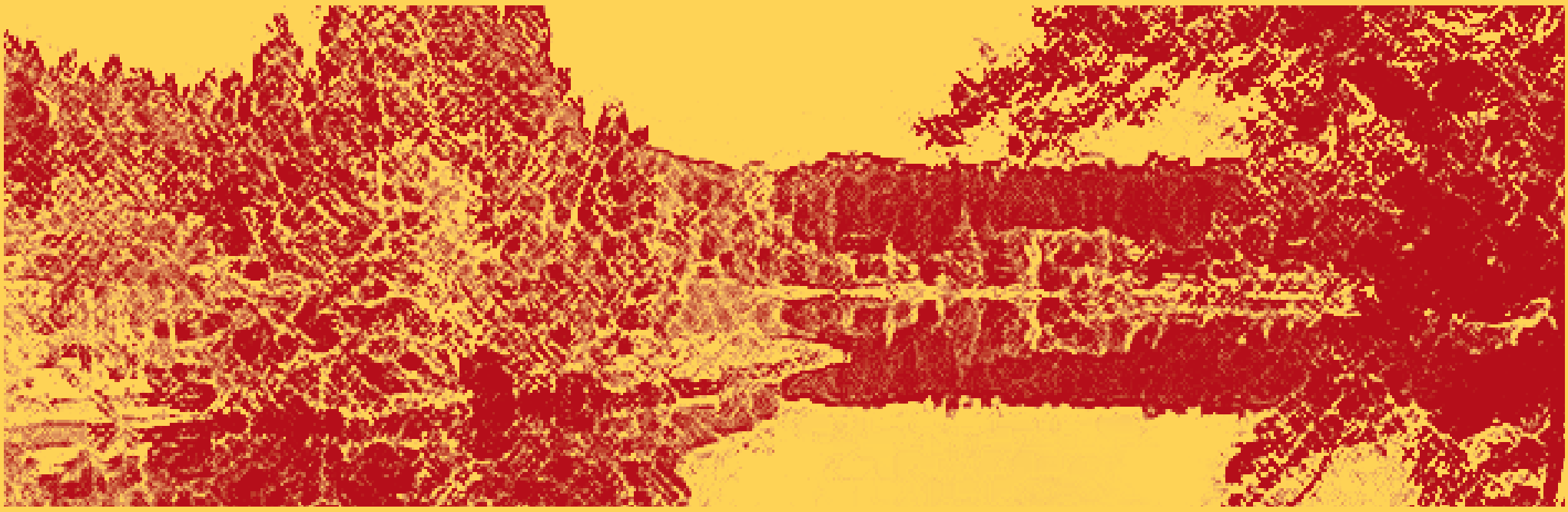
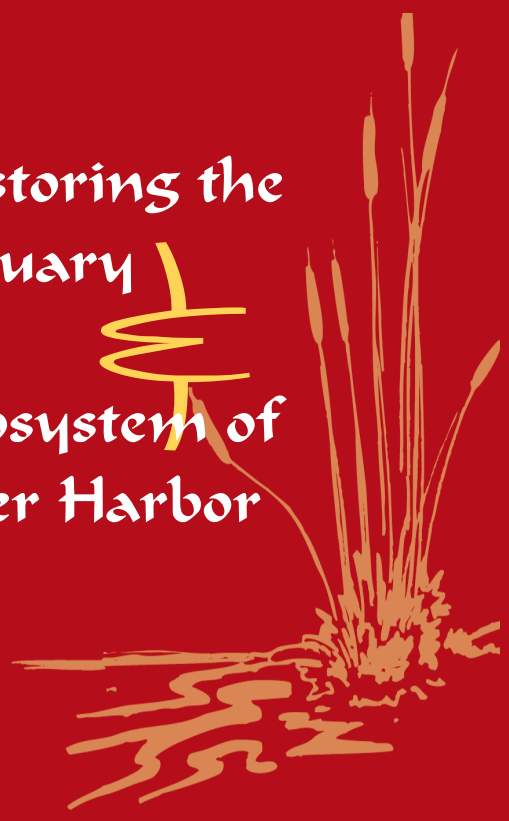


Newsletter - Volume II - October 2005

a place for Salmon

REED is the acronym for Restoring the Estuary and Ecosystem of Deer Harbor. It is a joint venture consisting of property owners, Deer Harbor community members, non-profit organizations, scientists, the Samish Indian Nation, and local, state, and federal governments all of who share a collective vision to study the estuary of Deer Harbor in an effort to understand its past ecological functions. Viewing the ecosystem from a historical perspective will shed light onto its potential to function as a vital and healthy ecosystem. The goal of this Salmon Recovery Funding Board (SRFB) grant is to paint the ecological and human picture clearer. REED seeks to integrate restoration measures into the fabric of our lives so that marine species, such as Dungeness crab, salmon, herring, surf smelt, sand lance, and the habitats that support this important food chain can co-exist thereby ensuring that Deer Harbor is a place we can all be proud of.

The scientific team is made up of geologists, engineers, hydrologists, an oceanographer, eelgrass habitat expert, botanists, ethnohistorians, salmon biologists and habitat experts all with strong ties to the San Juans. The articles that follow reflect the work so far completed and the plans for the future with regards to this Salmon Recovery Funding Board sponsored project.



Restoring the Estuary Ecosystem of Deer Harbor

RESTORATION UNDERWAY

By Bob and Meg Connor,
stewarding the Deer Harbor estuary since 1975

History, science, and common sense tell us that a vibrant, healthy estuarine ecosystem is essential for the health and well-being of San Juan County's vast marine life, and is indispensable for the economic and spiritual well-being of the region.

For nearly 3 years, a concerted effort to ascertain the health of the Deer Harbor estuarine ecosystem has been ongoing by a diverse team of renowned marine and environmental scientists. Volumes of significant data have been collected and condensed into a staff report with a first draft of recommended restorative measures. Some findings confirm suspected cause and effect relationships and others are creating a stir in the way the San Juan Islands are viewed in the Salmon Recovery movement.

- The near-shore area of San Juan County is important habitat for wild salmon runs.
- Seemingly minor stream interruptions can contribute to the degradation of riparian and estuarine environments.
- Straying salmon may find suitable spawning habitat if damaged streams restored.
- Decreasing human influenced erosion is an important element in restoration.
- The re-introduction of native plant species is essential for the repair and health of riparian and estuarine areas.
- Over the life of the a new Deer Harbor bridge a sea level rise could increase current flow within the Deer Harbor estuarine system.
- Re-establishing natural tidal flow at the bridge could reduce silting caused by sluicing and could improve near-shore habitat.

> *...we can make changes today that create a better place for salmon and...for us all.*

Extraordinarily significant and broad-reaching benefits are continuing to unfold in Deer Harbor spawned by this study.

- Hands-on educational classes from pre-school through post-graduate
- U. S. and Canadian scientists join to share knowledge and expertise
- Local mushroom propagation used to neutralize toxins
- Creosote remediation program being formulated
- Local students study native plant propagation and water quality monitoring.
- Permaculture sustainable design classes and hands-on agricultural enhancement
- Surface water flow study begins to benefit Deer Harbor "Critical Water Resource Area"
- Drainage and wetlands management programs are being implemented
- Integrated land and marine stewardship models are being developed
- Chance conversations and open dialogs are locally increasing environmental awareness.

Desire to desire the best you can desire.
Humbly humble self in search of wisdom to inspire.

Our local environment has been unintentionally degraded for over 100 years.
Many are now assuming the paramount responsibility of helping the earth restore its natural ecosystems for the mutual benefit of all inhabitants of this magnificent place. As we continue to focus our attention on the Deer Harbor environment, we begin to realize that we can make changes today that create a better place for salmon and, providentially, these changes also create a better place for us all.

PEOPLE FOR PUGET SOUND AND REED

BY ROBIN CLARK

Founded in 1991, People For Puget Sound has a mission to protect and restore Puget Sound and the Northwest Straits – our living waters, the land, and our common future. People For Puget Sound's vision is a clean and healthy Puget Sound, teeming with fish and wildlife, cared for by the people who live here. We work on the state level developing policies to protect our living shorelines, and on the local level with community partners.

People For Puget Sound has a mission to protect and restore Puget Sound and the Northwest Straits – our living waters, the land, and our common future.

In 2003, the project in Deer Harbor started to take shape, and People For Puget Sound was pleased to be invited by REED to develop a grant proposal to the Salmon Recovery Funding Board. The people involved in REED, in accordance with the Deer Harbor Hamlet Comprehensive Plan, asked a group of scientists from around the Sound to help define the research needs. This team put together a working plan to investigate critical the questions about the historic state of the lagoon, the geomorphology, fisheries, the hydrology and sediment transport in the area, botany, effects on the eelgrass and waterquality in the lagoon. We joined the team as the overall fiscal manager of the grant.

In October our final report was submitted, and it has been posted on the web at WWW.PUGETSOUND.ORG. This report provides baseline data necessary for the County to prepare their plans for building a new bridge. Without the interest of the community, and the motivation of a few people in Deer Harbor to get this underway, we would not have begun the project. We appreciate the enthusiasm and thoughtful comments of the people in Deer Harbor who attended the community meeting, and continue to be involved as San Juan County prepares to replace the bridge.

DEER HARBOR ESTUARY RESTORATION

BY JOE GAYDOS, VMD, PHD
REGIONAL DIRECTOR, SEADOC SOCIETY

The Deer Harbor Estuary Habitat Restoration Draft Environmental Assessment and Feasibility Study is now available (http://pugetsound.org/pdf/publications/2005_10_deer_harbor_report.pdf). This ecological characterization of the Deer Harbor Estuary was conducted over several years by a collection of scientists and regional non-governmental organizations and was funded by the Washington State Salmon Recovery Funding Board.

As citizens we often are interested in doing what we can to benefit our island. The information on exactly what we can do however often is lacking and without good information, even the best intentioned person is rendered ineffective. I applaud the authors of this report for collecting good data and trying to understand the estuary before making recommendations on what should be done to restore the area.

As is usually the case with science, we rarely have all the data we want to make decisions. This should not keep us from trying to collect as much data as possible, making the best possible decision based on the data available, and being willing to monitor the response and adjust our plan as needed. There is still more work needed to better understand and ultimately restore the estuary's ecological processes and conditions, but this report provides us with an outstanding starting point. I encourage all Deer Harbor community members to read the report.

Joe Gaydos
(Joe is the regional director of the SeaDoc Society (www.seadocsociety.org), a science-based group working to improve the health of the region's marine ecosystem. He was not an author on this study.)

a place for salmon

Restoring the Estuary Ecosystem of Deer Harbor

Newsletter - Volume II

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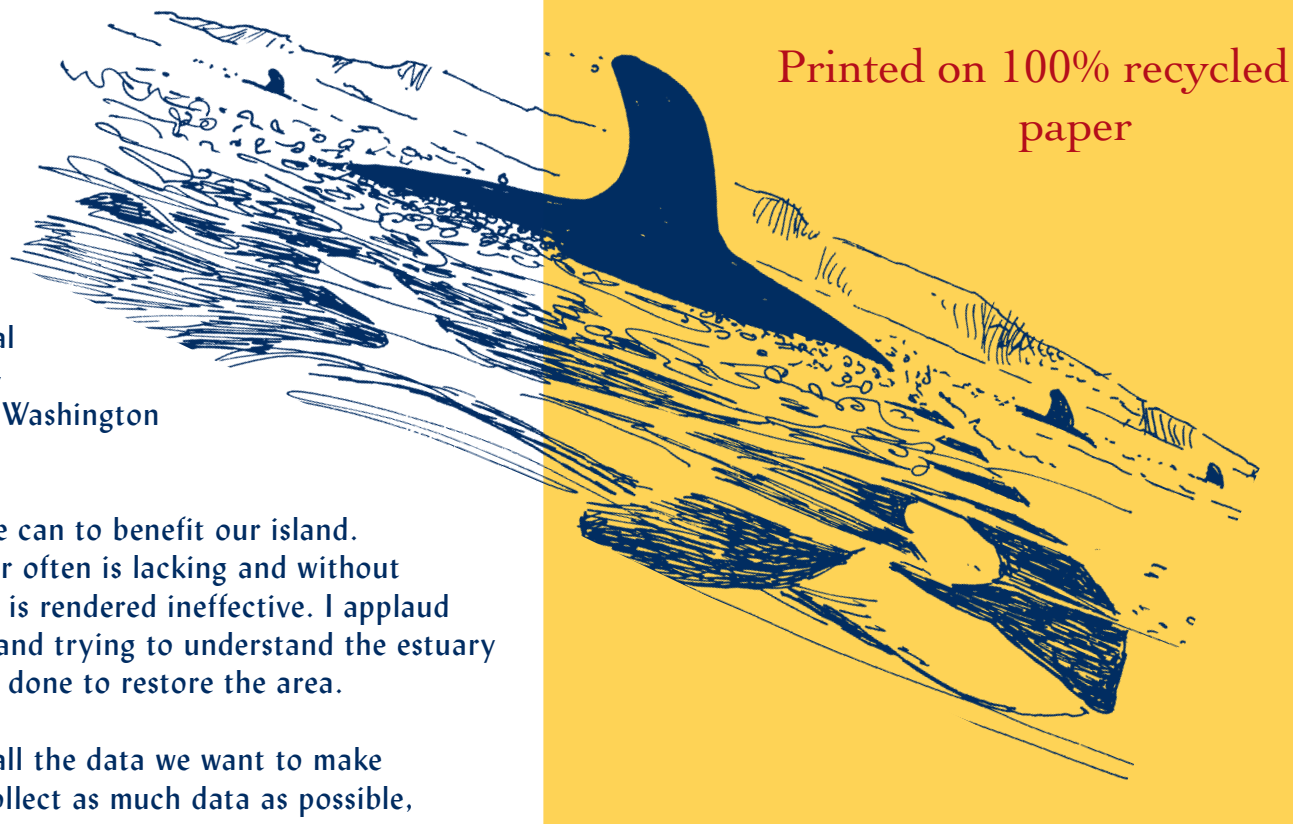
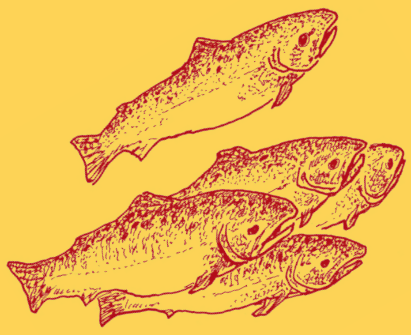


Photographs by Bob Connor, Ken Brown and Phil Branch

The SeaDoc Society, a marine ecosystem health program, is extremely supportive of the Deer Harbor estuary restoration project. They have assembled an amazing team of scientists and concerned local citizens and are basing their decisions and actions on good science.

THE SEADOC SOCIETY
a marine ecosystem health program



OUTREACH AND EDUCATION

by Ken Brown, Director, REED Project

I am taking this opportunity to let you know about the important educational programs that have taken place during this study.

A multitude of hands-on educational classes were conducted around the estuine environment by preschool through post-graduate students. The resultant dialog among these students, their families, teachers, and the scientists has created accurate awareness of, and active interest in, real environmental issues.

The following pictures and descriptions depict some of these programs.

Bob Connor, Sam Bullock and team prepare wood chips that will be used to grow oyster mushrooms to help clean surface water around the estuary.

Ken Brown teaches Waldron Island students in Peter Alexander's class about mushrooms that disassemble toxins.

Tsunami research and education in Deer Harbor

Geological Survey Team of Canada collecting core samples on the Connor family Deer Harbor Estuary Property. Samples were also taken near the Frank Richardson Wildlife Marsh on a portion of the Bullock family property. Ken Brown also took advantage of this educational opportunity by inviting the Orcas School's 4th grade class. Russel Barsh was in attendance to lend his educational and scientific skills and knowledge. Another example of stewardship and community service in the Deer Harbor community.

Water quality testing on the Deer Harbor Estuary

Russel Barsh discusses the results of water samples taken from drainage flow into Deer Harbor Estuary with Peggy Garcia's 5th grade class.

Fiona Norris, Ph.D., Science Education Coordinator of the San Juan Nature Institute, coordinated with Ken Brown to schedule Russel Barsh, Geological Survey Team of Canada, and property owners Bob and Meg Connor for this unique educational opportunity.

Bringing this scientific team and students together throughout this study has been rewarding to me personally and beneficial to the Deer Harbor community.

The students continue to build on and participate in education and stewardship programs that have become a model.

Once again the Deer Harbor community is involved in long-term leadership.

DEER HARBOR ASSESSMENT

by Jamie Glascow, Washington Trout

Deer Harbor is located on the southwest corner of Orcas Island in the San Juan archipelago. Fishtrap Creek, a small seasonal stream flows off the low hills in the harbor's uplands, entering the harbor from the north. The stream's estuary is bisected by a county road, whose bank armoring and prism restrict the flow of water into and out of the estuary, consequently interfering with the processes of sediment transport and salt/fresh water mixing. It is believed that the bottleneck formed by the road is causing sediment to accumulate within the estuary, compromising its integrity.

In a partnership with the Samish Tribe, Skagit Conservation District, REED, San Juan County, Smayda Environmental, People for Puget Sound, University of Washington, and Island residents, Washington Trout performed surveys to evaluate the current condition of Fish Trap Creek with respect to salmonid spawning and rearing potential to identify activities that would improve salmonid habitat in the creek. Simultaneously, other members of the project team have ascertained the nature and extent of ecological changes in Fish Trap Creek's estuary in the recent past (25-200 years) from historical records, archaeology, and sediments; evaluated the extent to which existing vegetation bordering Cayou Lagoon and Fish Trap Creek contributes to maintaining water quality, water quantity, water temperatures, sediments and nutrients appropriate for salmonids; and modeled how the presence of the bridge and associated infrastructure has affected historic estuarine processes.

Protecting these local adaptations is critically important to the health and the long-term resiliency of Washington's salmon stocks.

These data are being used to identify and prioritize restoration alternatives to help restore natural physical and biological processes within Fish Trap Creek and its estuary in Deer Harbor. Alternatives may include replacing the currently restrictive bridge with a larger one that does not impede flow and sediment, removing barriers to fish passage in Fish Trap Creek, removing invasive plants and revegetating the creek's estuary with native plants, among others.

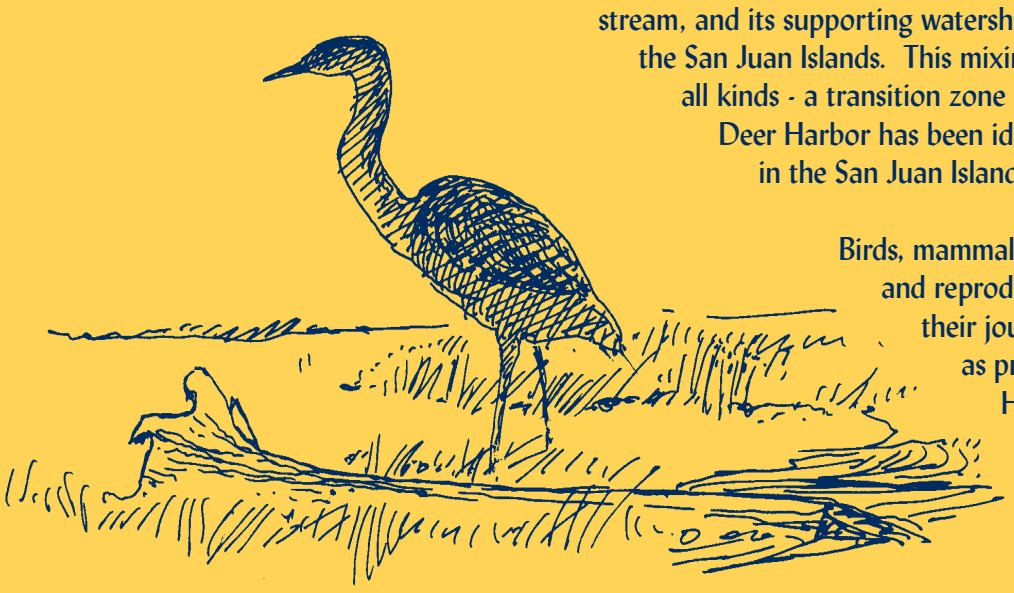
During spring 2004 Washington Trout conducted a qualitative habitat reconnaissance and fish passage assessment on Fishtrap Creek. The objectives of these surveys were 1) to evaluate the existing condition of Fishtrap Creek with respect to salmonid spawning and rearing potential and 2) to identify opportunities to improve salmonid habitat in the watershed. While no fish were observed at the time of the surveys, anecdotal evidence including its name and evidence offered by the presence of Samish tribal middens suggest that this watershed historically supported a salmon and/or sea-run cutthroat trout population. During the survey, much of the watershed was found to have the capacity to seasonally support salmonids – this capacity could be increased through the implementation of several prioritized activities that focus on restoring fish passage and the watershed's natural hydrology. For full study results and recommendations, please see: http://pugetsound.org/index/pubs.

The unique climate, topography, hydrology, and geology of the San Juan Island watersheds make them substantially different compared to watersheds found elsewhere in the region. The distinctiveness of the San Juan watersheds has and will continue to drive the local adaptations of the salmon that use them, no matter how few in number. For this reason, the current value of the San Juan's watersheds may be more associated with promoting and protecting genetic diversity of salmon populations, and not in overall production of large numbers of salmon (at least not in the current environmental conditions). Protecting these local adaptations is critically important to the health and the long-term resiliency of Washington's salmon stocks.

An estuary is "a semi-enclosed coastal body of water which has a free connection with the open sea and within which sea water is measurably diluted with fresh water derived from land drainage." – Pritchard (1967)

Deer Harbor has been identified as a critical pocket estuary vitally important to the marine life that dwell in the San Juan Islands.

A broader definition of estuary is "a semi-enclosed coastal body of water which has a free connection with the open sea and within which sea water is measurably diluted with fresh water derived from land drainage" (Pritchard, 1967). This definition includes the Deer Harbor Cayou Lagoon. The important characteristics of an estuary are that sea water mixes with fresh water, and that there is an influence of the ocean tide. Thus creating a dynamic relationship between the two water types. It is a zone of transition between the marine-dominated systems of the ocean and the upland river, or in our case a stream, and its supporting watershed. Our "pocket estuary" yields some of the most biologically productive life in the San Juan Islands. This mixing of fresh and salt water creates a unique environment that brims with life of all kinds - a transition zone between the land and sea. Estuaries are critical for the survival of many species. Deer Harbor has been identified as critical pocket estuary vitally important to the marine life that dwell in the San Juan Islands.



Birds, mammals, fish, and other wildlife depend on estuarine habitats as places to live, feed, and reproduce. Estuaries provide ideal spots for migratory birds to rest and refuel during their journeys. Species of fish and shellfish rely on the sheltered waters of estuaries as protected places to spawn, giving them the nickname "nurseries of the sea." Hundreds of marine organisms, including most commercially valuable fish species, depend on estuaries at some point during their development. Estuaries gathers and holds an abundance of life-giving nutrients from the land and from the ocean, forming an ecosystem that contains more life per square inch than the richest Midwest farmland.

What salmon need in Deer Harbor to complete their life cycle...

WATER Clear, cold, clean and consistent water

GRAVEL For laying their eggs. A REDD is the gravel nest for salmon eggs.

EGGS If salmon have healthy habitat and can get away from predators, they will live to return to their native stream and lay their own eggs...And the cycle of life starts all over again!

WETLANDS Wet land are important for regulating water flow and filtering runoff. They help to keep streams clean for salmon.

PLANTS The riparian vegetation along a stream, wetlands and the nearshore help shade the water to keep it cool and their roots and branches make great hiding places for fish. Riparian plants in the nearshore marine environment include eelgrass and kelp. Eelgrass is important habitat for migrating juvenile salmon and for hosting the forage fish that salmon rely on.

ESTUARIES Those pockets of convergence are the nursery grounds for the salmon cycle and the young and old marine creatures that support them. Juvenile salmon use estuaries, even the Deer Harbor one for shelter and to grow up in and when returning to spawn use the estuary to help them adapt to fresh water again.

FOOD In the estuary and the nearshore salmon eat foods that give their flesh the pink color we love to eat. The important forage fish in Deer Harbor are herring, surf smelt, sand lance, juvenile shiner perch, and crustaceans.

Eelgrass: A Marine Meadow

By Sandy Wyllie Echeverria Ph. D.
Research Scientist

Carried on the ocean currents in late summer or early fall the small seeds (about half the size of a single grain of short grain brown rice) of the seagrass, Zostera marina L. (eelgrass) arrive on the surface of the sediment. Over the next few months seeds are worked into the sediment matrix. Peak germination occurs in late winter and as the water warms, seedlings grow. Those that survive the critical stage of adjustment from seed to leaf green shoot continue to expand as rhizomes creep through the sediment assisted by the initiation of new daughter shoots that pierce the sediment to capture sunlight and fuel new growth. In this meadow forming process, Z. marina can cover many acres of submerged land creating underwater prairies that stabilize the bottom, retard currents, recycle nutrients and create habitat for other species. The diversity of habitat niches within the canopy of the swaying green leaves or the caramel colored rhizomes is truly amazing as all surfaces, edges, lateral leaf blades, rhizomal curves, are food, foraging grounds or nursery sites for animals that crawl, swim and fly. In the Puget Sound, this rich diversity also includes juvenile salmon and the prey of adult salmon. In more quantitative terms, the ecological services provided by an acre of Z. marina are valued at $25,000 (2004 dollars).

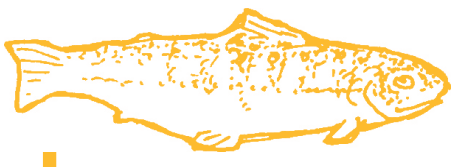
ORCAS STUDENTS NETTING SALMON

THE SEARCH FOR SALMON

Dr. Tina Wyllie-Echeverria, Fisheries Oceanographer

Do juvenile salmon occupy Deer Harbor and Cayou Estuary? That was the question posed by the habitat assessment team. To answer that question a variety of "fish traps" or nets were used in October, March and June to determine which fish were present.

YES! juvenile salmonids are found in Deer Harbor and in the Estuary



Our results are a positive indication of habitat use by salmonids.

The October sampling was aided by Marta Branch's Marine Biology class. Students and scientist worked together to set a Fyke net in the estuary and deploy a 37 meter beach seine along the eastern shore of Deer Harbor. Resident species such as staghorn sculpins, pipefish, and gunnels were found. Returning in March 2004 we were joined by Greg Book's Environmental Studies class. We found a few juvenile salmon, chums and pinks, in the estuary and in Deer Harbor. These fish were around 1.5 inches long, about the size they would be when they left their natal stream and entered the Sound. Our final sampling, just completed in June caught three chinook juveniles in the Deer Harbor area. Other fish caught with these nets included starry flounder, English sole, snake prickle backs, shiner surf perch, juvenile hexagrammids, surf smelt, sticklebacks, and juvenile herring. So, the answer to our question is YES! juvenile salmonids are found in Deer Harbor and in the Estuary during spring and summer months. Our results are a positive indication of habitat use by salmonids. More frequent sampling planned for next year will help us evaluate how long these species of salmon frequent Deer Harbor and its estuary.

THE STORY OF FISH TRAP CREEK

By Mary Lou White, Washington Trout

A watershed ecosystem (even a small one like Deer Harbor) is incredibly complex, all physical and biological elements interconnected. The system cannot function properly without all elements present and healthy. Washington Trout's mission is to use the best available science to identify problems that limit ecosystem function, and to design restoration models. Washington Trout represents no specific user groups, but is dedicated solely to the needs of Washington's wild fish. Washington Trout provides a vehicle for communities that want to get meaningfully involved in native fish recovery. Washington Trout is a non-profit conservation organization established in 1989 to protect and restore Washington's wild fish and their habitats. Washington Trout seeks to improve conditions for all of Washington's native fish by conducting important research on wild-fish populations and habitats, advocating for better land-use, salmon-harvest, and hatchery management, and developing model habitat-restoration projects.

A watershed ecosystem... is incredibly complex, all physical and biological elements interconnected. The system cannot function properly without all elements present and healthy.

Fish Trap Creek: A Restoration Opportunity

In March of 2004, Washington Trout accepted enthusiastically to be part of the REED scientific team. Our part of the Deer Harbor story is to conduct a qualitative habitat reconnaissance and culvert assessment on Fish Trap Creek, a small stream that drains a 736-acre watershed on the west side of Orcas Island into Deer Harbor. Existing stream conditions, fish habitat, barriers to fish passage, and salmonid spawning and rearing potential are of particular interest, since this information will help inform future restoration recommendations for Fish Trap Creek, and will also aid in developing design plans for the Deer Harbor Bridge project. REED will use the results of Washington Trout's watershed assessments to share with the community the most ecologically and economically appropriate salmon restoration projects.

At first glance, Fish Trap Creek's potential to bear fish is easily overlooked. No fish were in fact observed in Fish Trap Creek by Washington Trout Crews in 2004. However, it is currently classified by the Washington State Department of Natural Resources as a fish-bearing stream on the basis on physical characteristics such as stream width and gradient.

Because of its agricultural history and modifications to its hydrology, Fish Trap Creek is lacking in flow and in-stream LWD, and is therefore deficient in both deep water and riffle/pool complexes which together form favorable fish habitat. Fine sediment also covers the stream bottom which limits access to spawning gravel. Nevertheless, Fish Trap Creek has a number of important attributes of a stream that is still capable of supporting fish: (1) isolated patches of spawnable gravel; (2) mid-channel and headwater ponds which could provide rearing habitat upon the removal of man-made barriers; 3) wetlands which aid in ground water recharge, improve ecological diversity, protect water quality, and provide flood control; 4) stretches of intact riparian corridor; and 5) a well-defined estuary at its mouth. Unusual in the San Juan archipelago, such estuarine environments are of critical importance during the life history of Pacific salmon.

Fish Trap Creek has a number of important attributes of a stream that is still capable of supporting fish.

Fish Trap Creek is a potentially important watershed for salmonid use in the San Juan Islands.

Fish Trap Creek is a potentially important watershed for salmonid use in the San Juan Islands. Many of its current deficiencies can be corrected. Flows can be enhanced by redirecting the stream channel through sediment depositional areas and by improving connections. High water temperatures can be reduced by planting riparian corridors and pond banks. Large woody debris can be added to the stream and fish-passage barriers can be removed. Improving habitat in Fish Trap Creek may appear a daunting task. Fortunately, where communities are willing to restore natural areas miracles happen. Support, patience, and a positive vision go a long way in restoring the function of any watershed.

Where communities are willing to restore natural areas miracles happen. Support, patience, and a positive vision go a long way in restoring the function of any watershed.

SALMON RECOVERY FUNDING BOARD AND REED

By Marc Duboiski, SRFB Project Manager

Interagency Committee for OUTDOOR RECREATION
SALMON RECOVERY FUNDING BOARD

The Washington State Salmon Recovery Funding Board (SRFB) loves these types of projects – local communities working together to solve a habitat restoration need. The REED project is an excellent example of collaboration between the Deer Harbor hamlet, its surrounding landowners, and the Samish Indian Tribe. The people involved are conducting a thorough historical analysis of the estuary and bay prior to developing the engineering and design plans for a new bridge.

We hope this project serves as an example of how to garner, support, and develop community solutions to a resource need, and will act as a stepping-stone to future near-shore marine and estuary habitat restorations and protections on Orcas Island, and throughout San Juan County.

REED - DEER HARBOR ESTUARY

by Jim Johannessen, Licensed Engineering Geologist

In our two years of studying the natural and altered conditions of the FishTrap Creek-inner Deer Harbor estuary system, we have learned that much of the system is still intact and with several restoration actions, should be able to significantly improve conditions to allow for increased use by salmon, fish and other critters. After Coastal Geologic Services completed its three measurement and research tasks for the project (topography, historical shoreline change, and sedimentation and erosion), the recommended restoration actions are actually fairly modest when compared to most of the "pocket estuaries" around the region. Pocket estuaries have only recently been determined to be key habitats for juvenile salmon and more species than we even know of. Not many small estuaries are left in an unaltered condition as these areas have been often filled and highly altered around the Puget Sound region.

The neck of the estuary...was 120 feet wide in the 1880s. It is now 50 feet wide.

The first issues to be fixed are stopping the greatly increased sedimentation rate and reestablishing better fish access at low and mid tides. Both of these issues are linked to replacing the bridge. The neck of the estuary where the bridge is today was measured at 120 feet wide in the first reliable maps form the 1880s. It is now 50 feet wide. After rock was placed under the bridge the estuary appeared to experience relatively rapid sedimentation. The bridge and surrounding rock has caused erosion immediately upstream from the bridge. The rock under the bridge has caused the formation of a tidal pond, and cores show that sedimentation has increased. If only the rock were removed, the existing bridge would be in great danger of losing its foundation due to scour (and that probably why the rock was placed several times in the past.)

If the bridge span were widened and the rock removed, a channel would develop into accumulated sediments. This is expected to lead to flushing of a finite amount of accreted sediment, but it is unlikely that measurable sedimentation would occurred at eelgrass beds in the outer estuary, which are 1,200 feet distant. Removing the rock and lowering the bottom under the bridge would increase the time that fish could access the estuary substantially, as the rock dam would be gone and tidal currents would be greatly slowed. Historic comparison of the vegetation line and the MHHW line indicated that the inner estuary is not growing or decreasing in size, but generally staying the same shape, such that if the sedimentation and access issues are addressed, the longevity of the estuary does not seem to be a problem.

Additional restoration actions are recommended for the watershed above the estuary along with planting adjacent to the shores of the estuary and Fish Trap Creek.

THE EXISTING CAYOU ESTUARY BRIDGE

By Tom Smayda, Civil Engineer

The existing timber bridge has timber footers and rock fill on the beach and in the intertidal range. A rock dam constructed beneath the bridge prevents water from fully draining out of the lagoon. This photo, looking northward into Cayou Estuary, shows the rock dam under the existing bridge and the ponded water in the estuary. This ponding is not a natural condition, causing sediment to accumulate within the estuary and preventing the formation of tidal channels. Considerable beach fill is associated with the bridge approaches and footings. A portion of the beach fill is visible in this picture. The bridge approaches extend out about 80 feet onto the beach from one side and about 20 feet on the other, filling a portion of the intertidal zone with angular quarry rock.

DEER HARBOR BRIDGE REPLACEMENT UPDATE

by John A. Van Lund, P.E., S.E., County Engineer

In April 2005, the San Juan County Public Works Department submitted an application in response to the 2005 call for projects by the Washington State Department of Transportation (WSDOT) Local Agency Federal Bridge Program. This competitive bridge replacement program provides 100 percent federal funds to local agencies for the replacement of deficient bridges. Competition for this funding is stiff because all the state's counties, cities, and towns are eligible.

The Deer Harbor Bridge Replacement project was approved by the Board of County Commissioners (BOCC) on October 11, 2005, when the BOCC adopted the 6-Year Transportation Improvement Program (TIP). The BOCC approved this project under the condition that the project would not go forward unless it received 100 percent federal funding. In late October, Public Works learned that the call for projects was withdrawn because of cost overruns with currently funded projects. Therefore, no work will be done in 2006 unless an alternate funding source is found and funding for the project is appropriated by the BOCC.

We estimated that it would have cost $1 million dollars to replace the existing timber bridge with a new prestressed concrete bridge with timber railing, and concrete cap supported by steel piling filled with reinforced concrete. This estimate was in 2005 dollars and included all engineering, right-of-way, and permits. Preliminary bridge estimates are calculated based on a square foot of deck area. The overall bridge length was assumed to be 120 feet and the overall width for the two-lane bridge was assumed to be 32 feet.

It will most likely take a minimum of five years from start of design to complete final construction because of the time it takes to obtain right-of-way and acquire permits from the state's resource agencies. Realistically, it may be 2015 before a new bridge would be in service considering how long it takes to construct county projects. As time goes by, it will cost more because of inflation.

We are committed to community involvement...After all, it is the residents of the Deer Harbor Community who know best what they want, as well as, the local lore and history.

We are committed to community involvement in constructing the county's infrastructure. This is accomplished through public meetings with the Planning Commission, Eastsound Planning & Review Committee (EPRC), the BOCC, and project specific public meetings with the community. Engaging the Deer Harbor Community in the design process from the beginning is critical to the success of this project and to keep costs from escalating. After all, it is the residents of the Deer Harbor Community who know best what they want, as well as, the local lore and history.

We want to thank the REED group for the opportunity to share information, our expertise, and to participate in public meetings concerning the restoration of the Deer Harbor Estuary and the eventual replacement of the Deer Harbor Bridge.

STRUCTURE AND HISTORY OF CAYOU LAGOON

Russel Barsh
Director, Center for the Study of Coast Salish Environments

While our official role in the Deer Harbor study was limited to mapping present-day vegetation and making recommendations for ecosystem-friendly landscaping, we had our own scientific interest in reconstructing as much of the ecological and human history of Cayou Lagoon as possible. This interest is ongoing, and we will continue to share our findings with the community!

We began our investigations with three "big questions": How long has the lagoon been so soft and muddy? What did the lagoon ecosystem look like before? And why did it change?

To probe the ecological past, we used three main methods. First we dug a meter- wide trench into the lagoon to get a "profile" of its former bottoms and the sediments that have slowly filled it. Then we used a special tool to take several sediment cores from the middle of the lagoon—far too soft and wet for a trench—where we hoped to learn more about changes over time in the rate of sedimentation and the nature of the sediments. We also probed the bottom of the lagoon with a specially designed steel rod to look for "hard spots" which might tell us about the nature of earlier lagoon bottoms.

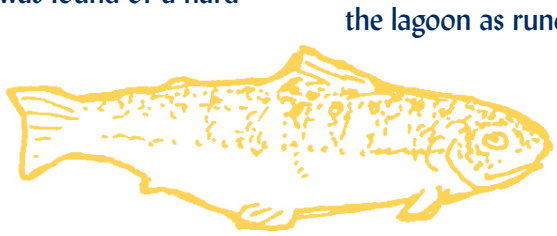
Our trench was dug from the west side of the lagoon, where we expected to find some evidence of the original Cayou homestead. Indeed, the topsoil of the upper bank is black with charcoal and ash from burning off trees and brush to clear the landscape for fields and pasture. Underneath 8 inches of topsoil on the bank, and 6-8 inches of black organic mud in the lagoon itself, we found just over 5 feet of gray gritty clays, containing a small number of smooth rounded gravels and pebbles. This clay is unstratified—that is, it does not form distinct layers, indicating continual mixing as it accumulated. Similarly, the gravels and pebbles do not form distinct layers or bands, either, suggesting that they were already present in the clay and were continually re-mixed. Towards the bottom of this 5-foot-thick layer, the clay is somewhat blocky and streaked with orange iron oxides: characteristic of material that accumulated under fresh water (wetlands or ponds).

We began our investigations with three "big questions": How long has the lagoon been so soft and muddy? What did the lagoon ecosystem look like before? And why did it change?

Beneath the 5-foot-thick layer of re-mixed clay, we encountered sharply stratified alternating strata of greasy bluish-gray clay and fine sand, which continued down as far as we could continue digging before we exceeded the capacity of our pump to keep water out of the trench: another 3.6 feet. The color and clear "bedding" of the clay and sands is typical of a "glacio-marine" deposit created as glacial ice melts and carries sediments into the sea. Alternating strata represent seasonal variations in flows of melt-water. We were able to recover a 137-year climate record from the uppermost few feet of stratified clays, which varied in thickness from 0.2 to 18.5 inches of annual accumulation.

Our test trench did not find the bottom of the glacio-marine clay beds, so we later enlisted the help of a Canadian Geological Survey team equipped with a 20-foot vibrating core drill slung from a derrick. With this equipment, we mapped the clay on the east side of the lagoon down more than 15 feet without reaching bedrock. The Cayou Lagoon clay could be much deeper. The glacio-marine deposits at Point Hammond (Waldron), which are dense with fossil scallops and other shellfish, are more than 25 feet thick.

To confirm the results of our trenching and coring, my students probed the bottom of the lagoon extensively. Soft mud is up to 5 feet thick in the deeper parts of the lagoon. Some gravels and pebbles are mixed with the mud and clay throughout the lagoon, but no evidence was found of a hard bottom within 6 feet below the current bottom. However, a rocky area extends northward from the bay under the bridge and for about 75 feet into the lagoon, and this is where we observed the greatest diversity of marine animals and plants, including Lemon and San Diego nudibranchs, several species of anemones, sponges, and sea stars, as well as a 1-meter square patch of eelgrass. This patch of diversity is partially due to the hard substrate, and partially to the effect of the artificial sill under the bridge in maintaining relatively high water levels on ebb tides.



Our studies of the lagoon have important practical implications.

Peat dug from the lakebed at the top of the Deer Harbor watershed (just over 380 feet elevation) contains the remains of mud-burrowing shellfish at least 8,000 years old. The enormous weight of the mile-thick glacier that once covered the islands pushed down the earth's crust. As the glacier melted, the islands rose once again, but so did sea levels, only more slowly. About 8,000 years ago, the shoreline was 380 feet higher, and the area of Jack Helsall's lake was a saltwater lagoon. Cayou Valley was deep undersea, filling in gradually with clays and sands carried to sea by the melting ice. About 4,000 years ago, based on chronologies developed by researchers working on the mainland, Cayou Valley began to rise above sea level. It was filled deep with clay, and annual flooding from Fish Trap Creek carried more gravel and pebbles into the lagoon as well as re-mixing the clay.

Has the rate of sedimentation changed over time? To answer this key question we collected cores in the deepest part of the lagoon where Jim Johannessen's sediment stakes indicated that silts and muds are currently accumulating fastest. One core was then sliced and the slices were dissolved and sifted to measure the size of sand grains (chart). Dating of the slices was relative: We identified the time period 1950-1960 by testing for sulfur which was released in large quantities into the lagoon by the sawmill that once stood near the bridge. There was a very high concentration of sulfur in slice 22. Based on the depth of slice 22 we estimated the rate of sedimentation since the 1950s. If silts and muds have been accumulating at roughly the same rate, our core record reached back to the 1840s—just before the first European settlers.

Some time around the 1930s, there was a jump in the proportion of very fine sand in the material settling in the bottom of Cayou Lagoon. Fine sand continued to make up a high proportion of the sediment from that time until today. The proportion of coarse sand has been smaller and more variable. What may explain this change? A strong suspect is upstream logging, followed by extensive clearing of the lands surrounding the lagoon for homes. That would have increased surface water runoff, carrying more fine material into the lagoon each year during the rainy season.

At the same time, the total amount of sand in our slices decreased somewhat from the 1950s to the present day. This could reflect a decrease in rainfall and/or stream flows carrying sediments into the lagoon. Some recent developments have disconnected nearly half of the Deer Harbor watershed from Fish Trap Creek. We tested salinity levels in the lagoon after heavy rains in 2003 and 2004, and found that as much fresh water enters the lagoon as runoff from the fields surrounding it, as comes from Fish Trap Creek. Most of the runoff nowadays is coming from the east side of the lagoon.

Our studies of the lagoon have important practical implications. Increasing flows in Fish Trap Creek, widening or deepening the channel under the bridge to improve tidal circulation, or dredging the lagoon itself to deepen it, will not make the lagoon less silty or muddy. The bottom will still be very soft, except in the area immediately north of the bridge. However, these and other measures can slow the rate of silting so that the lagoon does not disappear altogether within our lifetimes. In particular, it would help to re-plant shrubs along the shores of the lagoon that will help retain water and slow erosion. Many attractive flowering native species produce strong mats of roots and rhizomes that knit up shorelines effectively: they include native roses, red flowering currants, and honeysuckle, as well as spirea, oceanspray, twinberry, and willows.

CHANGE IS GOOD

By Tom Smayda, Civil Engineer

It's clear, removing the rock that now partially dams Cayou Estuary will allow more water exchange. Once removed, almost all the water will drain out during low tides, leaving exposed a meandering pattern of channels. We think that these channels will be sandy bottomed, will support oyster, and will be will be easier to walk along than the mud that currently exists. In my opinion this will look good. We anticipate that channels will develop over a period of one to two years. During higher tides, the estuary will be inundated as now occurs.

A similar estuary, Appletree Cove in Kingston, is fed by Carpenter Creek, a stream quite similar to Fishtrap Creek. A few pictures from Appletree Cove are presented here to show what the future may hold for Cayou. Note that the water leaves almost completely. Note the meandering channels within the mud flats. The last picture shows the head of Appletree Cove at the confluence of Carpenter Creek. Notice the mature spruce and the meadow, and the overall lay of the land.

So, to conclude, if you believe that natural beauty surpasses man-made beauty, then I think it safe to say that for Cayou Lagoon, dam removal is good.

SALMON AFFECT

Salmon Affect is the non-profit that has been organized to help continue the work of the REED Project and other education and restoration projects in San Juan County.

Information about these projects can be seen on line at *WWW.HELPINGTHEEARTH.ORG.*

These projects have been supported by grants written by REED Team members and by donated time of community members.

For information about volunteering, making financial donations for education and restoration projects please contact Leslie Seaman or Ken Brown.

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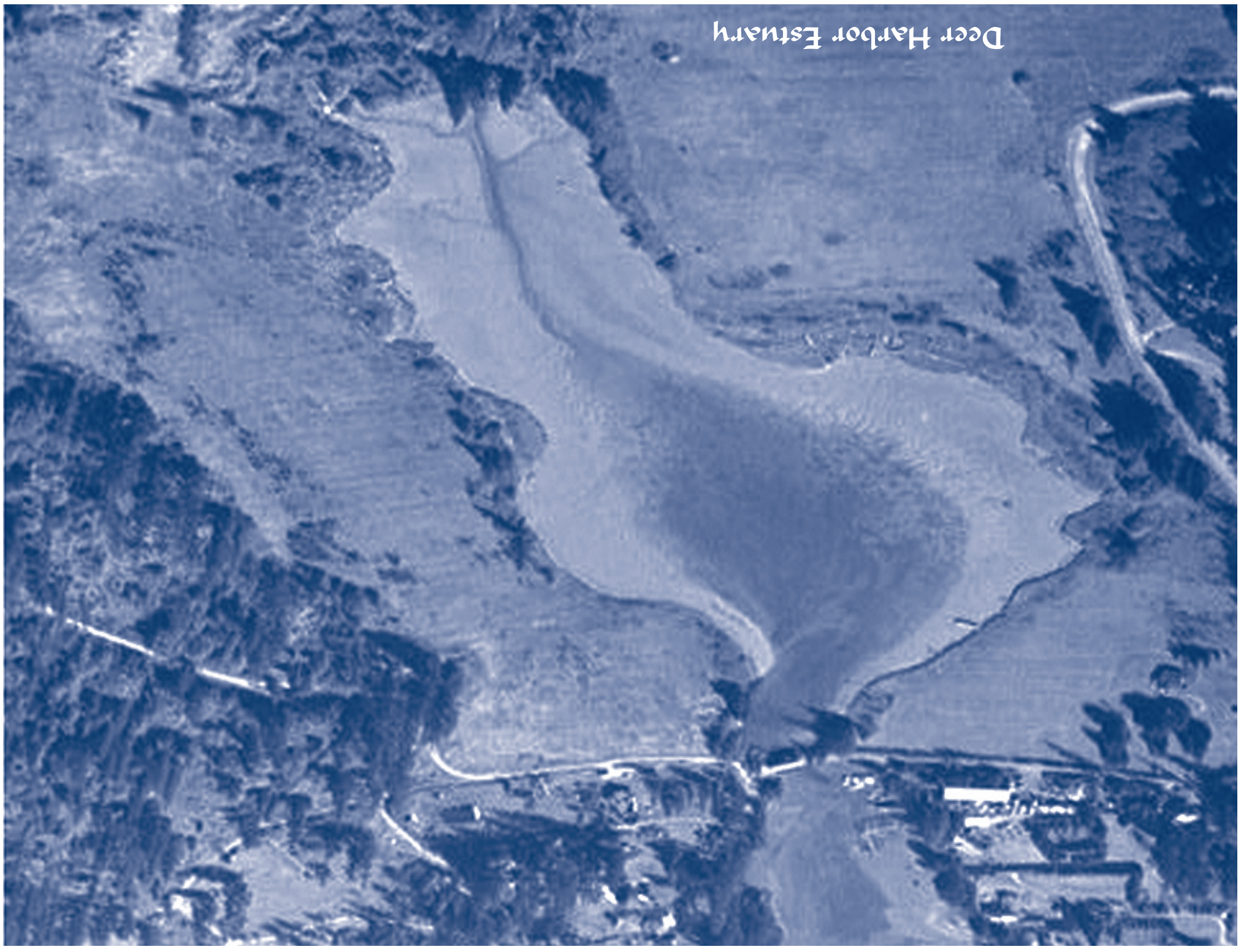

Restoring the Estuary & Ecosystem of Deer Harbor

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a place for salmon

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