide funds for managed retreat (relocation of structures, etc.); and
- Consider buyouts of vulnerable properties to reduce further demand for armoring.

Research and Education

Research and education strategies focused on the development of additional technical support tools to facilitate sea level rise adaptation, primarily at the county scale. Research efforts were ranked higher than education and outreach efforts.

Research and education management recommendations:

- Develop a detailed county-scale sea level rise adaptation plan;
- Perform a cost/benefit analysis of a variety of management approaches;
- Prioritize protection of habitat in the face of rising sea levels in the Puget Sound Action Agenda;
- Conduct outreach to communicate information about sea level rise to the community;
- Conduct outreach to communicate information about sea level rise to managers, hearing examiners, shoreline hearings board members and elected officials; and
- Improve sea level rise communication materials.

Restoration

Habitat improvement management strategies focused on restoration of key habitats and processes, and identified public infrastructure such as roads as a primary objective.

Specific restoration management recommendations included:

- Restore coastal processes to improve resiliency;
- Decrease public infrastructure in the shoreline; and
- Remove armor from forage fish spawning beaches and feeder bluffs.

“Non-regulatory strategies will be the key- it’s the only way to get compliance with regulations- it has to be voluntary” – Technical Team Participant

Conclusions

In 2005, Washington’s leadership ambitiously set out to protect and restore Puget Sound by 2020. The state and country have spent significant sums of money toward that goal and have achieved some success through planning and restoration projects. Yet the Puget Sound Partnership’s State of the Sound report concluded in 2012 that only two (2) of the twenty-one (21) “vital sign” indicators it evaluated had showed progress toward the targets established for 2020 – shellfish bed health and estuarine restoration. All of the others, including water quality of beaches, number of whales, total number of Chinook salmon, and area of eelgrass, reflected a worsened status, mixed progress, or incomplete results.

Entities charged with protecting ecologically-healthy, naturally-functioning marine shorelines have authorized these cumulative impacts under federal, state, and local laws, and have not ensured the consideration of sea level rise in planning and permitting processes. As sea levels rise toward increased shoreline development, nearshore ecosystems will continue to suffer in the absence of effective adaptation strategies and improved ecological protection.

However, federal, state, and local laws offer sufficient authority to protect our state’s public resources from the cumulative impacts of shoreline development as sea levels rise. Agencies might start to stem the tide of incremental damage by altering their approaches to increase inter-agency coordination and intra-agency reviews and by shifting cultures that typically prove more responsive to human applicants than natural habitat. In addition, overlapping regulatory authorities need to be applied consistently by permit reviewers. Those laws also offer the authority for local jurisdictions and non-profit organizations to design financial incentives to protect natural shorelines through taxation programs and conservation easements. Changes in those laws could also more expressly direct the protection of healthy shoreline ecosystems and processes.

Additional research would assist in the implementation and improvement of existing regulatory protections. Future areas of research that could support shoreline preservation efforts include continued study of the direct impacts between shoreline armoring and nearshore ecosystems and a comparison of the economic costs for attempting to defend against sea level rise and those associated with adapting to it. Long-term protection of intact beaches and coastal processes will depend on public support and political will and expanded education and social marketing campaigns will be needed to generate support for systemic changes to shoreline protection.

Results from the Healthy Beaches for People and Fish project can inform improvements to habitat protection in San Juan County and sound wide. Key findings of this project include new technical information that supports improved understanding of shoreline habitat and the likely impacts of shoreline armoring and sea level rise as well as the identification of specific management recommendations. Research results provide site specific historical erosion rate information for over 50 unique sites in San Juan County, and provide the first assessment of likely future erosion rates at the landscape scale. Inundation and erosion models and maps identify the most vulnerable places, structures and habitats in the near (2050) and long (2100) term. Policy results document significant challenges with existing protections, especially the lack of effectiveness of the Hydraulic Code, as well as significant opportunities to improve protection through Shoreline Master Programs, expanded implementation of common law jurisprudence, and a potentially larger role for the federal government and tribes in shoreline habitat protection.

Preventing cumulative impacts as sea levels rise is going to be a monumental task. The sustained momentum of public and private shoreline professionals working to generate the public and political will to make improvements within and beyond their programs will be an essential element of successful healthy beaches campaigns. While the list of additional needs is long, there appears to be a growing recognition among shoreline managers and the conservation community that restoration efforts will not come close to achieving habitat gains in the absence of vastly improved protection efforts. Project results, and the relationships and management discussions it has initiated, provide a framework for future action.

“Understand that we will not “restore our way” out of the present degraded condition of the Puget Sound shoreline ecosystem, so long as new armoring/armoring repair in-place continues to outstrip restoration efforts, mile for mile” – Technical Team Participant

