

**Species/Biodiversity  
Comments Submitted via Email  
4/14/2008 – 5/9/2008**

**From:** Debby Hyde

**Date:** 05/9/2008

**Comment:** Before I knew the date of the comment period, I asked staff from the various Pierce County agencies to review the topic papers and provide comments. When I realized our review date was later than your requested date, I still felt it important to collect them and send them on for your use. Some of the comments are very general and probably similar to others. But some staff had very specific thoughts as you will see in the accompany attachment. I hope you will find them useful.

Land Use/Habitat Protection and Species and Biodiversity Topic Forums  
The papers do a good job of pointing out some of the very real challenges we face. The two that arguably affect local government most are: 1) most permitting decisions ultimately become local issues but, those decisions rely on broad (read “vague”) management guidance provided at the State and Federal level; and 2) local government is constrained by inadequate resources, conflicting mandates, and transient political will.

The papers tend to downplay the 30-40 years of science that precede them. One can always learn more about any given subject but, I'm not sure I agree that "little is known" about so many aspects of Puget Sound. I expected to more frequently see comments in the two papers that acknowledge "There is much we know about the forces that threaten species survival" instead of the exact opposite.

The documents give the impression that we can't take much substantive action until our understanding of a wide range of ecosystem processes is better understood.

The documents reference the standard, universally popular and ecologically sound, buzzwords: "ecosystem scale", "ecosystem approach", "multi-stakeholder management" but, don't adequately acknowledge that, ultimately, most things boil down to local permitting and that specific quantitative standards are needed.

The papers are captioned Initial Discussion Draft and it is clear that they were prepared to “provoke thought”. Nonetheless, I was hoping that they would provide some direction immediately useful at the local level. The

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Partnership seems to have a great deal of public and political support which might be useful in promoting changes to our current processes, for example increasing our emphasis on enforcement and compliance monitoring. Instead, under “What immediate .....actions are needed” is listed: “Begin to design an ecosystem-based management approach”. If that is an “ immediate action”, I am concerned.

The papers left me with the impression that the Puget Sound Partnership proposes to make sweeping, fundamental changes to the current Puget Sound regulatory framework but, only when they are done studying everything remotely associated with Puget Sound.

Finally, the documents reference the standard, universally popular and ecologically sound, buzzwords: "ecosystem scale", "ecosystem approach", "multi-stakeholder management" but, don't adequately acknowledge that, ultimately, most things boil down to local permitting and that specific quantitative standards are needed.

**From:** David Beauchamp

**Date:** 05/09/2008

**Comment:** I just got back in town and lost the exact contact info for providing some feed back-sorry. Don't have much time to respond, but wanted to supply some papers and brief thoughts. I've attached some pdf's as citations to support:

1. the importance of zooplankton in any science and monitoring plan Beauchamp et al 2004 (Lake Washington; Duffy et al. 2005 Puget Sound
2. Approaches to analyzing food web interactions and contaminants (McIntyre et al 2006, 2007 papers)
3. Trophic interactions and distribution of salmon in Puget Sound (Duffy and co-authors).
4. Example of combining models and data to evaluate the relative importance of temperature, food supply and food quality on marine growth and survival of salmon (Beauchamp et al. 2007). Using directed sampling and bioenergetics based models provide more useable information for directly addressing management questions than either IBI or Ecopath (these are 2 extreme options) can offer. Moreover, the field-bioenergetics approach works well interactively with development of a monitoring program and utilization of the data generated.

I want to reiterate that even a skeletal monitoring program of key species in the food web should be instituted asap and can probably be conducted at

reasonable cost. This would both begin to satisfy the need for an assessment of current status of the food web as well as inform and guide the evolution of a fully-implemented monitoring program in terms of sample size and power trade-offs, timing, frequency and spatial intensity of sampling for different elements. At a minimum, for upper trophic levels adding some initial zooplankton sampling, a hydroacoustic and midwater trawling component, and some strategic expansion of the exiting PSAMP program would fill in some critical data & knowledge gaps between the water quality and birds-mammals data.

This, combined with the selection of indicator variables will be crucial early actions that influence the direction and potential success of PSP overall. Sorry I have to finish here for now, but am happy to discuss more with whomever is appropriate later.

PDF attachments:

Duffy et al 2005 hsr-g-marine trophic demand-synthesis.pdf

Duffy\_&\_Beauchamp\_TAFS\_2008 Cutthroat predation on salmon in Puget Sound.pdf

Ruggerone & Goetz 2004 Pink Salmon effects on Chinook Survival in Puget Sound.pdf

Beauchamp et al 2007 Bioenergetic response of salmon to climate-ecosystem change NPAFC Bull4.pdf

McIntyre et al 2006 Ontogenetic Trophic Interactions & Benthic-Pelagic Coupling in LW-Stable Isotopes-Diet.pdf

McIntyre & Beauchamp 2007 Age & trophic position dominate Hg & organochlorine bioaccumulation in Lk Washington foodweb.pdf

Beauchamp et al 2004 Early Food Supply-Demand Sockeye.pdf

**From:** Derek Poon

**Date:** 05/09/2008

**Comment:** After sending this acceptance notice to EPA people, I got a nice set of comments indicating sediment is listed in Idaho. Leigh Woodruff stated:

Just wanted to comment on your email below on the statement that sedimentation is not usually listed under 303(d). Clean sediment is considered to be a pollutant under the CWA, and if it is impairing beneficial uses or otherwise causing violations of WQS, it should be listed under 303(d). Hundreds of clean sediment TMDLs have been written here in Idaho. While most of these were driven by EPA listings in 1994, the State biological assessment methodology is

identifying additional streams with sediment impairments which need TMDLs. Hopefully Washington's assessment methodology will pick up these sediment impairments such as in the Lake Sammamish watershed. Idaho is now also using EPA's CADDIS causal assessment tool to help identify which pollutants are causing impairment.

I left out "in Washington" in my statement to you. Sorry.

The challenge is that sedimentation (not contaminated sediment or TSS) and flow are usually not listed under CWA 303d IN WASHINGTON; as you can tell from my report, that makes it very difficult to treat the problem. A sediment TMDL can be done, such as for Upper White and Simpson HCP, but Ecology has not shown an active interest at this time.

The business of 303d listing and TMDL is a complex topic and my purpose is not to point fingers, because I would have to pick up a good share of the responsibility myself. My point is simply that all available tools be used creatively to address the Lake Sammamish type of predicament in Washington and elsewhere, so we don't end up working with an end result such as listing, but work proactively with prevention and avoidance. That may be the take home message from lessons from the past.

**From:** Perry Falcone

**Date:** 05/09/2008

**Comment:** Thank you for the opportunity to comment on the Topic Forum papers. I attended the May 1st Species, Biodiversity, and Food Web Topic Forum. I wanted to forward a few additional comments to the Puget Sound Partnership (PSP) that I was unable to provide at the Topic Forum.

S1 Page 5 - Under "Status of biodiversity" please reference the newly released King County Biodiversity Report

S1 Page 5 - Under "Documented threats to abundance..." refers to "airborne mercury particles originating in Asia" A National Parks study - WACAP - Western Airborne Contaminants Assessment Project (Chapter 6, Section 6.5.1 [http://www.nature.nps.gov/air/Studies/air\\_toxics/wacap.cfm](http://www.nature.nps.gov/air/Studies/air_toxics/wacap.cfm)) describes airborne mercury particles that may originate locally in the case of Mount Rainier National Park.

S1 Page 7 - "Atlantic trout and salmon MAY escape from private hatcheries..." should be changed to Atlantic salmon have been documented to have escaped from net pens and adults have been found in the Green-

Duwamish River" (according to the WRIA 9 Habitat-limiting Factors and Reconnaissance Report

<ftp://dnr.metrokc.gov/dnr/library/2000/kcr728/vol1/partII/no2/2-6Non-Native%20species.pdf>

S1 Page 7 - In the Section for "Cultured Species" differentiate between native cultured species (e.g. native salmon species) and introduced cultured species (e.g. Atlantic Salmon). Or split the section by hatchery, shellfish cultures, fish farms, etc...

P1 Page 21 - The section labeled Cultured Species has disappeared and should discuss the lack of regulations and policies around cultured species.

P2 Page 32 - The first bullet under "Take action where we know there is urgency" says "Implement the most urgent actions in existing plans. This should say "Fully implement all actions in existing plans." Since the Puget Sound Salmon Recovery Plan and the component watershed conservation plans are severely underfunded, I would strongly recommend fully funding the federally adopted Endangered Species Act plans until such time as the PSP has substantiated reasoning why the plans need to be changed or there are other higher priorities. For example, the Snohomish River Basin Salmon Conservation Plan has received less than 50% of the \$13M per year called for by the Plan.

Thank you for the opportunity to provide additional comments. I look forward to working closely with PSP in the future to achieve a successful Action Agenda.

**From:** Andrea Copping

**Date:** 05/09/2008

**Comment:** On behalf of the staff of the Pacific Northwest National Laboratory (PNNL) Marine Sciences Laboratory staff, I would like to commend you and your staff for pulling together the five topic papers. There has been a great deal of thought and expertise brought to bear in creating these papers in a very short time, and they have provided an excellent point of departure for moving towards the Puget Sound Partnership Action Agenda.

I have worked with a number of PNNL staff to coordinate comments on the papers and I append those comments for four of the papers here. We have focused for the most part on scientific findings that should help to inform management decisions in Puget Sound, and we draw from programs in which we have been intimately involved, generally in partnership with agencies, tribes, and academia.

I would like to credit our scientific staff in Sequim and Richland for contributing to these comments, including Dr. Irv Schultz, Jill Brandenberger, Dr. Tarang Khangaonkar, Dr. Gary Gill and Dr. Charlie Brandt.

## Species, Biodiversity and Food Web Topic Paper

We commend the authors for recognizing that invasive species are an issue of concern for native species and biodiversity; we urge that this issue form an important part of the Action Agenda with greater emphasis on the prevalence, ecological impacts, and spread of invasive species in Puget Sound. Recognized as one of the most devastating impacts on native species and habitats worldwide, invasions by non-native marine plants, animals, and micro-organisms have the potential to reverse or marginalize many of the recovery activities planned under the Puget Sound Partnership.

Status of Invasive Species in Puget Sound – Recent surveys of Puget Sound including Cohen et al. 2000 (see additional references) have provided glimpses into the degree of invasion by many taxonomic groups. Management techniques to control the introduction and establishment of invasive species are most effectively targeted at the pathways by which they enter the environment, most of which are human-mediated. Work in the 1990s by Annette Olson and her students analyzed the most common pathways by which invasives enter Puget Sound (Olson et al 2000). This work needs to be updated and management programs targeted appropriately.

Ballast Water - There is general agreement that the greatest risk for the introduction of non-indigenous species into Puget Sound is through ballast water discharges. The Washington State Ballast Water Workgroup and similar efforts at the national and international level are working towards enforcement of ballast water treatment onboard ship; at the moment open ocean exchange is used in place of treatment. Ballast water exchange is preferable to no action but is not uniformly carried out nor is it necessarily effective in removing non-indigenous organisms.

Opportunity for Effective Ballast Water Program – Current efforts underway to require treatment of ballast water onboard ship could serve as a model of cooperation and effective management for government, industry, the public and Puget Sound. Support of the Puget Sound Partnership could be an important impetus for moving forward the current state efforts, soon to be superseded by uniform national standards.

Barriers that prevent the immediate adoption of effective ballast treatment include the lack of programs to test and verify treatment technologies and move them onboard ships. The first saltwater test facility in the nation is planned for construction in Puget Sound; support for this program could bring together industry, who are looking for uniform standards and regulatory certainty, government regulators including the US Coast Guard and EPA, and public interests, allowing the Puget Sound Partnership to showcase Puget Sound as a national model for preventing damage by invasive species.

## Additional References

Olson, A., J. Goen and N. Lerner. 2000. Handling and Disposal of Non-native Aquatic Species and their Packaging. Washington Sea Grant Program, Seattle WA 12 ppgs.

Cohen, A., C. Mills, H. Berry, M Wonham and B. Bingham. 2000. The 1998 Puget Sound Expedition: A Rapid Assessment Survey for Non-indigenous Species in the Puget Sound. Proc. First Nat'l Conf Bioinvasions, Boston MA.

Dethier, M. and S. Hacker. 2004. Improving Management Practices for Invasive Cordgrass in the Pacific Northwest: A Case Study of *Spartina anglica*. Washington Sea Grant Program, Seattle WA 24 ppgs.

Jamieson, G., E. Grosholz, D. Armstrong and R. Elner. 1998. Potential ecological implications from the introduction of the European green crab, *Carcinus maenas* (Linnaeus), to British Columbia, Canada, and Washington, USA. *J. Nat. History* 32(10-11): 1587-1598.

**From:** Sonia Thompson

**Date:** 05/08/2008

**Comment:** My name is Sonia Thompson and I am writing regarding the recent forums on the Action Agenda, and the Draft document:  
I appreciated the opportunity to attend the Biodiversity session of the forums last week, as a representative of Cascade Land Conservancy.

I was impressed by the organization of the session and the quality of material in the Draft agenda topic.

The draft made the important connection between shoreline and mid-elevation land use and the health and future integrity of the Puget Sound.

One topic which should be emphasized more strongly is the public education/outreach element. Unless citizens take on the quality of the Sound as a personal responsibility, government efforts will be diminished. Education should begin at the elementary level, as we all know that children can shame their parents in to doing the 'right thing'. The final plan should have a requirement that all schools in the Puget Sound region include a course about the Puget Sound -- importance, health and care thereof. The teaching staff could be recruited from the abundance of volunteer stewardship organization who now monitor and champion the sound.

### Biodiversity Topic Draft

Your draft mentions that population growth and sprawl are driving upland fragmentation and have a high negative impact on the sound. This language should be stronger; this threat will increase with the expected growth. In the section on Management Plans (starting on Page 28 of the Draft), you make a good start by referring to the Washington Biodiversity Conservation Strategy and promotion of habitat conservation. I urge you to strengthen this by outlining programs, both voluntary and regulatory for protecting habitats. Your plan should include protection of habitats upstream, because destruction upstream impacts the sound. If need be, draft a "Carrot & Stick" scenario which would make State and Federal funding contingent on implementation of good policies.

Again, thank you for the opportunity to attend the May 1st session and to comment.

- Pg 8 – The information on urbanization and stormwater would be stronger with more context on the degree to which growth is happening outside the UGA. Under the “urbanization” paragraph, the document could include the following sentence: “Significant growth continues outside the Urban Growth Boundary. In Pierce County, approximately 20% of the growth between 2000 and 2007 was outside the UGA. In Kitsap, between 40 and 60% of growth has been outside the UGA in recent years.” Source: Puget Sound Regional Council, Puget Sound Trends, April 2008

<http://www.psrc.org/publications/pubs/trends/d5apr08.pdf>

- Pg 15 – The list of stormwater source control measures on this page could include “conservation and smart growth strategies”

- Pg 17 – The document correctly lists out “limitation on impervious surface, and protection of ecologically functional areas” as an area that needs more findings. These findings should comment on the cost effectiveness of using conservation and smart growth as stormwater prevention strategies as compared to treatment.

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- Pg 21 – The end of the list of existing regulatory or management programs for addressing stormwater could include, as an example, the stormwater benefits of preventing development on the 90,000 Snoqualmie Tree farm through King County’s transfer of development rights from that property.
- Pg 31 – Add a bullet under the Land Use section that states “concurrent with employing conservation strategies for undeveloped portions of watersheds in the Puget Sound basin, pursue strategies to direct growth into urban areas and foster a high quality of life in urban areas to provide a positive alternative to low-density growth on rural or resource lands. Match these growth strategies with a range of techniques for Low-Impact Development and green infrastructure in urban areas.”

**From:** Susan Saffery

**Date:** 05/08/2008

**Comment:** We appreciate the opportunity to participate in the process of developing the Puget Sound Partnership Action Agenda. This document reflects the comments of professional staff with scientific, policy and programmatic expertise in this subject matter. While these comments are not “official City policy” per se, they do reflect the respected opinions of key staff from Seattle Public Utilities. In addition to these written comments, staff from both Seattle Public Utilities and Seattle City Light participated in the topic forum discussions directly. Comments made during those discussions stand alone and so are not necessarily reflected in these written comments. In reviewing our comments, please feel free to contact me if you have any questions, need clarification or would like more information.

General comments:

Overall, the committee has done a good job of discussing the Species and Biodiversity topic. This was a difficult job to do in a short amount of time and the authors deserve our appreciation for dedicating themselves to this important task. We look forward to seeing the synthesis report where habitat and water quality can be merged with the discussion of species and biodiversity.

It is important to add information about what we know about the levels of known toxics in species in Puget Sound to better link with the discussion of water quality in the synthesis report. For example, EPA has information on their website (EPA/ Region 10/ Puget Sound Georgia Basin Ecosystem/ indicators/ toxics in harbor seals) about toxics in harbor seals, herring,

salmon and killer whales and compares Puget Sound with other areas.

Given time constraints, we believe that the committee was right to focus primarily on the marine environment in this document as much is already available on the freshwater environment in salmon recovery plans.

Specific comments:

P. 1 under “marine trophic levels” – it is very important to include zooplankton.

P. 5-6. The ultimate identification of high priority actions will be aided by adding some indication of the relative significance of the listed threats to species abundance and diversity. Perhaps this could be done by categorizing them as broad and specific threats. Some are potential threats, while others are clearly linked to adverse effects. We should be clear about what is already recognized as being significant problems resulting in the depressed state of ecosystem health of Puget Sound (habitat loss and degradation, diminished water quality (eg. PCBs), point source pollution, cumulative impacts of non-point pollution, controlling or avoiding human exploitation rates of species as appropriate, addressing risk of human-caused invasive introductions). We need to say that the list of threats will evolve as our understanding of cause and effect relationships improves and we need to emphasize the importance of supporting this through time with effective monitoring and research.

P7. Cultured species - second sentence. The sentence would be better said if “those populations” was replaced by “their progeny” to survive...” Overall population fitness can be enhanced by hatchery production especially when population numbers are low; lower individual fitness can potentially be offset by larger numbers of returns to result in higher population fitness. 3rd sentence. Are there documented cases where disease in a hatchery has created outbreaks in natural populations? It is usually the other way around due to the stress and density in the hatchery. 4th sentence. Lumping farmed fish with fish released to the ocean by hatcheries makes this sentence confusing. However, I am not aware of evidence that the level of natural reproduction of escapees from fish farms has resulted in sufficient progeny to represent a competitive threat to Pacific salmon. Historical attempts to transplant Atlantic salmon to the Pacific coast have failed. This sentence should be removed.

p.8 A. 3rd para. 2nd sentence. Conditions will may naturally change over time ....

B. Status characterization of herring should be consistent with the most recent WDFW report. At least some herring stocks were not considered healthy (north Puget Sound: “below average”; Straits region “far below average”) in 2004 Washington State Herring Stock Status Report by WDFW done in 2005. This information (or more up to date information) should be mentioned in the 3rd bullet given the importance of this species in the Sound.

p.8 Paragraph below bullets. Saying that herring stocks are in good condition seems to miss important regional differences, based on the 2005 report. Following on the above comment, suggest discussing the health of herring stocks by the three regions used in the WDFW report on stock status.

p.13 Harvest management

Fourth paragraph. This discussion seems to presume that salmon management fully allocates returns to harvest and escapement and seems to ignore two points. First, marine predators are probably responsible for most of the roughly 90-99+% mortality that occurs to salmon in the ocean. Second, with hatcheries responsible for the majority of salmon returns to Puget Sound and the need to set harvest rates to ensure that natural spawning levels are met under ESA, substantial surpluses of returning salmon to hatcheries are now common. This indicates that predators and fisheries combined aren't taking all salmon that are currently available to them. Further, when setting harvest rates for ocean fisheries, natural mortality rates are an important consideration because they need to be accounted for in setting harvest rates on listed species. In essence this acknowledges an allocation to natural predators. Perhaps the discussion of harvest rates and ecosystem benefits should focus on nutrient impacts to freshwater ecosystems and effects of mass spawners on spawning habitat quality.

Fifth paragraph. This paragraph (other than the first two sentences and the last sentence) seems to raise issues that are not significant enough to be included in this document.

p. 14 Cultured Species.

Need to differentiate between hatcheries and hatchery practices when mentioning the rockfish concern. This concern appears to be associated with a hatchery practice that delays release of smolts to encourage released salmon to stay in Puget Sound instead of migrating to the North Pacific ocean. If the concern is valid, an alternative hatchery practice would be to release these fish at the normal smolting time with the result that they would likely exhibit normal migration patterns. Under this scenario, diet of natural and hatchery produced salmon would be expected to be similar. In other

words, it's the management decision on how the hatchery is used and not an inherent effect of the hatchery. Suggest clarifying the statement about hatchery effects on rockfish.

p. 16 Adaptive management

Suggest including the following: Adaptive management allows actions to be taken in spite of uncertainty and to treat these actions as systematic learning opportunities to inform future decisions. Ideally, adaptive management allows a better understanding of cause and effect; however, this becomes challenging as adaptive management is applied to more complex systems due to the number of factors that can influence the results.

Should highlight the need to improve how we evaluate management actions.

At the discussion forum, several comments were made about the incompatibility of HCPs and adaptive management. SPU's experience is that they can be compatible because there is flexibility in how actions are carried out in the HCP. SPU signed the Cedar River HCP in 2000 and is committed to applying adaptive management to its HCP programs. Examples include forest management practices and fish passage.

p.16 Second paragraph. Perhaps it would be good to include a statement about the effectiveness of mitigation as it is currently implemented through the permitting of projects.

p.17 C. second bullet. Some additional specificity for the conclusion that revised (reduced) harvest quotas would generate widespread benefits is needed (see comments under harvest management).

p.23 second bullet. Harvest management does include consideration of the needs of the ecosystem in setting harvest rates, by recognizing natural mortality in calculations of harvest rates. More could be done, but this statement ignores extensive efforts to account for the effects of predators.

p.23. last paragraph. Last sentence. Any resource management entity, state, federal or tribal, would have to deal with complications that result from the tension between harvest and species protection. Funding isn't the most important driver and this sentence is misleading.

p.29. third bullet. Suggest incorporating the idea of a science center that would be created to support the recovery of the Sound and affiliated with the U. of Washington. This center would implement the monitoring program and support research designed to answer key uncertainties. The center would

have credibility because of its affiliation with an academic institution and this is key for acceptance of results that could drive the need for regulatory and behavioral changes to improve the Sound. This concept would allow a core group of multi- disciplinary scientists to work in spatial proximity to one another for a common purpose, providing opportunities for collaboration, shared insights and understanding. Better efficiency, coordination and productivity would be likely.

p.30. C. under “which actions need the greatest attention?”

Creating an ecosystem-based framework should not forestall action on putting together pieces of the action plan or addressing known problems. Suggest rewording the sentence to “..., but the ecosystem-based framework must be created first is critical”. The time required to pull together a framework could be lengthy and momentum could be lost.

p.33 under “protect important habitats”

Should include important habitat even if used by a single keystone species (eg. spawning areas for herring) – unclear if current language does that.

p.34 under species.

Suggest adding zooplankton as a gap in our understanding of conditions in Puget Sound since abundance and species are critical to the food web and ultimately to much of the biota in the Sound, directly or indirectly. We need to include zooplankton monitoring in the monitoring program, even if phytoplankton monitoring had to be reduced.

Thank you for the opportunity to comment.

**From:** Tami Ishler

**Date:** 05/08/2008

**Comment:** Please find attached the Department of Natural Resources comments on the Puget Sound Partnership Topic Forums. A hard copy will follow in the mail.

General comments by the Department of Natural Resources  
Aquatic Resources Division and Forest Practices Division on  
Puget Sound Partnership Topic Forums

Aquatic Resource Division Comments

The Department of Natural Resources (DNR) appreciates the opportunity to comment on the Topic Forums presented by the Puget Sound Partnership.

We recognize the papers prepared by the Partnership were intended to elicit comment and are not meant to be definitive statements by their authors on the subject topic. While we are impressed by the volume of work that was completed in a short time frame in the Topic Forums, we view them only as first steps. A significant amount of additional work is needed to adequately summarize the state of the resources, assess the effectiveness of existing management tools, and to identify actions. These general comments and the attached forum specific comments are provided with that understanding and with the intent that they will strengthen the work of the Partnership in its effort to restore a healthy Puget Sound by 2020.

We remind the Partnership that DNR has a unique and central role as the manager of extensive terrestrial and aquatic lands with a diverse set of both regulatory and proprietary tools. Nearly all the marine and freshwater bedlands in Puget Sound remain in state ownership and are managed by DNR. DNR Aquatics staff believe there are potential synergies from working with DNR and utilizing its proprietary authority to help protect and restore the Sound. Accordingly, forum papers, especially the habitat topic, need to consider and integrate DNR's land management role more fully in order to effectively lead restoration of Puget Sound.

The topic forums suffer from artificial limitations placed on the scope of the topic. For example, an analysis of habitat status, threats and priority actions that omits water quality is fundamentally incomplete. This limitation will be a major challenge for the Partnership to address in the cross-topic synthesis workshop especially since it will be the only identified opportunity to discuss Human Quality of Life, a topic of central interest. Human Quality of Life is critical to integrate since a significant challenge for the Partnership is to identify how the region can balance environmental needs with human well being.

Balancing how best to accommodate increased population growth and economic development with improvements to the health of Puget Sound will be difficult to achieve. The aggressive schedule for completing the Action Agenda and its supporting documents should help build public interest and their consequent buy-in to actions and needed resources. However, the Partnership must increase efforts to maintain clear objectivity in its written products so citizens, agencies and organizations will engage in the Partnership's work.

Additionally, accountability and responsiveness should be a critical component of the forthcoming Action Agenda. To that end, monitoring programs should be established to assess the effectiveness of management efforts and whether those efforts are in compliance with the applicable laws, rules and management guidelines.

## Forest Practices Division Comments

Major concerns we have with the "Initial Discussion Draft Land Use/Habitat Protection And Restoration Topic Forum" (Forum) include the following.

1. The Forum's Preliminary Policy Recommendations call for "at state-level a single, integrated, set of regulations that apply in [sic] to the lands, streams and marine areas within Puget Sound to replace our present fragmented system of regulations." We are concerned that this recommendation may be inconsistent with RCW 90.71.360, which specifies,

No action of the partnership may alter the forest practices rules adopted pursuant to chapter 76.09 RCW, or any associated habitat conservation plan. Any changes in forest practices identified by the processes established in this chapter as necessary to fully recover the health of Puget Sound by 2020 may only be realized through the processes established in RCW 76.09.370 and other designated processes established in Title 76 RCW.

As you know, Washington's Forest Practices Act and Rules are built on a foundation of collaboration among the State, Indian Tribes, forest landowners, federal agencies, and others concerned with Washington's private and state forests. This foundation traces back over 20 years to the 1987 Timber, Fish & Wildlife Agreement (TFW). A call to wholesale replace our current system of regulation would be of great concern, for diverse reasons, to the caucuses that have worked together so hard, for so long, in the spirit of TFW and later, Forests & Fish. Any departure from our current system of regulation also could jeopardize the State's Forest Practices Habitat Conservation Plan, a 50-year agreement implemented in 2005 by the State, U.S. Department of Commerce / National Marine Fisheries Service, and U.S. Department of the Interior / U.S. Fish & Wildlife Service.

2. The Forum appears to assume that the Forest Practices Act and Rules were last updated in 1987 ("Updates to the FPA were added in 1987, as a result of the 'Timber, Fish and Wildlife' negotiations ..."). No mention is made of Washington's 1999 Forests & Fish Report, which was subsequently enacted into law by the legislature, then translated into major revisions to the Forest Practices Rules adopted by the Washington State Forest Practices Board (Board) in 2001. We are concerned that the Forum's perspective on the Act and Rules may be skewed, as it appears to assume that 2008 levels of public resource protection are the same as those that existed 20 years ago.

This "1987" perspective is again reflected in the statement, "The [1987] update also failed to address issues relating to small forest landowners (mainly those with parcels smaller than 20 acres in size)." As part of the 2001 rule changes, and since that time, several initiatives have been implemented to help maintain the viability of small forest landowners. These include the Forestry Riparian Easement Program, changes to road maintenance and abandonment plan requirements, the Family Forest Fish Passage Program, and long-term (up to 15-year) forest practices approvals.

3. The Forum overlooks the existence of the Forest Practices Adaptive Management Program (AMP):

Monitoring and adaptive management programs are sparse in Puget Sound. Although good examples of programs do exist ... there are few regulatory programs that require their use. This is an area where a significant gap exists in management tools in Puget Sound.

The AMP is a requisite, integral part of the Forest Practices Rules. Its purpose is "to provide science-based recommendations and technical information to assist the board in determining if and when it is necessary or advisable to adjust rules and guidance for aquatic resources to achieve resource goals and objectives." Over \$20 million in federal and state funding has been obtained over the past 8 years to implement dozens of scientific projects. Significant funding has been secured for the future; additional work is planned.

Time constraints prevent us from providing more detailed comments on the Forum at this time. We hope that the points noted above illustrate the need for increased interaction between the Partnership, DNR, and other organizations that are playing a leadership role in the conservation of Puget Sound's forest ecosystems.

Please let us know how the Forest Practices Program can best engage with the Partnership to accomplish the important work that is before us.

Forum-specific comments by DNR Aquatic Resources Division and Asset Management and Protection Division on Puget Sound Partnership Topic Forums

**From:** Emily Livengood

**Date:** 05/08/2008

**Comment:** The following Seattle Audubon Society citizen science survey may be useful when determining seabirds to be used as indicator species.

Seattle Audubon, 2007-8. "Puget Sound Seabird Survey" (pilot year). A citizen science seabird survey that monitors wintering seabird populations along near-shore saltwater habitat in King County.

Seabird research in Puget Sound has historically been a collaborative process between state and federal agencies, NGOs, and university scientists. In 1978-1979, the Environmental Protection Agency (EPA) and National Oceanic and Atmospheric Administration (NOAA) jointly funded the first seabird survey in Puget Sound, known as the Marine Ecosystems Analysis (MESA). Results from the MESA study have provided an initial baseline to estimate population trends and projections in Puget Sound. Beginning in the early 1990s, the Washington Department of Fish and Wildlife (WDFW) made seabirds a conservation priority, and began a series of continuous annual surveys to estimate temporal trends in seabird abundance. These data have been incorporated into the Puget Sound Assessment and Monitoring Program (PSAMP), and nearly all species have been shown to decline since 1978-79. One potential problem with comparing WDFW surveys with the MESA density estimates is that the sampling protocol has been slightly different. To address this issue, a Washington State Sea Grant funded survey was established in 2004-05 to replicate the initial MESA project (J. Bower, Western Washington University). Preliminary results from the WWU survey agree with the PSAMP trends to some degree, but also show different trends for some species, including pigeon guillemots (declined 55% in the PSAMP survey, increased 60% in the WWU survey). These discrepancies indicate the need for additional research and continuous shore-based surveys of Puget Sound seabirds.

Survey Protocol: <http://seattleaudubon.org/science.cfm?id=1169>

**From:** Jerry Johannes

**Date:** 05/08/2008

**Comment:** Here are the research studies from Dr. Thompson at Plymouth University.

Plastics are not biodegrading (they are too new) in the marine environment but they are being broken into smaller and smaller particles. And then the question remains of how many chemical compounds, if any, are being released into the marine waters.

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Laura, a great general reference is  
<http://www.worldwithoutus.com/excerpt.html> --fascinating reading on polymers.

The bird studies will follow shortly.

PDF attachments:

Thompson et al Science v304 p838 microplastic paper.pdf

Teuten, thompson et al ES & T 2007.pdf

letter to science.pdf

**From:** Jerry Johannes

**Date:** 05/08/2008

**Comment:** Here is some information on birds and the relationship with aquaculture.

Haffernan has a study

[http://protectourshoreline.org/studies/Review\\_Mariculture\\_Ireland.pdf](http://protectourshoreline.org/studies/Review_Mariculture_Ireland.pdf) pages 80-91 and 96-103 are most relevant.

The CSAS study from Canada

<http://govdocs.aquaculture.org/cgi/reprint/2004/410/4100110.pdf> pages 44-47 speaks to bird effects.

Leah Bendell Young (Simon Fraser University) has a study

<http://www.protectourshoreline.org/articles/07BendellShellfishCommunityStructure.pdf> page 7 speaks to predator exclusion netting relating to birds.

And then please read

[http://www.habitat.adfg.state.ak.us/geninfo/kbrr/coolkbayinfo/kbec\\_cd/html/ecosys/species/shorebrd.htm](http://www.habitat.adfg.state.ak.us/geninfo/kbrr/coolkbayinfo/kbec_cd/html/ecosys/species/shorebrd.htm) The third paragraph under Habitat Needs and Distribution is most germane.

With barges and scows on the beach during low tide cycles, with planting, with net cleaning periodically, with lights (during winter low tides) with generator noise, with crew noise, the effects on birds, by the scientific term, disturbance, in my estimation will be profound. (Disturbance defined at <http://www.marlin.ac.uk/sah/glossary.php?term=disturbance>).

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**From:** Jane Lamensdorf-Bucher

**Date:** 05/08/2008

**Comment:** Attached please find a cover letter from Theresa Jennings, Director of the King County Department of Natural Resources and Parks, and the following sets of comments on the Puget Sound Partnership topic forum discussion papers and risk analysis:

- 1) General Comments
- 2) Human Health
- 3) Land Use-Habitat
- 4) Water Quality
- 5) Species-Biodiversity
- 6) Water Quantity
- 7) Risk Analysis

We are also sending a hard copy to your attention at the Puget Sound Partnership address in Olympia.

see PDFS:

cover ltr to MNeuman from TJennings re comments.pdf

KC General Comments pdf

KC HumanHealth Comments pdf

KC LandUse-Habitat Comments pdf

KC Water Quality Comments pdf

KC Species-Biodiversity Comments pdf

KC Water Quantity Comments pdf

KC Comments on Risk Analysis pdf

**From:** Stewart Toshach

**Date:** 05/08/2008

**Comment:** Please forward attached comments/analysis to appropriate people in the Partnership or Science Panel.

See document:

PSP Topic Forums\_data needs\_2008-05-07.doc

**From:** Derek Poon

**Date:** 05/07/2008

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**Comment:** Forgot to note that this proposed listing is for land locked Kokanee, and causes are all fresh water, not hatchery, harvest, hydro, or the ocean.

This will change the landscape a bit for Puget Sound Lowlands. One more listing with an equally difficult chance for recovery. I attached a report on field conditions.

The challenge is that sedimentation (not contaminated sediment or TSS) and flow are usually not listed under CWA 303d; as you can tell from my report, that makes it very difficult to treat the problem. A sediment TMDL can be done, such as for Upper White and Simpson HCP, but Ecology has not shown an active interest at this time.

Good luck on Puget Sound Partnership.

Attached pdf file:

Federal Register 6 May 2008\_lk samm finding.pdf

**From:** Naki Stevens

**Date:** 05/07/2008

**Comment:** For Water Quality, Habitat, and Biodiversity papers: Copper in stormwater runoff might play a role in coho kill-off in Longfellow Creek.

attached pdf file:

mccarthy.pdf

**From:** Darlene Schanfald

**Date:** 05/06/2008

**Comment:** This is Part 2 of the submission from the Olympic Environmental Council regarding our comments for the Topic Forum issues.

Air Operating Permits (AOP). (continued)

AOPs are overseen by two agencies. Ecology has selective oversight of some industrial sites; the Clean Air Agencies (CAA) over others. We strongly recommend that all AOP's be put under the CAAs in order to have consistent laws, oversight and enforcement.

Currently, Ecology's AOP regulations and oversight are so lax that industry has little regulation, which is why there is so much air pollution.

Example (and see attachment)

[http://seattletimes.nwsourc.com/html/localnews/2004189039\\_mill19m.html](http://seattletimes.nwsourc.com/html/localnews/2004189039_mill19m.html)

The Director of Ecology needs to direct staff to respond to concerns of citizens, EPA and ORCAA.

Ecology must do the following to satisfy the citizens, to protect their health, and to protect Puget Sound.

A more responsive and transparent Department of Ecology:

- 1) An investigation should be conducted at the Department of Ecology to uncover reasons deficient permits are granted to industries that emit pollutants, and to weed out the root causes of an agency culture that has grown inappropriately cozy with the industry it is meant to regulate, while demonstrating hostility to the public it is chartered to protect.
- 2) Laws require there be adequate reliable monitoring data to prove compliance. Citizen reports of apparent permit violations to Ecology must be recorded, investigated, and tracked, and details of any investigation must be passed on to citizens and/or be made available upon.
- 3) Appropriate fines should be levied. Companies that need air(AOP) and water (NPDES)permits to pollute should put up significant funding for potential cleanup purposes. These monies can be banked by Ecology for future need. Legislation that lets polluting companies decide the type of guarantee it will give the agency should be done away with and proactive legislation should be written that protects the public good.
- 4) As the only agency with the legal right to request additional emissions information from corporations, Ecology must honor data requests from other agencies and not refuse legitimate requests from the Washington State Department of Health and the Clean Air Agencies.

#### OVERSIGHT AND ENFORCEMENT

- 1) An enforced responsive and transparent policy for citizen complaints about mill emissions.
- 2) Ecology must conduct more mill inspections.
- 3) Ecology must require reporting of emissions from the ponds on industrial sites.
- 4) Ecology must review mill complaint records monthly to ensure that maintenance problems do not continue for protracted periods of time.
- 5) Ecology must cite and fine industry when it a company is violating the Facility Wide General Requirements (FWGR) #'s 1, 2, and 7.
- 6) Ecology should conduct a study of soils for contamination as a result of contaminated dust/particulates from the mill emissions

## AIR OPERATING PERMIT

- 1) Permits must "allow for meaningful review."
- 2) Permits must require 24-hour access to a real person via phone who can take citizen reports and begin an immediate investigation of problems as they arise.
- 3) Permits must require companies to report to Ecology citizen reports that include investigative information about mill conditions.
- 4) Companies must be required to promptly report all citizen reports
- 5) Permits must require monitoring of ambient air in the surrounding neighborhoods.
- 6) Permit must require complete testing and monitoring of pond conditions.
- 7) Companies must be required to document working order of equipment to Ecology monthly.
- 8) Permits must include a full accounting of fuels used and the contaminants contained in those fuels.
- 9) Permits must require more complete testing of reprocessed fuel oil (RFO) and a full air pollution modeling study on the effects of burning hazardous waste in the air.
- 10) Permits must request testing of the RFO ash composition.
- 11) Permits must require documentation of mill procedures to prevent the ash in company landfills from becoming fugitive dust.
- 12) Determination of waivers for meeting daily emission limits for criteria pollutants should be based on recent data, not data a decade old and reported to Ecology annually
- 13) Permits needs to require companies to meet the additional requirements for an acid rain generator.
- 14) Permit exemption limits need to be minimized.
- 15) There should be direct measurement of the most hazardous chemicals emitted by companies.
- 16) All TRS gases need to be reportable on a twice-daily average to track whether the polluter is increasing emissions at night.
- 17) Ecology must be given records for ALL fuels of ALL types used by companies.

## COMPANIES THAT POLLUTE THE AIR

- 1) Companies should share monitoring and air condition information with the public and public agencies.
- 2) Companies should respond to citizen reports and comments with respect.
- 3) Companies should resolve their emission problems, especially on keeping air pollution equipment in good operating condition.
- 4) Companies should upgrade their equipment; grand fathering equipment should cease.
- 5) Companies should install pollution control equipment throughout their sites,

and assure that the reprocessed fuel oil (RFO) does not have chlorinated compounds and solvents in the fuel.

6) Companies should capture all their pollutants and recycle materials that can be reused.

Adequate monitoring must be included in permits:

Per WAC 173-401-615, All air pollution laws must have adequate reliable monitoring that allow compliance to be judged.

Some State Laws that Ecology has refused to enforce:

Code:WAC 173-401-615

Monitoring and related recordkeeping and reporting requirements.

(1) Monitoring. Each permit shall contain the following requirements with respect to monitoring:

(b)

Impacts to health and property are banned by state law:

(WAC 173-400-040(5):

"The permittee shall not cause or allow emission of any contaminant if it is detrimental to the health, safety, welfare of any person, or causes damage to property or business."

WAC 173-400-040(4)

Air Act: Any person causing odor which may unreasonably interfere with use and enjoyment of property must use recognized good practices and procedures to reduce odors to a reasonable minimum

WAC 173-405-040 (10)

"The permittee shall at all times, including periods of abnormal operation and upset conditions, to the extent practicable, maintain and operate any affected facility, including associated air pollution control equipment, in a manner consistent with good air pollution control practice."

WAC 173-400-105(2):

"Ecology shall conduct a continuous surveillance program to monitor the quality of the ambient atmosphere as to concentrations and movements of air contaminants. As a part of this program, the director of ecology or an authorized representative may require any source under the jurisdiction of ecology to conduct stack and/or ambient air monitoring and to report the results to ecology."

WAC 173-405-072(5)

Š.."Other data: Each kraft mill shall furnish, upon request of ecology, such other pertinent data required to evaluate the mill's emissions or emission control

program".

## PESTICIDES

The attached photos show the results of a snail whose habitat was invaded by Garlon 3A, compliments of the WA State Department of Transportation. Don't let the snail die in vain. Use it as the poster life for what pesticides are causing.

This was incident at Jimmy Come Lately Creek area in Blyn WA. Jimmy Come Lately Creek was just restored for salmon habitat with millions of dollars of federal, state, regional and local governments, including employee time and resources. Yet, the WA State Department of Transportation has no compunction about spraying the area to hold back vegetation along the highway, even though the highly toxic substance will float, one way or another, right into the Creek. Some of the areas

sprayed extended down toward the creek and estuary and into the woods on the east side of the estuary. The spray was as close as 10 feet away from the water.

Talk about cumulative affects! Noxious weed programs, county roadside vegetation management, the WA State Department of Transportation, the WA State Department of Agriculture, and the WA State Department of Natural Resources all apply cides, and right into wetlands.

Here's a local example of how cavalier and insensitive to harm government can be. In 1990, Clallam County banned county roadside spraying on ALL rights of ways to maintain vegetation, and have moved to mowing. Yet, a few years ago they turned to spraying the recreation trail, used for health, that runs from eastern Clallam County west to the City of Port Angeles and beyond, and with little to none notification that the trail area is sprayed with poisons that take 6 months to 2 years to have no impact, except that the area is sprayed more than once, so there is always a health and environment impact. This is were pregnant women, women of child bearing age, youngsters, babies are strolled, and pets are walked, as well as where wildlife tries to survive. Trail maintenance volunteers are too lazy to pull weeds along the trail and wanted to use toxins. Well, toxins only make plants resistant to the toxins, so the situation is bizarre and the county personnel does not want to educate the volunteers on the hazards of cides, or become educated themselves. Who suffers, all those using the trail and the wildlife.

DNR aerial sprays. And on and on. Besides killing and maiming wildlife and eventually humans that are in the way, the poisons end up in surface and ground water; and in soil that blows all around.

OEC does not need to send you reading material. You should already know the

issue and have easy access to getting more.

In sum, WA State needs to wean itself off of toxins and work with organizations like the WA Toxics Coalition, the Eugene OR based NW Coalition for Alternatives to Pesticides (NCAP), and the WA D.C. based Beyond Pesticides to plan a strategy to do this. Money will be needed from the WA State Legislature to bring such groups together to plan an agenda which will include the development of safe methods for handling noxious weeds, roadside and forest vegetation, etc., and, most of all, a plan to educate state employees, the medical industry personnel, nurseries, and the public on why they should not use poisons and what they can effectively substitute.

Many people are sickened and die from these poisons, acutely or over time. Many can not even afford to get well because they can't afford medical care. Public health must count, and so must the environment. These must be the two highest priorities to make healthy and keep healthy.

## AQUACULTURE

Volumes of material have been written on this subject. Shamefully the WA State Department of Fish and Wildlife participates in this very toxic industry. NPDES permits are given to this industry by Ecology to pollute. And now DNR is involved.

The farmed fish industry is helping to poison Puget Sound, damaging bottom lands and ruining marine habitat and all aquatic life around these sites. Atlantic Salmon escapees have managed to take over wild spawning streams and move out the wild salmon from their historic sites. Sealice abound in penned fish. Diseases can spread between wild and penned fish. Interbreeding between the escaped penned fish and wild salmon have occurred, further ruining the wild gene pool. The penned fin fish food has enough toxins involved that pregnant women are warned not to eat the fish. Retail sellers don't label these as farmed fish. And NOAA is pushing to fill our waters, in state and beyond state boundaries, with penned fish farms.

<http://www.doh.wa.gov/ehp/oehas/fish/farmedsalmon.htm> lists some of the environmental concerns, yet exhibits no back bone to protect the public.

The West Coast Governors' Agreement on Ocean Health Draft Action Plan does not hold back on the problems this industry causes.

(<http://query.nytimes.com/gst/fullpage.html?res=9A01E3D81031F93BA15756C0A9659C8B63&sec=&spon=&pagewanted=all>)

Issues of Purity and Pollution Leave Farmed Salmon Looking Less Rosy

By MARIAN BURROS

Published: May 28, 2003

<http://www.fluoridealert.org/pesticides/epage.teflubenzuron.htm>

Teflubenzuron is an acyl urea derivate classified as an insecticide for use in treatment of infestation with sea lice in salmon. Teflubenzuron is admixed with pelleted diet at a level of 2 g/kg. The intended dosage level of teflubenzuron is 10 mg/kg bw administered once daily for 7 consecutive days. The substance is also used as a pesticide on crops. Very few substances are available for treatment of sea lice in salmon....t is likely that the sediments will act as a sink for teflubenzuron and so sediment associated organisms are more likely to be affected by this chemical...

A recent video of penned salmon impacts

<http://www.youtube.com/watch?v=of3URNIMLMk>

Alex Morton presents to Cermaq AGM

Additionally, DNR is leases public lands to geoduck farmers and are, themselves, doing massive sized research in the waters. But the white plastic bags and tubing don't remain stationary, move around, and cause some havoc in the marine system. Too, they reportedly snag birds. This plantings change beach ecology and wipe out other marine life, such as mussel beds. In sum, these plantings and farming are degrading state tide lands.

[http://www.ProtectOurShoreline.org/legal/080326\\_PierceCnty\\_TaylorShellfishDecision.pdf](http://www.ProtectOurShoreline.org/legal/080326_PierceCnty_TaylorShellfishDecision.pdf)

A recent Pierce County court decision and documentation of environmental impacts.

[http://www.protectourshoreline.com/slideshow/POS\\_ShellfishAquacultureConcerns.pdf](http://www.protectourshoreline.com/slideshow/POS_ShellfishAquacultureConcerns.pdf)

A slide show of a geoduck farm on Nisqually Reach.

## FLUORIDE

On August 13, The Lillie Center, Inc., filed ethics charges against the CDC's Oral Health Division and the CDC's director Julie Gerberding for failure to follow the CDC's own ethical code. The charge is specifically aimed at their failure to warn the public, especially the most vulnerable in the population-- "kidney patients, diabetics, infants, and seniors", of the dangers of drinking fluoridated water. These dangers were clearly stated in the National Research Council's report (2006) on fluoride's toxicity, as well as concerns raised by the US Department of Agriculture about the total dose of fluoride people are getting from all sources, including food, toothpaste, mouthwash, dental floss, and

dietary supplements, to name a few.

Not only is fluoride added to water which, we now know from a Harvard study is harmful to the development of youngsters 10 years of age and under and other studies regarding infants getting too much, but fluoride is in food and toothpaste, so it compounds the problem. Fluoride then runs down our drains into ground, then surface waters, and into the world of marine life. What is the effect on them?

The Environmental Working Group has added to its web site a long list of articles, etc. about fluoride impacts on humans.

<http://www.ewg.org/featured/222>

Further, from this web site (see

([www.ada.org/prof/resources/positions/statements/fluoride\\_infants.asp](http://www.ada.org/prof/resources/positions/statements/fluoride_infants.asp)):

"It is deeply troubling that children, including bottle-fed infants, will begin drinking fluoridated water without the benefit of the ADA warning and in spite of the many [other] serious concerns [about fluoridation] raised by the National Academy of Sciences last spring," EWG wrote. "Public water supplies should be safe for all consumers, young and old alike." (The letter is available at [www.ewg.org](http://www.ewg.org).)

Last November, the ADA - long a strong advocate of fluoridation, said: "Infants less than one year old may be getting more than the optimal amount of fluoride" if they consume formula or food prepared with fluoridated water. ADA added: "If using a product that needs to be reconstituted, parents and care givers should consider using water that has no or low levels of fluoride."

<http://www.msnbc.msn.com/id/23651072/page/2/>

This is an article about people looking for graves at the old Charles Manson sites. They use a detector that finds fluoride because it is expected to be in human bones and not animal bones.

(noted on page 2)

This is a review on fluoride toxicity to aquatic organisms:

Fluoride toxicity to aquatic organisms: a review

Julio A. Camargo,

Departamento Interuniversitario de Ecología, Edificio de Ciencias, Universidad de Alcalá, Alcalá de Henares, Madrid E-28871, Spain

Received 8 March 2002; revised 22 July 2002; accepted 23 August 2002. ; Available online 9 November 2002.

Abstract

Published data on the toxicity of fluoride (F<sup>-</sup>) to algae, aquatic plants, invertebrates and fishes are reviewed. Aquatic organisms living in soft waters may be more adversely affected by fluoride pollution than those living in hard or seawaters because the bioavailability of fluoride ions is reduced with increasing water hardness. Fluoride can either inhibit or enhance the population growth of algae, depending upon fluoride concentration, exposure time and algal species. Aquatic plants seem to be effective in removing fluoride from contaminated water under laboratory and field conditions. In aquatic animals, fluoride tends to be accumulated in the exoskeleton of invertebrates and in the bone tissue of fishes. The toxic action of fluoride resides in the fact that fluoride ions act as enzymatic poisons, inhibiting enzyme activity and, ultimately, interrupting metabolic processes such as glycolysis and synthesis of proteins. Fluoride toxicity to aquatic invertebrates and fishes increases with increasing fluoride concentration, exposure time and water temperature, and decreases with increasing intraspecific body size and water content of calcium and chloride. Freshwater invertebrates and fishes, especially net-spinning caddisfly larvae and upstream-migrating adult salmon, appear to be more sensitive to fluoride toxicity than estuarine and marine animals. Because, in soft waters with low ionic content, a fluoride concentration as low as 0.5 mg F<sup>-</sup>/l can adversely affect invertebrates and fishes, safe levels below this fluoride concentration are recommended in order to protect freshwater animals from fluoride pollution. [http://www.sciencedirect.com/science?\\_ob=ArticleURL&\\_udi=B6V74-476073H-3&\\_user=10&\\_rdoc=1&\\_fmt=&\\_orig=search&\\_sort=d&view=c&acct=C000050221&\\_version=1&\\_urlVersion=0&\\_userid=10&md5=856ff329e5a0308d535aa37ab811b5e2](http://www.sciencedirect.com/science?_ob=ArticleURL&_udi=B6V74-476073H-3&_user=10&_rdoc=1&_fmt=&_orig=search&_sort=d&view=c&acct=C000050221&_version=1&_urlVersion=0&_userid=10&md5=856ff329e5a0308d535aa37ab811b5e2)

**From:** Ginny Broadhurst

**Date:** 05/06/2008

**Comment:** Thank you for the opportunity to comment and participate in the development of the topic papers. We provided hard copy references and oral comments at the Everett meeting on species and biodiversity to ensure that derelict fishing gear impacts are addressed and well referenced in that topic paper. Derelict fishing gear (nets and crab pots) cause direct damage to species as well as marine habitats. For example, a derelict gillnet can damage kelp beds, scour rocky reef habitat and/or prevent access to all types of marine habitats. Derelict crab pots have been documented to scour eelgrass beds in addition to having a direct footprint on the seabed. These impacts are documented in our Cost/Benefit Analysis (attached). We suggest that these impacts be referenced in the Habitat topic paper as well as the Species and Biodiversity (or cross referenced).

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Discussion and acknowledgement of other marine debris issues (i.e. creosote debris, plastics, boater waste) also seem to be missing in these reports and we suggest that they be considered for inclusion as appropriate.

Thank you. Please let us know if you have questions or additional need for information.

Attached: DG cost benefit final.pdf, PriorityRankingReport-041808.pdf

**From:** Anne Mosness

**Date:** 05/06/2008

**Comment:** To the Puget Sound Partnership:

There are some Puget Sound activities and industries that are largely under the water line and also operate with a disconcerting degree of political coverage that keeps their impacts from being scientifically reviewed or often discussed. Since there is little time to create the plan that might save Puget Sound, it is extremely important that we no longer grant exemptions to special interests because they have been grandfathered in, work hard at cultivating alliances and positive public perceptions, are promoted by federal or state agencies, or are part of our export economy. This is particularly important for products that are not utilized here, but their pollution and impacts stay behind while profits go into corporate bank accounts.

Since we live in a region that has a long history of fish propagation at the university and agency level, it is not easy to find independent research on the impacts of fish and shellfish culture. And when discussing "culture", we need to differentiate between hatchery production of fish that is mitigation for destruction of watersheds and to provide tribal harvest opportunities, and the privately owned finfish and shellfish operations that use our public waters and tidelands and causes habitat destruction and impacts on other species, including wild salmon.

The National Oceanic and Atmospheric Administration has funneled money into our region for some time, and publish weighty appearing non-peer reviewed papers promoting aquaculture of blackcod, salmon, steelhead and several shellfish species, including geoduck clams. (see attached NOAA handout for the extent Washington is targeted for expansion of aquaculture in our waters). Other NOAA funded studies promote private fish farms in the Strait of Juan de Fuca with money passing through the

Washington Fish Growers Association and to contract scientists. Citizens of our state have not agreed that we want tax dollars spent in this manner to place additional feedlot operations in our state waters.

[http://www.lib.noaa.gov/docaquareports\\_noaaresearch/straitoffinal\\_report2005\\_1.pdf](http://www.lib.noaa.gov/docaquareports_noaaresearch/straitoffinal_report2005_1.pdf)

[http://www.lib.noaa.gov/docaquareports\\_noaaresearch/juandefucarept.htm](http://www.lib.noaa.gov/docaquareports_noaaresearch/juandefucarept.htm)

<http://www.fra.affrc.go.jp/bulletin/bull/bull19/13.pdf>

Since the Department of Commerce/NOAA has made passage of the "National Offshore Aquaculture Act of 2007" a priority, it is very important that we do not ignore science from other regions in assessing the impacts of open cage fish production. In BC, parasites are implicated in the decline of wild salmon populations and several important papers have described sea lice transmission and risks to wild salmon. Washington has not yet experienced a major sea lice epidemic and the fish farm industry argues that salinity and conditions are different here. Yet, it is widely acknowledged that concentrated animal facilities provide the necessary environment for magnification and spread of diseases and parasites. We are reckless if we think otherwise.

"Epizootics of wild fish induced by farm fish"

<http://www.pnas.org/cgi/content/full/103/42/15506>

"Sea Lice From Fish Farms May Wipe Out Wild Salmon"

<http://news.nationalgeographic.com/news/2007/12/071213-salmon-lice.html>

Washington has also had large numbers of nonnative salmon escape from the farms into Puget Sound. In four years, between 1996 and 1999, more than 613,000 Atlantic salmon escaped from cages and there is always a risk from storms, predators, human error and other events. According to John Volpe, these nonnative fish can establish populations in Western rivers and compete for food and territory. Despite earlier unsuccessful attempts to plant Atlantic salmon as game fish in our waters by our WDFW, the chances increase for colonization when wild salmon populations are reduced.

This winter, viral hemorrhagic septicemia was reported in the salmon farms in Washington, and despite WDFW's "site specific containment plans", it is sadly apparent that there is no way to prevent pollution, pathogens or

parasites from flushing into our state waters from open cages and putting other marine life at risk.

Several state agencies oversee the aquaculture industry and frequently appear to be too closely aligned to provide adequate supervision. There has also been an undercurrent of stilling dissension or disagreement with the prevailing agency “culture” of supporting aquaculture. Worse, there has been pressure brought by the industry to remove agency personnel for speaking up. We observed that in Whatcom County when the County Council was considering a resolution banning salmon farms from our waters and an agency person who spoke in favor of the ban was under threat of firing after the industry took their complaints to his employing agency and the governor’s office. The atmosphere seems as repressive now and especially with proponents of offshore aquaculture and industrial state aquaculture in influential positions.

So, we need to sometimes look beyond our state agencies and organizations for assistance and independent review. Following are comments sent from Environmental Defense and Ocean Conservancy about the renewal of American Gold Seafoods’ National Pollution Discharge Elimination System (NPDES) permit last Fall. While the letter refers to American Gold Seafoods as owner of the Atlantic salmon farms in Washington, the parent company Smoki Seafoods was recently purchased by Icicle Seafoods.

To quote from Ocean Conservancy/Environmental Defense letter, also attached in a pdf file:

"We believe that fundamental changes to typical fish farming practices are needed to make salmon and other marine finfish production more environmentally sound, for example with respect to farming nonnative species. These comments are, however, narrowly focused on the current draft permit, which lacks a number of basic environmental safeguards.

Washington has a responsibility to its citizens to protect the natural resources that it holds in the public trust. Part of this responsibility is sufficiently monitoring the activities of its permittees that have the potential to harm the environment. Large-scale salmon net pen facilities have the demonstrated capacity to cause significant environmental degradation, including: extensive seafloor damage, water pollution, and harm to native fish species. As detailed below, stricter standards for net pen facilities are needed to ensure that Washington adequately addresses these and other environmental impacts.

Another serious concern, not addressed in the draft permit, is the threat posed by parasite transmission from captive farmed salmon to the dwindling numbers of young, wild salmon native to the Pacific Northwest.

Washington state's water pollution prevention and control law mandates that "Washington will exercise its powers, as fully and as effectively as possible, to retain and secure high quality for all waters of the state."<sup>1</sup> The current draft American Gold Seafoods' permit fails "to retain and secure high quality for all waters of the state" as required, and fails to reflect steps taken in other jurisdictions to protect their waters from pollution by salmon farms.

## Washington permit requirements

Washington's draft permit for American Gold fails to require reasonably frequent monitoring and reporting necessary to maintain minimum environmental protection standards employed in other states such as Maine. (See the appended chart for a detailed comparison of the two states' requirements.)

Washington calls for routine monitoring only once every three years, while Maine may require routine monitoring up to 20+ times in a five month period. Given that farmed salmon typically spend about eighteen months in net pens, Washington's suggested three year cycle for routine monitoring will fail to capture the environmental impacts from an entire crop of salmon. Maine requires monthly reports on, among other things, the amount of food administered to fish and fish densities in each net pen, while the Washington draft permit only requires an annual report.

The routine monitoring parameters in the Washington permit are overwhelmingly centered on sediment sampling, with no attention paid to water quality in the water column beyond a dissolved oxygen (DO) profile every three years. By failing to require frequent DO testing, the draft permit allows for the possibility that the increased oxygen demand attendant to net pen practices and the recognized seasonal variations in DO in Puget Sound<sup>2</sup> will together cause DO in areas of Puget Sound to fall below state water quality standards. In contrast, Maine requires frequent DO testing in the water column mixing zone, at a down-current far-field point, and at a reference point. Maine also requires comprehensive baseline testing on a site prior to use for aquaculture and requires monitoring of temperature, salinity, and transparency as additional water quality metrics.<sup>3</sup>

Maine has developed a table with specific numerical impact thresholds for certain indicators both inside and outside of the sediment mixing zone. If a "warning level" threshold is exceeded, a permittee must notify the Department, review its operations, and propose changes that are likely to bring the facility back into compliance. Then, if in subsequent monitoring the facility exceeds the warning level threshold by a greater degree, or if the facility ever exceeds the "impact limit" threshold, the permittee must submit a modification of operations plan and implementation schedule for review and approval by the Department. No new fish may be stocked until the approved plan has been implemented.<sup>4</sup>

In contrast to Maine's approach, Washington's course for addressing failed testing is a two-tier retesting process that may last two years. This is an excessive grace period if facilities fail to meet routine monitoring guidelines. Under the draft permit's two-year retesting window, a permittee that has exceeded routine monitoring thresholds could continue restocking net pens and raise an entirely new crop of salmon. Washington should adopt bright-line pollutant thresholds and require that noncompliant facilities take immediate remedial measures or face suspension of restocking privileges and other penalties. By including an explicit injunction provision in the permit, Washington would encourage more frequent monitoring, deter deviations from permit requirements and best management practices, and punish any persistent violators. Washington should also monitor and limit the discharge of nutrients, since research shows that Puget Sound waters can be sensitive to nutrient additions.<sup>5</sup>

Maine explicitly prohibits the use of materials containing TBT as an antifoulant because it is extremely toxic to aquatic organisms. The EPA has established Aquatic Life Criteria for TBT.<sup>6</sup> Washington should also prohibit its use entirely; at the very least the permit should explicitly include the one-hour average concentration threshold established by the EPA. Washington also fails to limit a number of other known chemicals used in salmon farms, including various aquaculture drugs approved or designated as "low regulatory priority" by FDA.<sup>7</sup>

The Washington permit requires best management practices (BMPs) to address escaped farmed, non-native Atlantic salmon; nevertheless, the draft permit lacks key elements such as an explicit requirement for fish tagging or marking of farmed fish. Without a reliable method to determine the source facility of escaped farmed fish, the state loses the ability to identify and hold accountable facilities with persistent escapes. The draft

permit should so require measures to prevent escapes to the maximum extent possible as required in California,<sup>8</sup> and should require that permittees be responsible for damages caused by escapes.<sup>9</sup>

The number of escaped fish comprising a "significant" release, triggering an immediate reporting requirement in the draft permit, is woefully inadequate. The significance threshold of 1,500 to 3,000 fish does not address the threat to native species that can occur with the release of far fewer fish. Finally, the BMPs that inform the "Fish Release Prevention" and "Accidental Fish Release" plans should explicitly require that facilities plan for predator control, unusual events management, and severe weather.

## Sea lice

Recent research in British Columbia (BC) shows a definitive link between sea lice transmission from farmed salmon to sensitive juvenile pink and chum salmon.<sup>10</sup> One BC study noted that, under natural conditions, juvenile pink and chum salmon are not exposed to sea lice, because "they enter the sea without lice several months before the return of wild adult salmon."<sup>11</sup>

However, when these juvenile salmon are in areas with abundances of farmed salmon, the "farms provide parasites novel access to these juvenile hosts, resulting in measurable and sometimes severe impacts on salmon survival." The risk posed by parasites to these fish in the early part of their lives is extremely high; the study concluded that, while *L. salmonis* is usually considered a benign pathogen in adult salmon, it "was a severe pathogen of juvenile pink and chum salmon...an abundance of more than two motile lice was lethal, and survival of hosts with one or two motile lice was poor."<sup>12</sup>

Washington should begin to address potential threats to wild salmon from sea lice by adopting monitoring protocols and sea lice density thresholds in order to document sea lice levels and mitigate any harms resulting from the transmission of sea lice to native salmon species. The BC provincial government and BC salmon farms have adopted monitoring protocols and thresholds for sea lice on salmon farms. Washington should look to these sources and develop appropriate measures to prevent harm to wild salmon from sea lice. In particular, see the appended attached monitoring protocol developed by Marine Harvest Canada and the Coastal Alliance for Aquaculture Reform – a salmon farming company and environmental coalition – under their "Framework for Dialogue."

## Conclusion

Washington's draft permit for American Gold Seafoods lacks comprehensive monitoring requirements for net pen facilities, ignores the potentially serious harm to wild salmon from sea lice, and fails to limit known pollutants from fish farms. Washington should increase monitoring frequency, expand monitoring criteria to include more water quality metrics, adopt stricter measures to prevent and address fish escapes, adopt monitoring protocols and thresholds for sea lice, and limit known pollutants, in order to protect its waters in a manner consistent with state law.

1 WASH. REV. CODE § 90.48.010.

2 Letter from Pam Bissonnette, Director of the King County Department of Parks and Natural Resources, to Linda Hoffman, Director of the Washington State Department of Ecology (Dec. 17, 2004) (available at:

[http://www.ecy.wa.gov/programs/wq/303d/2002/2004\\_documents/2004\\_comments\\_1204/303d\\_comments\\_0282.pdf](http://www.ecy.wa.gov/programs/wq/303d/2002/2004_documents/2004_comments_1204/303d_comments_0282.pdf)).

3 Maine Pollutant Discharge Elimination System, General Permit for Atlantic Salmon Aquaculture at 9 (available at:

<http://www.maine.gov/dep/blwq/docstand/aquaculture/MEG130000.pdf>).

4 Id. at 22.

5 See, e.g., Newton, J.A. and K. Van Voorhis. 2002. Seasonal Patterns and Controlling Factors of Primary

Production in Puget Sound's Central Basin and Possession Sound.

Washington State Department of Ecology.

<http://www.ecy.wa.gov/biblio/0203059.html>

6 U.S. Environmental Protection Agency, Fact Sheet: Aquatic Life Criteria for Tributyltin (TBT) (Jan. 2004).

7 See <http://www.fda.gov/cvm/drugsapprovedaqua.htm> and

<http://www.fda.gov/cvm/Documents/LRPDrugs.pdf>

8 CA Fish and Game Code Section 15400(b)(9).

9 CA Fish and Game Code Section 15409(c).

10 See, e.g., Martin Krkosek et al., Epizootics of wild fish induced by farm fish, Proceedings of the National

Academy of Science vol. 103, no. 42, 15506-15510 (October 17, 2006)

available at:

<http://www.pnas.org/cgi/reprint/103/42/15506> ; Martin Krkosek et al.,

Transmission dynamic of parasitic sea lice

from farm to wild salmon, Proceedings of the Royal Society, vol. 272, no.

# PugetSoundPartnership

our sound, our community, our chance

1564 (April 7, 2005) available at:

<http://www.journals.royalsoc.ac.uk/content/jbldatk20uc3t1k2/fulltext.pdf>;

Alexandra Morton and Rick Routledge,

Mortality Rates for Juvenile Pink Oncorhynchus gorbuscha and Chum O.  
keta Salmon Infested with Sea Lice

Lepeophtheirus salmonis in the Broughton Archipelago, Alaska Fisheries  
Bulletin, vol. 11, no. 2 (Winter 2005)

available at:

[http://www.adfg.state.ak.us/pubs/afrb/vol11\\_n2/mortv11n2.pdf](http://www.adfg.state.ak.us/pubs/afrb/vol11_n2/mortv11n2.pdf).

11 Epizootics, supra note 6.

Attached: NOAA handout washington opportunities for growth sept  
2007.doc, WASTateED-TOCNPDEScommentsJun1507.pdf

**From:** Jeff Adams

**Date:** 05/06/2008

**Comment:** Hello and best wishes on the Action Agenda development process. There was a lot of interest at the Species/Biodiversity forum for insuring invasive species received the attention the threat and problem deserved. In case you hadn't received these documents from other sources (WDFW would be a likely contributor), I thought I would pass them along. One attachment is for the 2001 report on the 2000 expedition. The other two are part of the same report; the Word doc is the text and the Excel doc is the locations where tunicates were surveyed and found. Of course, we need to focus on eliminating new introductions, but surveying is almost equally as important.

These discuss some threats in marine waters, but I'd also like to give a plug for terrestrial environments and a question for you to think how broadly the Partnership will address the "Watershed". Would a group of volunteers removing ivy and restoring understory vegetation on an upland site be contributing to the biodiversity, human prosperity, habitat, and water quantity of the Puget Sound Watershed? I'd argue yes, and that that should fall under the overall programs encouraged by the Partnership. Thanks for all your hard work and good luck!

Cohen, A., Mills, C., Berry, H., Wonham, M., Bingham, B., Bookheim, B., Carlton, J., Chapman, J., Cordell, J., Harris, L., Klinger, T., Kohn, A., Lambert, C., Lambert, G., Li, K., Secord, D. and Toft, J. 1998. Report of the Puget Sound Expedition Sept. 8-16, 1998; A Rapid Assessment Survey of Non-indigenous Species in the Shallow Waters of Puget Sound. Wash. State

Dept. Nat. Res., Olympia, WA. 37 pp.,

Cohen, A. N., Berry, H. D., Mills, C. E., Milne, D., Britton-Simmons, K., Wonham, M. J., Secord, D. L., Barkas, J. A., Bingham, B., Bookheim, B. E., Byers, J. E., Chapman, J. W., Cordell, J. R., Dumbauld, B., Fukuyama, A., Harris, L. H., Kohn, A. J., Li, K., Mumford, T. F. J., Radashevsky, V., Sewell, A. T. and Welch, K. 2001. Washington state exotics expedition 2000: a rapid survey of exotic species in the shallow waters of Elliott Bay, Totten and Eld Inlets, and Willapa Bay. Washington State Dept. of Natural Resources Nearshore Habitat Program, Olympia. 47 pp.

(Attachments: 2001-2000Washington\_exotic\_spp\_Srvy355.pdf, Washington State invasive tunicate survey for WDFW.doc, Washington State invasive tunicates -Gretchen Lambert June 2006.xls)

**From:** Treva Coe

**Date:** 05/06/2008

**Comment:** Below please find my comments on the following two Topic Forum Papers.

- Land Use/Habitat Protection and Restoration in Puget Sound (Initial Discussion Draft Paper, April 14, 2008)
- Species and Biodiversity Topic Forum (Initial Discussion Draft, April 14, 2008)

Please note that I did not attend either of these Topic Forum workshops, nor have I specifically addressed the questions posed for the online discussions.

## SPECIES AND BIODIVERSITY

### Question S1

- Page 4, Section B, 2nd Paragraph: I appreciate the recognition of the contribution of marine-derived nutrients by salmon, but also mention that declines in many salmonid populations has likely reduced the contribution of MDN to freshwater ecosystems. Some have attempted to quantify the loss; a quick Google search yielded the following:

<http://www.inforain.org/reports/Historic%20and%20Current%20Levels%20GRESH.pdf>

and Scheuerell et al. 2005: CJFAS 62(5): 961-964.

- Page 6, 1st paragraph: add “freshwater”, i.e. “Conversion and modification of marine, estuarine, freshwater, and upland ecosystems...”
- Page 6, 2nd paragraph: include effects on precipitation patterns and potential ecological implications to freshwater ecosystems.
- Page 6, 3rd paragraph: low streamflows also exacerbate water quality

problems in freshwater (dissolved oxygen, temperature).

- Page 7, 1st Paragraph: recognize role of conservation hatchery programs (traditional, captive brood) in helping to prevent extinction of some critically low salmonid populations; also discuss (potential) impacts of sea lice from net pens – severe impacts have been found to pink salmon populations on Vancouver Island.
- Page 7, 3rd paragraph: include effects of ORV use and redd trampling in freshwater.
- Page 7, Section B, 1st paragraph: qualify statement thus: “There is much we do not know about the forces that threaten the survival of many species...” We do know much (although not all) about the forces threatening some species like salmon and others with recovery plans.

## Question S2

- Page 12, last paragraph and elsewhere: I appreciate the recognition that focus on individual species for planning and implementation is effective at recovering the species of interest. Continued focus on some species (those that are culturally and economically important, like salmon) will be important for garnering and maintain tribal and broader public support for the PSP effort.
- Page 13, Harvest Management, 2nd paragraph: Second sentence (“Federal and WA State agencies...”, deleting “fish management plans”) should be moved to Species Plans. Elaborate on salmon harvest management framework (i.e. describe Comp Chinook). Also, present information on effectiveness at reducing harvest rates.
- Page 14, Cultured Species: I appreciate the recognition of benefits of cultured salmon. Consider also including description of the benefits to research of mass-marked hatchery fish. Also, describe HGMP and Hatchery Reform processes.
- Page 15, Ecosystem-Based Management, last paragraph. With your reference to “Marine Resources Councils”, do you mean “Marine Resources Committees”?
- Page 16, Section B, 3rd paragraph: Here, and/or elsewhere as appropriate, describe state and tribes’ salmon population monitoring efforts. Like with the reserves, it only provides species information, but it is a critical data need for biological effectiveness monitoring.
- Page 17, 2nd bullet. Tribal harvest opportunities have already been drastically reduced, so recognize the difficulty of further reducing harvest in favor of increasing escapement to support ecosystem benefits. However, where recruitment to hatcheries greatly outweighs broodstock needs, the excess carcasses could be transported to appropriate rivers and streams.

## Question P1

- Page 21, Surface and G/W Impacts, 2nd bullet: WRIA 1 (and perhaps others) has developed a watershed management plan.
- Page 21, Harvest, 1st bullet: at least for WRIA 1, the salmon recovery plan primarily addresses habitat, including harvest and hatchery actions largely by referencing other plans and planning processes already in place. It would be best to describe in more detail the salmon harvest management framework.
- Page 22: A section for Cultured Species appears to be missing. It should include mention of HGMPs, Hatchery Reform.

## Question P2

- Page 32, last bullet: Consider selecting key species for indicators, perhaps within each of the groups identified on pages 1 (3?) and 4. As I mentioned earlier, certain species (like salmon) are very culturally and economically important and maintaining some focus on such species will be critical to garnering and maintaining public support for PSP efforts. To that end, consider using such species as indicators.

**From:** Tami Ishler

**Date:** 05/06/2008

**Comment:** Species and Biodiversity Topic Forum  
Aquatic Resource Division Comments  
General Comments

- While the document does a reasonable job of discussing the status and threats to higher food web species, it does not adequately discuss lower food web organisms (particularly the primary producers, zooplankton, and forage fish). Since the overall health of any species is directly related to the health of the food web that supports it, this link must be understood and managed accordingly.
- It is widely believed that habitat loss is one of the greatest threats to recovery of threatened species, yet these topic forums have attempted to discuss these two topics in isolation. Habitats and species must be considered in tandem to achieve species recovery or biodiversity.
- Invasive species are often considered the second greatest threat to recovery of imperiled species (second to habitat loss). There appears to be no comprehensive effort underway to understand and manage major invasive species pathways. Such an effort should be a high priority.
- Discussion about linkages between toxic pollutants and species health or biodiversity is needed. This oversight was recognized by the authors of this topic paper.
- More detail is needed about agency mandates, policy limitations, conflicts,

and overlaps. For instance, it is difficult to assess whether or not current regulations are adequate to protect species because we know little about compliance in some instances. A comprehensive review of statutes, rules, and policies related to protecting species / biodiversity should take place.

#### Detailed Comments

- S1: The omission of discussion of water quality degradation on species and biodiversity is problematic. In Science Question 1, there is a short paragraph on Pollution (p. 6), and small references in the remaining section for the other questions. Water quality degradation is one of the most important threats to species and biodiversity. It is likely to become a greater threat in the future unless extreme measures are taken. This issue is covered to some degree in the water quality topic report; this report should reference those sections. Water quality is discussed briefly in Section B – “Threats not being address and why”, p. 22. Water quality should be included in P2-C (p. 30), and all through Section P2-B- what actions to monitor.
- Page 4: “ecopath” should be “Ecopath modeling”
- Pg. 7: Additional research is needed on cumulative effects of threats, interactions of different threats, and the non-linear nature of threats.
- Pg. 7-8: Food web indicators are needed.
- Pg. 8: The use of “healthy condition (S1-A, p. 8) is confused with the use of reference condition (see last paragraph on p. 8). Does healthy condition refer to benchmarks that need to be set through policy or to a reference condition?
- Pg. 8: Section S1-B: Include species that are known to have been extirpated from Puget Sound. Also describe fisheries that once existed in Puget Sound but no longer are viable.
- Page 14: While WSDA has the general responsibility to promote aquaculture, many state agencies share management responsibilities. If any shortcomings are to be addressed, this dynamic must be understood. Refer to the following Statutes:
  - DNR - Chapter 79.135 RCW - Aquatic Lands, Shellfish and Aquaculture
  - Agriculture - Chapter 15.85 RCW - Aquaculture Marketing
  - WDFW - Chapter 77.60 RCW – Shellfish, Chapter 77.115 RCW - Aquaculture Disease Control, Chapter 77.125 RCW - Marine Finfish Aquaculture Programs
  - Health - Chapter 69.30 RCW - Commercial Shellfish Operation Requirements
  - Ecology - Chapter 90.58 RCW - Shoreline Management Act, Chapter 43.143 RCW - Ocean Resources Management Act
- Pg. 20: While this paper identifies habitat loss or modification as one of the leading threats to species, there is little discussion about the existing regulatory processes that are in place to protect habitat. For example, the goal of the WDFW Hydraulic Project Approval (Chapter 77.55 RCW) is to

ensure that construction is completed in a manner to prevent damage to the state's fish, shellfish and their habitat. The only mention of the WDFW HPA in this paper is that the program is undergoing a Habitat Conservation Plan on page 20. If this issue is covered in the habitat topic paper, it should be cross-referenced.

- Pg. 29: Section P2-B: The statement “DNR manages... “ is not accurate. Replace with “DNR manages forest lands and uses them to generate funding for its trust beneficiaries. DNR manages aquatic lands to balance public benefits and may generate funds from the use of these lands that will fund restoration programs and resource management.”
- Pg. 32, Section P2-b: Include some measure of poaching within the harvest regime.
- Various: The statement “keeping common species common” appears several times apparently as a goal. Given the current imbalance of the ecosystem, this assumption should be challenged. Many introduced species are common; alder is common, seagulls are common, etc., and none of these reflect a “healthy” ecosystem.
- Various: There is the use of the term “Memorandum” P1 when it probably should be “Section” P1, etc.

#### Asset Management and Protection Division Comments

- The Natural Heritage information system approach to inventory and classification of species and ecosystems would be appropriate for answering the first science question regarding the status of the biodiversity of the Sound. The use of a “coarse filter/fine filter” approach to organizing information may work well in the aquatic environment as it does in uplands. This approach captures most species in the coarse filter of ecological systems and allows assessment of condition of those systems to be a surrogate for the condition of the species that make up the system. The fine filter is then applied to those rarer species that may not be adequately assessed within the ecological system. This approach is used by Natural Heritage programs across the country and is captured in the Natural Heritage Plan which can be found on-line at DNR's website at [http://www.dnr.wa.gov/Publications/amp\\_nh\\_plan\\_2007.pdf](http://www.dnr.wa.gov/Publications/amp_nh_plan_2007.pdf) and is reflected in 79.71 RCW.
- The inventory, classification and ranking system for species and ecosystems used by DNR's Natural Heritage Program is used across the U.S. and in thirty countries in the western hemisphere. The data is shared via the NH information network through NatureServe. This model of data collection and distribution may provide a platform on which information regarding the aquatic environment can be collected, maintained and distributed. More information can be found at [www.natureserve.org](http://www.natureserve.org)
- A conservation framework for protecting critical aquatic lands may be found in the Natural Areas Preserve Act (79.70 RCW) and the Natural

Resources Conservation Areas Act (79.71 RCW) both of which allow the acquisition of important aquatic lands for long-term conservation purposes.

- In developing the strategies for the Action Agenda, adequate emphasis must be placed on the interaction of upland and aquatic environments. The line we as humans draw at the water line is much less defined in the natural world. Protection of critical uplands and consideration of policies toward conservation of lands not already converted in the watersheds contributory to Puget Sound is a critical piece of maintaining aquatic habitats and reversing the impacts already affecting the health of the Sound. The efforts presently underway toward upland conservation should be seen as a part of the whole in using an ecosystem based approach to improving and maintaining Puget Sound.

- Water rights policy should be considered in addressing both water quantity and quality. We should be rewarding water right holders for water conservation not penalizing them with the specter of losing rights that aren't used.

- The Natural Heritage Program has identified the need to address invertebrates, including aquatic species, as a biodiversity data gap. More attention to inventory and classification of this order of animals could help address some of the food web questions that must be answered so that higher order species recovery be addressed. Adding capacity to carry out the needed data collection could help forward food web recovery efforts and should be part of the strategies.

**From:** Robert Cusimano

**Date:** 05/05/2008

**Comment:** Species, Biodiversity, and Foodweb Topic Forum – Initial Discussion Draft Comments –WA Dept of Ecology, 4-28-08

Policy Question 2 (P2): Needs Assessment and Actions: What are the Gaps?

- Page 35 – B. What actions and outcomes would be important to monitor in evaluating progress on this topic?

Status and trend of ecosystem conditions

Monitoring should include:

? Trends in and status of species' abundance, productivity, spatial structure, and diversity...

I agree with the stated need to design and implement an ecosystem-based management approach for Puget Sound, and that this approach should

include selection of indicators and development of an understanding of species, biodiversity, and the food web as a baseline against which to monitor progress and manage adaptively.

In order to effectively interpret species data that is collected, appropriate indicators will have to be recognized, chosen, or developed for use in the ecosystem-based management framework. For example, the current Benthic Infaunal Index in the Washington State Sediment Management Standards is inadequate. Development of an accepted Puget Sound Benthic Infaunal Index is critical for adequate evaluation of the health of invertebrate communities that live in Puget Sound sediments. Puget Sound is one of the few large estuaries in the nation without such an index.

**From:** Fred Felleman

**Date:** 05/02/2008

**Comment:** In following up on the discussion yesterday about the importance of herring to the biodiversity of Puget Sound and the significance of the Cherry Point stock in particular I am providing the following two documents that were used to petition the listing of the stock under ESA. These two documents have an extensive list of references. It is also worth noting that DNR has spent the past 6 months in a stakeholder process developing a management plan for the Cherry Point Aquatic Reserve which should be mentioned as well. Dave Roberts at DNR is the lead on that effort.

Thank you for including this material in the issue paper.

(Attached: herring-pet5-04.pdf, Cherry Point He...SA petition.pdf)

**From:** Chris Weller

**Date:** 05/02/2008

**Comment:** Re: Hood Canal and Eastern Strait of Juan de Fuca Summer Chum Recovery Planning and Implementation

The Hood Canal Summer Chum Salmon Recovery Plan authored by the Hood Canal Coordinating Council is cited in the Species, Food Web & Biodiversity draft document, which is of course appropriate. That document in turn cites and incorporates the work of the State and Tribal Co-managers that specifically addresses harvest and hatchery management.

You may wish to directly cite documents prepared by the Co-managers,

since these provide detailed information on harvest and hatchery management, as well as population assessment and monitoring information. Consider, for example, the following two documents. The first describes the Co-managers' Conservation Initiative or plan for implementing summer chum recovery. The second document is a five year progress report on the implementation plan.

Washington Dept. of Fish and Wildlife and Point no Point Treaty Tribes. 2000. Summer Chum Conservation Initiative - An Implementation Plan to Recover Summer Chum in the Hood Canal and Strait of Juan de Fuca Region. April, 2000. Washington Dept. of Fish and Wildlife. Olympia, WA. 800 p.

Washington Dept. of Fish and Wildlife and Point no Point Treaty Tribes. 2007. Five-year review of the Summer Chum Salmon Conservation Initiative: Supplemental Report No. 7. December 2007. Washington Dept. of Fish and Wildlife. Olympia, WA. 235 p.

These two reports and others addressing conservation of Hood Canal Summer Chum are available for downloading at the Washington Dept. of Fish and Wildlife web site:  
<http://wdfw.wa.gov/fish/chum/chum.htm>

**From:** Peter Beaulieu

**Date:** 05/02/2008

**Comment:** Following the forum session in Everett yesterday, I have given some thought to four ideas that might help invent the institutional architecture of a sustainable effort toward a sustainable Puget Sound ecosystem. With a minimum of elaboration, let me simply pose four mutually supporting concepts for your possible interest. Not all of this is new.

1. Build a switchboard, not a new “layer”. Avoid creating a dysfunctional new layer of activity by instituting, instead, a catalyst among the existing agencies.

This forum activity would not add to workloads, but instead would cause lead agencies to do better their existing duties, and in this way would lead to a rolling set of discrete “action packages,” the first of which is the Action Agenda. One example in our region is the equally shared and collaborative Regional Freight Mobility Roundtable, of which the most prominent action package by government participants (all levels) is the FAST Corridor

Program which, in turn, consists of a system of separately sponsored and accountable, and still cooperatively supported, transportation projects. (Leadership Council member Dan O’Neal can elaborate.)

The I-405 Corridor Program succeeds because it does not add new work to that of resource managers; rather, it helps them together to do their current work better. Part of the “better” is in engaging the parties early in a broad geographic scale of thinking, both to hear the roadblocks early (future permit conditions), and at the same time to smooth the way for less myopic permit reviews, based on earlier systems level involvement. As part of a new kind of institutional architecture, the Record of Decision included an Environmental Element under which mitigation for altered runoff volumes can be mitigated with more effective and cost-effective off-site mitigation actions drawn from (otherwise unfunded) WRIA resource management plans.

A relational data base, or GIS maps with common registrations, is long overdue. In the 1960s the Puget Sound and Adjacent Waters Study developed by hand a set of hundreds of consistent maps for WRIAs and the Puget Sound basin as a whole. Might we at least match this elementary effort, with the technical tools we now have some fifty years later?

2. Invent an eco-conomy worthy of imitation in other regions. Treat federal any possible federal funds primarily as a centerpiece for assembling an ongoing partnership of local commitment and funds (again, the original FAST Corridor model).

Why not foster corporate donations toward a Trust fund on the grounds that the economy depends upon the attractiveness of our natural setting. Corporate engagement would help build the elusive street level commitment necessary to assure the social and political environment needed to act regionally in an eco-system sort of way at least some of the time. The Partnership should investigate the business model used in Richland to save the Hanford Project, by creatively diversifying the resource into a multi-party research center. Candidate research companies were recruited nationally to help save and diversify the economy by bringing with them, as part of each competing proposal, a second industry unrelated to the nuclear facility, e.g., Battelle competed successfully partly by starting an alfalfa production line, another firm brought to the area a potato processing plant.

In our Puget Sound region, the multiplicity of major existing corporations might be linked in an analogous way to our resource and to parts or all of the Action Agenda. This eco-conomy approach would not require much from,

say, Boeing, Weyerhaeuser, Microsoft et al. The Partnership need not confine itself to the obsolete federal grantsmanship model that sprang up around the Great Society of the late 1960s. Such private sector funds, if secured, should serve as seed money for something more home grown, more integrating, and more sustainable.

3. Think rolling “action packages” which then might include a so-called “final Action Agenda” if it is framed properly. The suggestion has been made that the “final Action Agenda” should be thought of more as a “formal Management Agenda,” and made such by how it subjects itself to adaptive management. How can the Agenda remain “problem solving rather than project driven”?

The message is that only in this way will the commitment to adaptive management become a living reality, rather than a neglected line item. We do not need a slush fund for science projects, but we do need an ongoing guidance system, if only to ensure that limited funds are not themselves poured into one rat hole or another. Cost-effectiveness requires adaptive management (as does even basic effectiveness.) A shared learning approach – essentially continuing in a convincing way the forum approach already underway – would exist to create “action packages” for the Sound as a whole and for each of the highly diverse (varied priorities) action areas. The Action Agenda, as it is currently called, should include as an “action” a substantive commitment (more than rhetorical) to adaptive management, a dialogue between science and public and private policy. In this context the Agenda becomes one action package timed to merit Congressional attention, but this strategic action does not become the definition of the program.

Strategic choice theory, as it has been called, is a systematic and systemic way to reconcile the real world problems of simplicity versus complexity, urgency versus the need for information, commitment versus flexibility, and incrementality versus comprehensiveness. The only written resource I know of that graphically presents strategic choice – the way that things actually do get done – is Aids to Strategic Choice, by Allen Hickling, University of British Columbia, unpublished c. 1975), but there must be more recent work under his authorship.

4. Foster bite-sized and cumulative results. The Agenda should foster parallel pathways of analysis, decisions, and actions at a range of geographic scales.

The Puget Sound ecosystem, and its subsystems, are sufficiently complex to almost ensure that eyes will glaze over before anything new gets done. We

can avoid the opposite fallacies of random ineffectiveness and contrived crisis politics. (What would happen if we declared a crisis, and no one came?) Action packages can be both systemic and discrete, rather than fragmented. This is the crux of the “strategic choice” approach to complex systems. The I-405 Corridor Program, again, is an overall systems solution that is implemented through a sequence of actions that each make sense even if possibly stranded later to stand on their own. A good model in a time of chaotic budgets, etc.

The Partnership already is directing its attention to “action areas”, and my only addition to this -- an addition I think is critical to success -- is to set up the process to work equally at two levels. That is, the action areas will be more successful if they work in dialogue with the Sound wide effort, rather than only as details within a Sound wide monologue conducted at 10,000 feet, as we say.

Each of the action areas should work from the clam beds and herring habitats up toward a relatively freestanding action agenda. Sound wide issues will be obvious enough, and can be seen as an alignment of local efforts in local areas. One function of the “switchboard” (item #1) is to organize alignments. Community engagement depends upon geographic immediacy. We might think of a sort of “institutional ecology” with its own food web of thriving success stories (and even a “human ecology” of stewardship that doesn’t short change the next generation).

These are my thoughts. The key ideas are to think: (1) switchboard rather than layer, (2) eco-economy beyond grantsmanship, (3) action packages rather than a final plan, and (4) cumulative efforts all within the Partnership’s ecosystem context. In suggesting these notions about institutional architecture, I am also highlighting examples of success in our region.

**From:** Randall Marshall

**Date:** 05/02/2008

**Comment:** To assist in the incorporation of my comments from yesterday, please look at the attachments. The attachments contain the requested references to the scientific literature.

The poster presentation occurred at the 2004 annual meeting of the Society of Environmental Toxicology and Chemistry in Portland, OR.

<<CPher2004SETACprint.ppt>>

This manuscript on the Cherry Point herring has not yet been submitted for publication. It not only raises issues of concern for this important fish population but also illustrates the value of plankton monitoring.

<<CherryPointmanuscript.doc>>

The draft issue paper on vessel hulls was written for the ANS Committee and WISC.

Basic questions about Washington State's largest herring stock and its decline wait for definitive answers from further research into this unique population

R.R. Marshall<sup>1</sup> and G.G. Bargmann

R.R. Marshall. Washington Department of Ecology, P.O. Box 47600, Olympia, WA 98504-7600, U.S.A.

G.G. Bargmann. Washington Department of Fish and Wildlife, 600 Capitol Way North, Olympia, WA 98501-1091, U.S.A.

<sup>1</sup>Corresponding author (e-mail: rmar461@ecy.wa.gov)

**Abstract:** In less than 30 years the Cherry Point herring (*Clupea pallasii*) stock declined steadily to below 10% of its former size. There is evidence that the decline was caused by the sharp reduction in a major food source, *Neocalanus plumchrus*, a large and nutritious calanoid copepod that was once very abundant at the time and place of the herring stock's spawning and was therefore available for adult herring consumption at a critical time. An examination of Canada's Pacific Region Zooplankton Database and a review of published observations of zooplankton and fish populations in the Strait of Georgia also provided an indication that smaller copepod species may have benefited from the absence of *N. plumchrus* and that Cherry Point herring recruitment benefited as well. Data are too sparse to support definite conclusions at this time but observations and the available literature strongly suggest these relationships. The Strait of Georgia may be an ideal location to see these kinds of relationships between fish and their environment. The Cherry Point herring have become very dependent on recruitment in recent years and this has put the stock at risk.

Introduction

The Cherry Point herring stock has been a great concern to Washington State in recent years. It once had a spawning biomass equal to that of all of the other herring stocks in the state combined. The Cherry Point stock size declined from nearly 15,000 tons in 1973 to just above 800 tons in 2000 (Washington Department of Fish and Wildlife (WDFW), 2001). The decline was characterized by mortality in older age classes resulting in a recruit-dominated age structure. Recruitment was generally good during much of the period of steady decline in stock size. The average annual recruitment from 1974 to 1995 was 2121 tons. 1994 had a record recruitment of 4076 tons. However, recruitment dropped steeply in 1996 and only averaged 755 tons from 1996 to 2001. Other Washington State herring stocks had poor recruitment in 1994 when Cherry Point had a record high recruitment. Recruitment for these other herring stocks has been relatively good since 1995 and excellent since 1999 while Cherry Point recruitment has been depressed since 1996. In addition, the Cherry Point herring have two behaviors that are unique relative to other regional herring stocks. They spawn in the late spring (April to early June) at a later time of year than almost all of the other regional herring. They also deposit much of their spawn on a relatively open shoreline rather than the usual bay or other sheltered location.

Even though millions of dollars have been spent on studies and a risk assessment (EVS, 1999), satisfactory explanations for the Cherry Point herring behaviors and population trends have been elusive. A survey of the scientific literature for relevant historical data seems to have provided an obvious explanation for the timing and location of spawning for the Cherry Point herring. The science literature and the Pacific Region Zooplankton Database of the Institute of Ocean Sciences (IOS) of the Department of Fisheries and Oceans Canada have also provided some clues worth exploring that might eventually explain the rest of the circumstances surrounding the Cherry Point herring and its decline. Finally, the results of environmental studies on the Cherry Point shoreline may point to the right question about how to protect this stock in the future.

## Methods

The Pacific Region Zooplankton Database of the Institute of Ocean Sciences (IOS) of the Department of Fisheries and Oceans Canada was queried for data from the two standard COPRA stations (CPF1 and CPF2) in the main basin of the Strait of Georgia (Romaine et al, 2002). The Cooperative Plankton Research Monitoring Program (COPRA) is a program that monitors long-term zooplankton biodiversities along the B.C. coast. CPF1 is south of Texada Island and CPF2 is west of Sisters Island. The calanoid

copepod data from these stations were averaged for each year both all together and separated by species. These averages were compared to Cherry Point herring recruitment.

The results of environmental studies on the Cherry Point shoreline were examined in order to evaluate the relative contribution to the decline in the Cherry Point herring of conditions in the spawning zone. Of particular interest are the results of the herring embryo outplants that Kocan and Hershberger (Hershberger et al, 1999) placed at locations along the Cherry Point shoreline. The percentages of abnormal larvae hatching from the embryo outplants were averaged from the four years and ranked by shoreline station. The resulting geographical pattern was compared to Cherry Point herring spawning behavior and recruitment success.

## Results

The Cherry Point herring spawn in the Strait Georgia at the time when the zooplankton bloom is at its peak

The location of the Cherry Point area explains both the timing and the use of what appears to be open shoreline for spawning. The Cherry Point shoreline lies just south of the Fraser River delta and is part of the Strait of Georgia system. The spring freshet of the Fraser River provides the nutrients and stable stratification needed for abundant primary and secondary production in late spring (Harrison et al, 1983). Currents concentrate phytoplankton and zooplankton off of the Cherry Point shoreline providing prey for both larval and adult herring (LeBrasseur et al, 1969; Legare, 1957; Parsons et al, 1969). These currents may also serve as the larval retention mechanism and allow spawning on an open shoreline. Barraclough (1967d) encountered a large number of herring larvae in July 1966 tows in the Strait of Georgia and could not account for them because they had to be from a substantial spawning in the late spring. Based on the oceanography of the Strait of Georgia, he calculated that they could have been spawned in Boundary Bay where the extensive shallow water and unexpected timing of the spawn discouraged observation. The location, quantity, and timing of these herring larvae found by Barraclough most likely means that they are part of the Cherry Point population. However, this possibility was never assessed. See Figure 1. Herring in Alaska have been observed timing their spawning so that larvae coincide with abundant copepod nauplii (Smith et al, 1991).

Fig. 1. Cherry Point Herring Spawning Areas

Is *Neocalanus plumchrus* the reason for the large Cherry Point stock size in some decades and population crash in others?

It has been known since the 1920s that the zooplankton biomass of the upper layer of the Strait of Georgia peaks in April through early June and is dominated in some decades by one very important species, *Neocalanus plumchrus* (Campbell, 1934). The value of these *N. plumchrus* as prey for fish has long been known as well. Wailes (1936) examined the stomach contents of southern British Columbia herring in 1931-1934 and found samples from April and May with 98% to 100% *N. plumchrus* and rated this species along with *Euphausia pacifica* as most important for adult herring. The aggregations of this large and lipid rich copepod are particularly high around the edges of the Fraser River plume reaching 60 animals/L (Mackas et al, 1988). These *N. plumchrus* are present near the surface of the Strait of Georgia for a relatively brief (70-100 days) period of time before they descend below 300 m early in July to enter diapause until mid-winter when they mature and spawn (Fulton, 1973).

*N. plumchrus* overwhelmingly dominated the zooplankton biomass of the Strait of Georgia in late spring during the 1960s (Parsons et al, 1970). LeBrasseur et al (1969) observed that *N. plumchrus* was virtually the only organism contributing to zooplankton biomass in the Strait of Georgia in May 1967. The stomach contents of fish captured in surface trawls around the Strait of Georgia in April, June, and July of 1966 were examined by Barraclough et al (1967a.b.c.), and 90% to 100% of the stomach contents of adult herring during June were *Neocalanus plumchrus* if it was also found in concurrent zooplankton tows. Copepods from adult herring stomachs in the April trawls were not identified to species, but a trawl conducted near Pt. Roberts found a few fish with over 68% of the stomach contents being copepods that were 4 mm long. Because of the large size and occurrence in April, these copepods were likely to have been *N. plumchrus*. *N. plumchrus* was rare in July tows and a relatively large (223 fish) July catch of adult herring near Pt. Roberts in 1966 had stomach contents that were 99% *Euphausia pacifica* eggs. Haegele (1997) concluded from his trawls in the Strait of Georgia in 1990–1994 that euphausiids and amphipods were the major food items for adult herring in late spring. However, *N. plumchrus* was rare in the early 1990s in the Strait of Georgia and it was unlikely to be found in adult herring stomachs. See Table 1.

The *N. plumchrus* population of the Strait of Georgia went into steep decline in 1971 while populations of smaller copepods such as *Calanus marshallae* increased (Gardner, 1977). Gardner (1976) predicted declines in economically important Strait of Georgia fish populations due to the greater energy expenditure needed to acquire the same amount of nutrition from smaller copepods as from *N. plumchrus*. The Cherry Point herring population may have already been in decline in 1973 when assessments of

the stock began.

A large decrease in the Cherry Point herring population has happened before. The WA State Dept. of Fisheries reported a large decline in the late 1930s for Cherry Point and Discovery Bay herring (Chapman et al, 1941). Tester (1942) reported large numbers of dead and moribund herring along the southeast coast of Vancouver Island in March and April of 1942 although it is not clear if these were Cherry Point herring or what had caused their deaths. Unfortunately, these events in the late 1930s and early 1940s occurred near the beginning of a two decade gap in the study of Strait of Georgia zooplankton (Harrison et al, 1983).

Was the poor adult survival which brought about the Cherry Point herring population crash due to starvation perhaps in combination with disease? Adult herring must feed and begin rebuilding fat reserves soon after spawning and may time spawning to account for this need as well as the need for larval food (Quast, 1986). The Cherry Point herring spawn later than other regional herring and must delay full-time feeding for a longer period of time. Energy demand for gonad recrudescence increases with age because of the higher ratio of gonadal to somatic body mass resulting in greater starvation rates for older herring (Quast, 1986; Tanasichuk, 2000). Gunderson et al (1988) determined reproductive effort as measured by the gonadal–somatic weight index to be the best predictor of natural mortality rate for 20 fish stocks and reported an increase in natural mortality rate from 0.37 to 0.56 during the 1970s for northern Puget Sound herring. Herring embryos and larvae from Cherry Point in 2000 were deficient in yolk indicating poor nutritional status of adults (Hershberger et al, 2001). WDFW has observed the adult Cherry Point herring in recent years to have little body fat. Hershberger et al (2001) found an increased incidence of *Ichthyophonus* in Cherry Point herring relative to other local stocks. Holst et al (1997) has described a relationship in Atlantic herring (*Clupea harengus*) between feeding success, ability to migrate, and *Ichthyophonus* infection. These factors can account for the age-related mortality in the Cherry Point herring population.

Did the near absence of *N. plumchrus* in the Strait of Georgia in the 1990s allow for greater abundance of smaller copepods and good recruitment for the Cherry Point herring?

There are hints that recruitment of Cherry Point herring is better when smaller copepods such as *Pseudocalanus* are in abundance and this abundance may be due to the absence of *N. plumchrus*. Similar patterns have been found elsewhere. Brown (2003) discovered a positive correlation between zooplankton population densities lagged one year and Pacific

herring size-at-age and recruit per spawner index. Rothschild (1998) found in an analysis of North Sea zooplankton data from 1948 to 1980 that large year classes of either the larger calanoid copepods in the genus *Calanus* or the smaller ones in *Pseudocalanus* and *Paracalanus* benefited populations of cod and the Buchan stock of Atlantic herring. Rothschild also found that simultaneous large year classes of both the *Calanus* and *Pseudocalanus/Paracalanus* groups are very unusual. Cushing (1992) determined that recruitment for the Downs stock of Atlantic herring depends positively on the abundance of *Pseudocalanus* and *Paracalanus*. Checkley (1982) observed that the smaller larvae of Atlantic herring selectively fed on *Pseudocalanus* when presented along with a natural assemblage of other zooplankton. Barraclough et al (1967c.) found *Pseudocalanus minutus* in 71% of the stomachs examined from the herring larvae captured in one of the July 1966 tows in the Strait of Georgia.

Haegele (1997) found herring larvae in 1990-1994 tows in the Strait of Georgia that had copepods in 89% of stomachs and these copepods contributed 78% of the stomach contents. He noted that 1993 had the highest zooplankton density of all of the years in his study. The copepod data from the Pacific Region Zooplankton Database summarized in Table 1 below reflects the 1993 abundance noted by Haegele. Table 1 shows that the large abundance and biomass of all calanoid copepods in 1993 coincides with excellent recruitment at Cherry Point that year and a record recruitment the next year. In addition, the IOS CPF1 and CPF2 data separated by species shows the highest annual average abundance of *Pseudocalanus* for all years to have occurred in 1993 at 306.6/m<sup>3</sup> which was 2.5 times the average for all years. *Paracalanus* abundance was also above average in 1993 at stations CPF1 and CPF2.

The mean biomass of calanoid copepods declined in 1998–2001 relative to 1991-1995 as the *N. plumchrus* returned to dominance in the spring and began carrying more of the Strait of Georgia biomass down into deep water soon after the beginning of summer where it was unlikely to be encountered in any plankton tows for the remainder of the year. This decline in calanoid copepod biomass approximately coincided with the decline in Cherry Point herring recruitment. The copepod data for the important 1996 and 1997 transition years are unfortunately unavailable. See Table 1. The ability of these large and dominant copepods to capture biomass needs to be appreciated. In helping to explain how the Southwest Pacific serves as an important sink for atmospheric CO<sub>2</sub>, Bradford-Grieve et al (2001) have estimated that *N. tonsus* produces a downward carbon flux of 1.7-9.3 g C m<sup>-2</sup> year<sup>-1</sup>. They also state that *N. plumchrus* must produce a similar downward carbon flux in the North Pacific.

Table 1. Comparison of Strait of Georgia Copepod Abundance and Biomass from IOS Zooplankton Database (COPRA stations CPF1 & CPF2) and CP Herring Stock Assessment from WDFW

Year SOG calanoid copepods SOG Neocalanus plumchrus CP herring  
mean abundance (#/m<sup>3</sup>) mean biomass

(mg dw/m<sup>3</sup>) mean abundance (#/m<sup>3</sup>) mean biomass

(mg dw/m<sup>3</sup>) recruitment (tons) stock size (tons)

1991 44.1 16.2 0 0 1141 4624

1992 38.7 10.6 \* \* 1991 4009

1993 157.6 127.6 0 0 3434 4894

1994 34.4 12.7 0 0 4076 6324

1995 150.0 17.2 0 0 1204 4105

1996 NA NA NA NA 772 3095

1997 NA NA NA NA 645 1574

1998 47.4 3.0 62.2 17.8 984 1322

1999 73.6 5.0 73.4 29.6 890 1266

2000 36.3 3.9 54.6 23.7 559 808

2001 37.0 4.2 117.3 30.7 680 1241

NA = data not available \* found 1 day (July 23) > 300 m

Was there a mismatch between the Cherry Point herring and *N. plumchrus* when these copepods returned to abundance in the Strait of Georgia in 1996-1997?

*N. plumchrus* began a return to abundance in the Strait of Georgia sometime during 1996-1997, but the Cherry Point spawning biomass continued to decline through the 1990s to its lowest level in 2000. Since then, the Cherry Point population has produced an increase in spawning biomass every year from 2001 to 2004. If these increases have been due to the renewed availability of *N. plumchrus* in the Strait of Georgia, then the delayed response of the Cherry Point herring to the return of *N. plumchrus* may have been due to a timing mismatch. WDFW has observed a slight delay in the Cherry Point herring spawning time recently possibly due to the preponderance of younger adults. Bornhold (2000) found that *N. plumchrus* arrived at the surface of the Strait of Georgia 25 days earlier in 1997 than in 1967 creating the potential for a mismatch between fish predators and copepod prey. Mackas et al (1998) report a similar shift in timing for the *N. plumchrus* at Ocean Station P, but since that population is present near the surface nearly twice as long (100–150 days) each year as the Strait of Georgia *N. plumchrus*, there is less potential for a mismatch.

Could shoreline degradation threaten the Cherry Point herring?

Even though recruitment at Cherry Point was known to be fairly good during

most of the period of herring stock decline, there was enough concern about conditions in the spawning zone to warrant an environmental study using outplants of herring embryos at stations along the shoreline. The percentages of abnormal larvae hatching from the embryo outplants were averaged for the 4 years (1990, 1991, 1992, and 1998) of study at the 12 standardized outplant stations along the Cherry Point shoreline (Hershberger et al, 1999). The percent abnormal ranged from 54.3% at the worst station to 25.4% at the best station. Stations that are adjacent along the shoreline tend to also be adjacent in the table when ranked by percent abnormal. The probability that this pattern occurred due to chance alone is nearly 5000:1. The four best stations for larval development are grouped together at the northern end of the study area and the four worst stations are grouped together at the southern end of the study area. The difference between the northern and southern group means is statistically significant at  $\alpha = 0.05$ . During the time period of this study, the Cherry Point herring only spawned near the best four stations at the northern end of the shoreline (WDFW, 2001). Recruitment in the early 1990s was very good, but the biomass of small calanoid copepods was large and the CP herring were only spawning along the shoreline where the embryo outplants developed best.

The Cherry Point herring spawning grounds need to be protected and preserved for those times when the stock becomes dependent on recruitment for survival. The proportion of recruits in the population since 1985 has usually been above 0.5 and reaches above 0.7 in some years. When the biomass of recruits dropped steeply in 1996, the population decline steepened because of the dependence on recruits. Future shoreline environmental studies need to focus on determining the causes for the increased abnormalities in some areas and future risk assessment efforts need to estimate the degree of shoreline degradation that would endanger the Cherry Point herring stock when it is dependent on recruits for population maintenance or rebuilding.

Are the Cherry Point herring and Strait of Georgia *N. plumchrus* distinct populations responding to conditions in the Strait of Georgia?

The Cherry Point herring seem to have adapted to the annual cycle of the Strait of Georgia. A major part of this adaptation is the late spawning timed to coincide with the plankton bloom generated by the freshet of the Fraser River. Haegele et al (1985) state that very early or very late spawning are characteristics of a resident stock adapting to local conditions. Quast (1986) argues that the timing of spawning in Pacific herring is determined genetically. This and other genetic differences could be maintained by the reproductive isolation due to the unusually late spawning time and account for the findings of Beacham et al (2001) based on microsatellite DNA that

the Cherry Point herring are genetically distinct from other regional herring populations and most similar to three British Columbia stocks with unusually late or early spawning times.

The main basin of the Strait of Georgia holds more than one unique population. Barraclough et al (1954) describes the occurrence of four species of bathypelagic fish isolated from their oceanic relatives by the narrow straits and shallow sills of the Strait of Georgia system. *N. plumchrus* is another deep water species that may be isolated in the Strait of Georgia from its oceanic populations and has changed its lifecycle to adapt to conditions in the Strait of Georgia. These adaptations include delayed maturation and mating, a shorter period of time for their annual feeding and development in surface waters, and grazing primarily on diatoms instead of microzooplankton (Bornhold, 2000).

Ianora et al (2004) have shown that some species of diatoms, like *Skeletonema costatum*, produce a teratogenic aldehyde that can cause as much as 100% mortality in the larvae of *Calanus helgolandicus* adults consuming them exclusively. They also observe that copepods consuming a mixed diet that includes microzooplankton would benefit by diluting the diatom toxin and the diatoms would benefit by the reduction in protistan grazers of diatoms. Ianora et al conclude by suggesting that competition between toxic and innocuous diatom species could explain the complex oscillation between copepod and diatom populations observed over decadal scales. *S. costatum* is common in the spring phytoplankton bloom in the Strait of Georgia and perhaps is part of the relationship between the *N. plumchrus* and herring populations but more research is needed in order to establish its role.

Another possible explanation for fluctuations in the population of Strait of Georgia *N. plumchrus* is variation in a limiting nutrient such as iron. Harrison (2002) describes how iron enrichment encourages the growth of larger diatoms (> 10  $\mu\text{m}$ ) which the *N. plumchrus* at Ocean Station P do not eat to any marked extent. Iron is the limiting nutrient for the growth of large diatoms at Ocean Station P in late spring and early summer but what this might mean for the Strait of Georgia *N. plumchrus* (which have a greater reliance on diatoms for food than the oceanic *N. plumchrus*) is not clear at the moment. More research is obviously needed into the dynamics of the Strait of Georgia and how oceanography and nutrients affect the food chain especially during the spring plankton bloom.

Discussion and conclusions

The Strait of Georgia is a very unique and productive marine system, and its semi-isolated condition and relatively small scale make it a natural laboratory that is invaluable for what it can show about marine ecosystems and productivity. It is also exposed to multiple environmental risks due to the nearby human population centers. These are excellent reasons for a consistently high level of study effort. A thorough understanding can only come from maintaining a consistently high level of effort in observing the ecosystem at all trophic levels, better communication between biologists studying different taxa, and paying no more attention to the national border than the herring do.

Fish population numbers alone are not adequate for risk management decisions. No population can be understood except in relation to its food and predators. Misunderstandings and mysteries can be expensive when circumstances demand risk management decisions. Mysteries can be solved. Existing information suggests explanations for the Cherry Point herring late spawning time, population decline, record 1994 recruitment, etc. Nature works on a long time scale and older publications in biology are absolutely necessary for drawing conclusions and asking further questions. Older publications from the Washington Department of Fisheries indicate that the Cherry Point population may have undergone similar declines in abundance in previous decades. If this is a natural and recurring population cycle with copepods as an important factor, the spawning grounds need to be preserved so that recruits are available for population maintenance or rebuilding at critical points in the population cycle.

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Ship and Boat Hull Risk Management  
10/11/07 draft by Randall Marshall

Although the risk has declined due to steel hulls, antifouling paints, and regular hull cleaning, introduction of species via ship hulls remains similar in magnitude to introductions via ballast water. Not every ship voyage ends with a discharge of ballast water but the potential for invasive species introductions from hulls exists for every visit. Estimates of the percentage of coastal invasive species introduced via ship hulls to various ports around the world range from 10% to 90%.

Over 438 million square meters of wetted surface area on ship hulls arrive in United States ports each year. 438 million square meters is nearly equal to 1.5 times the area of Vermont. Biofouling on any ship will cover between 1% to 90% of the hull surface. Sea-chests, dry dock support strips, and recesses for rudders and propellers are places on a vessel that are particularly susceptible to biofouling. Slow moving coastal vessels, such as barges, are more susceptible to hull fouling than faster transoceanic vessels. However, hull and ballast water organism survival is often better on faster vessels with shorter transit times. The types of organisms known to be carried on vessel hulls include barnacles, amphipods, crabs, mussels, clams, sea slugs, sponges, bryozoans, hydroids, anemones, protozoans, marine worms, tunicates, fish, and seaweed.

Portland State University researchers estimate that about 10% of the species

introduced into the Lower Columbia River came from ship hulls. They also determined that over 12 million square meters of ship wetted surface area arrive in the Columbia River annually. Based upon a measured range of 5% to 20% hull coverage by biofouling, that means between six hundred thousand and 2.4 million square meters of biofouling on ship hulls enter the Columbia River each year. The diluted salinity in the Lower Columbia River may serve as a barrier to the introduction of some species from ship biofouling, but Puget Sound lacks a low salinity barrier and could experience a higher introduction rate from ship hulls.

Recreational and commercial boats also readily move invasive species around marine environments due to the relationship between marinas, boat hulls, and invasive species. Marinas provide plenty of surfaces to colonize and boats transport rapidly-colonizing invasive species from marina to marina. This relationship is ideal for the spread of invasive species and could explain our state's problems with tunicates. Boats also move ship-borne invasive species from their point of entry at a port to other places within a region. The list of marine species known to have been spread by recreational boats around the world includes Japanese kelp, broccoli weed, black striped mussel, Asian green mussel, and serpulid tubeworm.

Properly maintained antifouling coatings help prevent biofouling but aren't always maintained, and the more toxic coatings tend to get banned for environmental reasons. Antifouling coatings slow but do not eliminate hull fouling or the introduction of unwanted organisms. Antifouling paint cannot be applied to dry dock support strips and other places on ships. The best method right now for controlling biofouling and invasive species introductions from ship or boat hulls is frequent removal of the vessel onto a shipyard or boatyard for cleaning. Until new technologies are developed and put into place, cleaning of ship or boat hulls while still in the water will disperse biofouling organisms around the location of the vessel. State agencies currently allow under some circumstances the removal of biofouling from boat or ship hulls while still in the water.

The ability of recreational boats to introduce freshwater invasive species is well known. Zebra mussels, milfoil, and many other nuisance species are commonly spread between freshwater environments by recreational boats. The spread is generally due to the trailering of boats from one freshwater body to another. Quagga mussels, an equally invasive and costly relative of zebra mussels, have now become established in California and Nevada. Trailered boats are the most likely pathway for quagga or zebra mussels to our state.

Biofouling on ship and boat hulls cannot be completely eliminated, but it can be better controlled. Our recently increased efforts to intercept and inspect trailered boats at our borders make sense. Providing access to facilities for cleaning boats and trailers also makes sense. A similar system is needed for ships and boats entering our state by water. We should also encourage the regular cleaning of boats even if they usually only travel within the state. Boating should be banned in waters infested with especially invasive species, or the boats in those areas should be subjected to thorough cleaning and inspection procedures.

see pdf:  
Cpher2004SETACprint

**From:** Glen Hemerick

**Date:** 05/02/2008

**Comment:** [http://www.sas.org/tcs/weeklyIssues\\_2008/2008-05-02/backscatter/index.html](http://www.sas.org/tcs/weeklyIssues_2008/2008-05-02/backscatter/index.html)

"A Lake Algae Control Experiment  
Editor,

Long Lake in Washington was toxic in 2003, but free of toxic algae in 2004, 2005 and 2006 after plankton releases each year. In 2006 the Kitsap County Health District [was notified before] I released plankton into toxic Kitsap Lake and into red tide paralytic Hood Canal. I grow plankton by dipping water into a glass jug or tank with bubbling air, light, and 1/4 tsp/gallon and garden fertilizer. After 40 days the water becomes green. I can take away half the water each day and replace it with fresh or well water (not city water!). I pour some of the green plankton into streams that flow into a toxic lake. I also pour plankton into streams that flow into Puget Sound. The plankton absorb pesticides and chlorine, and they all die when they reach salt water and are buried under sediment "

**From:** Randall Marshall

**Date:** 04/30/2008

**Comment:** I wish to submit the two attached documents which address issues of concern for herring. Pacific herring is a species that is an important link in the food chain and extremely important to salmon and orcas.

(Attached: PSPresentation\_5-1-08.doc, 0603SETACGlobe-CPherLD.pdf)

**From:** Glen Hemerick

**Date:** 04/29/2008

**Comment:** [http://blogs.kitsapsun.com/kitsap/waterways/archive/2008/04/water\\_raises\\_concerns\\_on\\_bainb.html#c2547536](http://blogs.kitsapsun.com/kitsap/waterways/archive/2008/04/water_raises_concerns_on_bainb.html#c2547536)  
"BI Survey Shows Residents Concerned About Water" i live in olalla; i have a well; i supply water to neighbors via pipeline. i store all rain underground by planting in rows in little ditches that slope downhill two feet every 100 feet. my daughter was rototilling the little ditches today. if you are interested in paralytic shellfish, let me try to help without charge; but i would appreciate an offer of 10 minutes help.

[http://www.sas.org/tcs/weeklyIssues\\_2005/2005-08-26/backscatter/index](http://www.sas.org/tcs/weeklyIssues_2005/2005-08-26/backscatter/index)

**From:** Jerry Johannes

**Date:** 04/28/2008

**Comment:** I have some serious concerns about the effect aquaculture may have on the habitat of Puget Sound. Geoduck aquaculture is introducing plastic tubes (PVC) and nylon netting along with rubber bands into the marine environment at a time when we need to keep plastic away from our marine systems. With 43,000 tubes per acre and the same amount for netting, these tubes and netting are coming loose and rolling along the floor of Puget Sound. How many are out there is under dispute--I have seen figures upward of 80,000! Ingestion and entanglement are problems here.

There is an RCW

<http://apps.leg.wa.gov/RCW/default.aspx?cite=79.145&full=true> already on the books that speaks to this issue.

Let's clean this derelict gear up with cooperation from many.

I have some serious concerns about macrophyte destruction upon planting of the tubes in the substrate. Please read page 45 under the Macrophyte section of [http://www.dfo-mpo.gc.ca/csas/Csas/DocREC/2006/RES2006\\_011\\_e.pdf](http://www.dfo-mpo.gc.ca/csas/Csas/DocREC/2006/RES2006_011_e.pdf). Just how much habitat is destroyed upon planting?

And then, with plantings from -4.5 feet to +7 feet in tide level (please see enclosed sheet A) a wide swath of intertidal area is affected. The oyster areas will have racks and/or plastic oyster bags on the beach and the clams will be

# PugetSoundPartnership

our sound, our community, our chance

covered with netting. Please note the linear dimensions of this application. Please look at the Eelgrass Meadow sheet--does this go away after planting?

I have some serious concerns about the effects of macrophyte destruction on forage fish in terms of their spawning and rearing. Herring spawning is documented to be generally in the 0 to -10 water column--right where geoduck planting occurs. And what happens if rearing and protective habitat is eliminated? How does this affect salmon--particularly the ESA listed chinook salmon and Puget Sound steelhead?

I have some serious concerns about geoduck aquaculture on marine birds. The shorebirds (dunlin, yellowlegs, plovers, etc.) and the marine birds (loons, scoters mergansers, widgeon, etc.) and the nearshore birds (eagles, osprey, heron, kingfishers, etc.) are all affected. These birds all depend upon on the intertidal area for their survival and, in some cases, for the survival of their young. Please read pages 44-47 of <http://govdocs.aquake.org/cgi/reprint/2004/410/4100110.pdf> to read of bird effects.

Also, please study [http://www.habitat.adfg.state.ak.us/geninfo/kbrr/coolkbayinfo/kbec\\_cd/html/ecosys/species/shorebrd.htm](http://www.habitat.adfg.state.ak.us/geninfo/kbrr/coolkbayinfo/kbec_cd/html/ecosys/species/shorebrd.htm) The third paragraph under Habitat Needs and Distribution is most germane

The issues for birds include entanglement (in netting). ingestion (of plastic tubing and/or netting), exclusion (from feeding grounds) and perhaps most importantly, disturbance. With barges on the beach day and night for many hours at low tides, with lights, with crew noise, with generator noise, the effects on birds will be profou

I do hope you will include aquaculture as a major potential threat and look at ways to lessen it's impact.

I am including a chart from the South Sound Salmon Recovery group that lists aquaculture as a stressor on salmon populations. For me, the best indicator for restoring Puget Sound would be the return of the salmon and the benefits that would accrue to all.

**From:** Peter Beaulieu

**Date:** 04/22/2008

**Comment:** The following suggestions are somewhat of a patchwork rather than

comprehensive, and do not duplicate points already made in the Partnership's five initial draft topic papers. They consist mostly of one retiree's reminiscences (!) of specific examples possibly helpful to the Partnership in its new work, and hopefully carry forward the dedicated work of many who have come before. (The Partnership is to be specifically commended in its enabling statute and personnel connections for building directly on the sustained efforts of the Puget Sound Action Team.)

Overall, the content of the Partnership's draft papers, their content and tone, and the reader friendly structure for response are all to be most highly commended. This is good work, and even a pleasure to read.

Thank you for this early opportunity to contribute.

## THE BASELINE PROBLEM STATEMENT

Find opportunities to tie pollutants to large scale or widespread chosen practices, when this is more instructive than a less direct tie to demographics. (The governing state statute is the Growth Management Act of 1991, which mandates "management" rather than an abstract ceiling.)

Examples:

- The Water Quality paper reports that in recent years polynucleated aromatic hydrocarbons (PAHs) have increased. PAH deposition rates dropped precipitously in the 1950s as coal burning was replaced with other home heating systems. The recent increase (still far below historic levels?) must be presented in this larger context, and then traced to correctable sources.
- As a second example, the Interstate 405 Corridor Program and the earlier I-90 bridge crossing claim a net decrease in runoff even as transportation capacity is increased. This outcome is due to design improvements such as culvert improvements for both old and new facilities (case study for retrofit discussion, pp. 16, 29). The cleanup burden must not be placed fully on the incremental increase in Sound area activity (a case study is the rate structure attached to the Brightwater Wastewater Treatment Plant proposal in King/Snohomish County. A balance was attempted between the financing of new treatment capacity and stormwater runoff.).

What is the more researched and current timeline information for various deposition rates (not only levels in the water column)? In 1983 the deposition rates for Puget Sound as a whole (not for localized sites) for

several contaminants were reported to have declined in recent years.

Examples (affects p. 32):

- hydrocarbons reduced by 50 percent since 1950,
- Chlorinated compounds by 30 to 50 percent since 1960,
- Mercury by 20 percent since 1960 (The Habitat – Species Diversity paper reports that airborne mercury is on the rise due to emissions in Asia, p. 5),
- Arsenic by 15 percent since 1960 (Tacoma Asarco Plant closure);
- Lead by 10 percent since 1960.
- Holding constant in 1983 were silver, copper, cadmium.

## STRATEGY: OVERALL

Further develop the insight that optimum ecological restoration is not the same as homogeneous protection at all geographic scales. That is to say, it is a smart move to protect the most valuable and vulnerable areas (equivalent examples: Mountain to Sound Greenway, rainforest preserves established in the Amazon rainforests, and even National Parks).

Puget Sound examples (finer grained, but from within our urban region):

- The approach used for offsite mitigation in the Cross-Base Highway Corridor Program might offer a kind of template. The documented strategy included identification of redundant candidate project areas offsite (each with unknown availability), and for each investigates public and private long-term management options, etc.
- The incorporation of an Environmental Program into the Record of Decision for the I-405 Corridor Program (making such actions obligatory), and which selects (with directly involved water resource agencies) cost-effective mitigation sites for runoff volumes from within entire sub-basins of the WRIAs, rather than only from within the project corridor. (The transportation Corridor and sub-basin maps – in the Green and Cedar WRIAs -- are superimposed. In its complexity and size – 240 square miles – the I-405 Corridor is conceptually equivalent to a WRIA plan. The transportation and WRIA fiefdoms worked together.)
- Supporting the proposal for protection of pristine areas (Water Quality paper), is the example of Seattle Water Department consolidation of Cedar River Watershed ownership. This was done over two decades of trading property inholdings for acreage at other locations in the Cascades (and as originally proposed in the 1983 Comprehensive Water Supply Plan, another

good model of complex resource management.)

- On the two-way relationship between water resources and land use, notice that the Snohomish Valley is protected by the urban growth boundary, while the earlier Green River Valley is not. Much of the difference turns on a seemingly technical detail, the fact that under federal guidelines urban development in the flood plane counted as a project benefit in the 1950s (hence the Kent-Auburn warehouse and Boeing complex), but not for any proposed dam on the Snohomish tributaries as under the Snohomish Basin Mediated Agreement (hence dairies and cattle pads).

## STRATEGY: GEOGRAPHIC FRAMEWORK

Thinking backwards from implementation options to the way we frame the Puget Sound problem statement at the start, how might we begin early to cross-connect problem formulations to real implementation options? How can we think right-brained about the total package?

- Without muddling the more linear and legitimate Partnership approach, develop flexible technical capabilities, i.e., provide a standardized GIS capacity, a shared ecosystem map overlay system displaying (a) the Puget Sound Basin, (b) the Water Resource Inventory Areas (WRIA) boundaries and plans, and where available (c) 1960, 2000 and 2040 data sets (e.g., now available Puget Sound Regional Council maps), etc.
- For each sub-basin; the Geographic Information System (GIS) capability must be transparent to GIS for Water Resource Inventory Areas (WRIAs), to local land use GIS as well as habitat GIS (which is already proposed in the Habitat paper, P.20), and to stormwater (Water Quality, p. 30).
- The logic of realistic and effective implementation requires that the Sound be treated equally as a basin unit and as a collage of sub-basins, rather than as a unity nuanced only a bit with local detail. Specifically, priorities and an action agenda must be decisively developed in two distinct categories: overall, and sub-basin with some shared elements. The layered look is in. For example, and affecting both categories, what do we know about tidal circulation patterns and basin and sub-basin flushing cycle?
- The purpose for GIS compatibility and transparency is twofold: technical analysis and integration as already proposed, but also layered visibility of interrelated issues for the direct attention policy boards otherwise confined to their fragmented agency mandates and “radar scopes”. An excellent display would be a view of future land uses, showing those small sub-basins

where future growth will violate the general thresholds of more than 12 percent impervious surface, or less than 65 percent forest cover (p. 8).

- This reader believes that the regional agenda must consist mostly of a fabric of sub-regional actions. GIS transparency is encouraged, for example, to help ensure integration of land use and water resources planning (p. 31), however this technical tool must not take on a life of its own, obscuring critical caution contained in the Water Quality text, namely, that pollutant runoff is highly variable within land use classifications (p. 7). A focus on gusty and clear performance measures is probably more consistent with the state Growth Management Act and more to the point than a population lid as seems to be implied in the Habitat paper (pp. 63, 65).

More rumination:

- Develop a map strategy. Replace or greatly supplement the King County pre- and post-1990 Map in two ways (Water Quality paper). The suggestion here is to move in the same direction, but in a more informative and comprehensive way. Why only King County, and why pre- and post- 1990? First, use the Puget Sound Regional Council maps for the four-county sub-region for 1960, 2000 and 2040, supplementing these as possible for the remainder of the Puget Sound basin. Second, superimpose the pre- and post-map onto the mosaic of WRIA basins. A technically consistent and shared map strategy might or might not imply a centralized control of maps and information (as is proposed in the Habitat paper).
- Superimpose the Conservation Trust Map (Habitat paper) onto a mosaic of WRIA maps and onto a jurisdictional map. This will give a better look at natural systems and at local government implementation aspects.
- Systematize the maps. We are challenged by the fact that Puget Sound basin activities were superimposed on a standard composite of WRIA boundaries (not yet labeled as such) in all of the topical volumes of the federal/state multi-agency Puget Sound and Adjacent Water Study (PSAWS), completed in 1971 and in the days prior to GIS(!). With this basinwide context, additional WRIA level maps can then be lifted out for sub-basin attention without fragmenting the unified effort. This split-level approach has been done before.
- Marine mapping. Show what we can about Puget Sound tidal behavior and sedimentation issues. A very preliminary effort is provided by the 1983 Puget Sound Water Quality Conference (see footnote 3, Proceedings, above). Of ten outgoing tidal units heading north from Seattle, seven reverse

with the next tide to return from a point south of Port Townsend, with six of these then continuing so far south as to mostly encircle Vashon Island clockwise (four units), or to move south even through the Tacoma Narrows (two units). Supports Water Quality paper, p. 33).

## HABITAT – SPECIES DIVERSITY PAPER

I have no detailed input at this time to the institutional recommendations posed in the Habitat– Species Diversity paper. But, I do suggest that the boldness of centralized control, if warranted (as it might be), must be strategic rather than blanket, and nevertheless find a way to truly share the spotlight, share the credit, and structure itself as a convincingly collaborative Puget Sound initiative, e.g., project-level co-sponsorships. (Co-sponsorship assures co-operation, in spades; it also inoculates against unilateral budget triage along the way.) An annual awards program for stellar actions worthy of replication, large and small, also might help keep the initiative visible by routinely fostering community stewardship and cumulative small steps serving our common heritage and responsibility. It might be that centralization – the CEO model – might best be applied to strategically selected elements of a broader and collaborative political and community chemistry.

Are there at least one or two opportunities for bio-manipulation toward good results in either the Sound or the tributary basins? A possible example is the story of Lake Washington cleanup, a training wheel exercise compared now to the needs of the entire Puget Sound basin. The lesson here is that in complex situations, some properly conceived engineering actions can actually improve the ecosystem.

- Finding: In the 1970s Lake clarity improved twice as much as was predicted from proposed engineering solutions (the later interception and diversion of sewage local outfalls by Municipality of Metropolitan Seattle) and is traced in part to channel dredging and the resulting improvements to spawning and survival conditions for smelt (!) in the Cedar River. Read on...
- Partial explanation: As shown by science, perturbations in the food chain – not only pipes and mortar – accounted for half of the reduction in algae growth in the Lake. Augmenting the documented channel modifications, and not suspected in the Edmondson article, is the concurrent and additional benefit of enhanced streamflows. This enhancement was due to development of the adjacent South Tolt River Watershed as a conjunctively operated water supply source. (When I detailed the timing and magnitude of this

serendipity action to him, Edmondson was intrigued, but scientific conclusiveness was not pursued.) Bio-manipulation might merit a line in the Water Quality paper 28. (Edmondson is cited on p. 11).

- **Land Use Connection.** As a major point to be carried into the Land Use paper, we should flag the benefit of habitat corridors in urban areas (I think I did see this in one of the papers), linking small and otherwise fragmented habitat areas together into more viable systems. An object lesson on why cost-effective habitat alternatives are sometimes needed – off-site mitigation – is provided in the Corridor Plan for the Cross-Base Highway in Pierce County. The habitat corridor approach involved a bizarre structural squirrel bridge (gasp!) over the proposed highway, at great cost. It looked like the Aurora Boulevard pedestrian overpasses linking the Seattle Zoo to the lower parkland south of Greenlake). This was to protect stands of mature oak trees south of the McCord runways, which however took root only after the site was cleared for runway use a recent fifty or sixty years ago. (Further, the troublesome demise of Western Gray Squirrel populations is traced largely to the introduction of the more aggressive Eastern Gray Squirrels).

- **Resilience.** The paper refers to “resilient” ecosystems (p. 7). This discussion should be expanded slightly to explain that species are resilient, rather than fragile, but that this resilience does have boundaries. Part of the research and management effort is to understand and preserve these boundary conditions.

- **An Object Lesson.** The plight of the elusive Beller’s ground beetle is noted (p.2). Note well the following....In the early 1980s the Mediated Agreement for the Snohomish Basin (the first large scale national mediation in the United States, convened under Governor Evans) was stalled because the keystone element, a proposed dam on the North Fork of the Snoqualmie River, stumbled across the possibly endangered Beller’s ground beetle. The upshot of all this was that the single find of such a beetle was due to the fact that some wandering explorer picked one up, and not necessarily that this was the only one around. A beetle in a bottle equals the sum total of data available.

- (Continued) Further research disclosed that staff at the national level responsible for sorting through this sort of thing consisted of only two people. As chair of Seattle’s interagency and public-private Comprehensive Water Supply Plan Advisory Committee (1983-5, or so) I recall debating whether local funds should be used to help support additional staff people at the federal level to clean out the in-basket. One can only hope that there are not other such species regarded as endangered possible because of

incomplete paperwork. This was in the 1980s. One would think that after a quarter of a century the National Fish and Wildlife in-basket would be cleaned out (!). The gap between data and information should never be underestimated. The data say(s) “here’s a beetle;” the information says we should light some more lamp posts before in-basket paralysis (quite different from analysis paralysis) becomes a default policy. This caution toward data (all bow, please) applies in at least a limited way to the goal of “identify(ing) the most immediate needs for species, conservation and recovery” (p. 5).

(Continued) The Partnership proposes an ecosystem planning approach. Are there tensions between this approach and the occasionally problematic listing of species (the Beller’s beetle) under the current wording of the Endangered Species Act (ESA)? What would a hybrid and mutually consistent program look like?

- Invasive Species. In the remarks on invasive species (p. 7) the paper does not mention the Eurasian Water Milfoil invasion and proliferation that began in the late 1970s. The Section 208 (National Water Quality Act) effort of the Municipality of Metropolitan Seattle spent considerable time on this at the time new threat. Here’s the scoop....The Milfoil was probably imported from southeastern states by migratory birds, or perhaps attached to boats. It is my distinct memory that a local figure, a proprietor of commercial parking lot fame, noticed this stuff around his dock on Lake Washington and ripped it all out, chopped it up, and then disposed of it in the Lake. Milfoil segments are capable of re-rooting, separately, and so, there you have it. Perhaps a lesson here about ecosystem surprises and best management practices.

- Fine tune Tables S1-1 and 2, and the text. Distinguish between “levies” and setback levies as are installed in the Snohomish Basin. Distinguish between “culverts” and culvert retrofits that can yield net benefits. The ambiguity of dredging in some cases might also be noted (see my comments on Edmondson and the Cedar River). With regard to “dams” we should note the likely Sound-wide significance to habitat of removing (retrofit big time) the Elwa Dam near Port Angeles. The Hood Canal entries should recognize the decisive impact of low tidal circulation, not simply the shoreline activities. In the discussion of impervious surfaces, refer to the threshold reported elsewhere in the papers (12 percent impervious surface), and like wise for forest removal (threshold of less than 65 percent coverage). In the text (p. 35), it was the small and industrial Cuyahoga River in Cincinnati that caught fire, not the Ohio River. On page 43 it might be useful to distinguish NEPA and SEPA, the latter goes so far as to assert environmental rights, and procedurally the former considers new alternatives up until the final point of

decision (no earlier cutoff). On page 58 the national trend of 80 percent net loss in wetlands since passage of the Clean Water Act is deceptive. In our region, much of the loss is in the filled and industrialized lower Duwamish, dating from the turn of the last century.

- Steps toward management at the ecosystem scale (p. 35) can learn from the I-405 Corridor Program experience (Department of Transportation). Two features were (1) the use of interagency consensus points and, therefore, (2) the early engagement of resource management permitting agencies at an early stage. That is, the permit focus of these agencies was broken open by their participation in earlier and corridor-wide framing of issues and solutions, within which project-level permits might be given more meaningful and less myopic review. A third essential feature of the Corridor Program was (3) its joint planning structure; it was an interagency effort precisely because the various agencies have separate mandates and the potential for downstream vetoes.

(Continued) Also related to ecosystem approaches, the introduction of “adaptive management” might be expanded slightly to note the value of having a portfolio of corrective actions to choose from and, second, the explicit recognition that as we learn more commitments to past actions can legitimately be replaced (in some instances), not simply dog-piled with additional requirements. The pioneering entity for adaptive management, the Pacific Northwest Power and Planning Council, (I believe) follows this philosophy.

(Afterthought). Regarding wetlands designations, here’s an anomaly to think about. Under the FAST Corridor Program (Freight Action Strategy), a systemic and largely successful approach was attempted to dealing with the intersection of marine port rail container traffic and the constricted urban setting with so many at-grade rail crossings. In the dozen or so projects selected, the environmental work was assigned to the free-standing (but systemic) grade-separation projects (ranging downward in cost from \$150 million). In the Kent Valley we encountered a project that got stuck for budgetary reasons, and then found that the cleared site had earned inflexible wetland status due to seasonal ponding in successive years. A “wetland”?

The project had to start over at a less optimum location. The incremental cost increase would have been sufficient to support the Partnership for several years. Part of the “problem statement” for the Partnership will be to step out its own process in order to touch bases with reality on things like this. One of the consistencies in fragmented decision making is to remain ever “penny wise and pound foolish”.

**From:** Don Russell

**Date:** 04/22/2008

**Comment:** The recent article appearing in The News Tribune about the placement of 27 root wads along the shores of Spanaway Lake (only one of which is entirely immersed in the lake) to "restore the shoreline and protect salmon" inspired me to write a paper titled Pierce County's Faith Based Chambers-Clover Creek Watershed Recovery Program. A tenet of this faith appears to be that if you can keep surface water runoff on the surface in the midstem Clover Creek drainage channel, the salmon will return.

A copy of that paper is attached. Enjoy.

## PIERCE COUNTY'S FAITH BASED CHAMBERS-CLOVER CREEK WATERSHED SALMON RECOVERY PROGRAM

### Preface

This paper describes the origins and current existence of Pierce County's faith based Chambers-Clover Creek watershed salmon recovery program.

### Historical Backdrop

Up until the mid 1850s there were substantial runs of chinook, coho, sockeye salmon and steelhead (sea run rainbow trout) in the Chambers-Clover Creek watershed. By the late 1800s these runs had been significantly diminished as a result of dam building activities and the draining and filling of wetlands that served as dry season refuges for salmon smolts and steelhead. By 1940 almost all salmon runs had ceased in the Clover Creek above Lake Steilacoom as the upper Clover Creek reaches were modified and drainage ditches were dug to convey surface water runoff from the Parkland, Spanaway and Midland areas. In the 1960s the perennial Clover Creek stream reach that flowed through PLU was diverted to a dug drainage channel that paralleled Tule Lake Road. As a result of loss of water in the reach of Clover Creek from 136th St S to the wetlands located between Spanaway Loop Road and McChord AFB the entire relocated streambed was asphalt lined. This had several effects. The surface water runoff carrying capacity of the modified channel was enhanced and the asphalt lining prevented weed growth in the channel thereby reducing flooding and drainage channel maintenance costs. By this time no salmon could reach the Parkland area (except during 1996-97 groundwater flooding).

On to this scene came the Clover Creek Council comprised of a few

dedicated individuals who vowed to restore salmon runs to the Clover Creek system above Lake Steilacoom. Unfortunately they subscribed to the notion that was promulgated by DOE's 1986 publication titled: Intermittent Flow on Clover Creek: Causes and Possible Solutions. This publication attributed intermittent flow to "disturbance of natural stream bed seals" and advocated sealing losing reaches of Clover Creek as a remedy. The Council accepted "sealing the stream bed" as one of the tenets of its faith and decided that all that was necessary to restore salmon runs in this drainage ditch was to place large rocks, gravel and large woody debris on top of the asphalt and plant shade trees all along its banks. They also realized that for salmon to reach this "restored" reach they would have to construct fish ladders in the lower portion of Clover Creek to allow salmon passage over the physical barriers that existed above Lake Steilacoom. At first these ladders were constructed of wood. Eventually the Council was instrumental in convincing the Pierce Conservation District and the City of Lakewood to construct permanent fish ladders and weirs in the area immediately above Lake Steilacoom so salmon could access the "restored" asphalt lined Parkland portions of Clover Creek.

The Council became concerned about a continual loss (due to infiltration) of mainstem Clover Creek water between 136th St and 138th St S and, according to one tenet of its faith, began a long term effort to seal this portion of the creek with bentonite.

#### Recent Manifestations of the Faith Based Approach

Pierce County's 136th St and B St S Clover Creek Flood Plain Restoration Project removed the artificial asphalt seal in the portion of the North Fork just above its confluence with the mainstem and replaced it with a "natural seal", i.e., clay. They rerouted mainstem Clover Creek from 136th St S to its junction with the North Fork and lined its bed with the same "natural seal" material, all at considerable cost. Because of a continual loss of surface water due to infiltration above 136th St S, a group of volunteers sealed the stream bed with clay from just below 138th St S to the 136th St sealed portion of the completed Phase Two Restoration project. The intent of all this streambed sealing with clay was to prevent surface water loss due to infiltration and thereby allow surface water flowing from the North Fork and mainstem Clover Creek to reach the asphalt lined portion of the Clover Creek drainage ditch located west of A St S.

A more recent example of the "seal" tenet of Pierce County's faith based salmon restoration project is "restoration" of a portion of the Clover Creek drainage ditch located on the Parkland Prairie Reserve. Here the intent is to divert surface water runoff into an engineered simulated stream that features meanders and large woody debris, and true to the tenet, incorporates a sealed

(clay) low flow channel.

## Situational Reality

The salmonids that once inhabited the Chambers-Clover Creek watershed evolved in an environment where groundwater discharge was the dominant determinant of their success. Groundwater discharge was the source of water in Clover Creek, its tributaries, wetlands and lakes. Groundwater flooding provided the means for salmonid to migrate between discrete and dry season disconnected water bodies that served as their spawning beds in the fall and rearing habitats during the dry season. The connectivity of streams, wetlands and lakes with underlying shallow aquifer groundwater was important in many ways. In the fall groundwater (flooding) discharging up through streambeds, and wetland and lake bottoms dislodged accumulated silt and sediments thereby preparing these gravel substrates for salmon spawning activities. Continued groundwater discharge up through gravel nesting areas provided the dissolved oxygen and water chemistry required to maintain viability of salmonid eggs. Upon hatching salmon young found ample macroinvertebrates to feed upon. The cold, oxygenated groundwater discharged into discrete wetlands and lakes provided the rearing habitat for smolt over the dry season. Groundwater flooding in the following year allowed the smolt to migrate over otherwise dry streambeds and land surfaces downstream to Puget Sound. Almost all of this natural condition and groundwater functioning has been lost in the heavily urbanized Clover Creek Basin.

What we now have instead is groundwater that is disconnected from streams and wetlands, lower lake levels and diminished groundwater flow through. Exacerbating this condition is that the shallow aquifer that does discharge into our streams, wetlands and lakes is now polluted with nutrients as a result of current surface water and human waste management practices. The Folly of a Faith Based Approach to Pierce County's Salmon Recovery Program

Millions of dollars are being spent on trying to keep polluted surface water runoff on the surface in Clover Creek drainage ditch rather than to treat it in managed wetlands and drainage ditches and ponds (by allowing vegetation to assimilate nutrients, organics and heavy metals during the growing season and then remove these sequestered pollutants from the system by harvesting and removing vegetation each fall) and allowing the cleansed surface water to infiltrate to recharge the depleted and underlying shallow aquifer. Sealing a streambed is a contradiction of the natural scheme of things in a glacial flood plain setting.

The entire North Fork and mainstem of Clover Creek from 138 th St S to the sediment laden wetland located between Spanaway Loop Road and McChord AFB has been engineered as a surface water runoff drainage system. Therefore it should be managed to treat and infiltrate as much of this surface water runoff as possible so it doesn't pollute what little remains of lower (McChord and below) Clover Creek's groundwater discharge dominated flow. As a surface water drainage system this reach of Clover Creek is inhospitable to salmon and, at this late date, very little can be done to make it so. Surface water runoff chemistry is antithetical to salmon survival.

Fortunately there are reaches of the Clover Creek and tributaries that could be managed as salmonid sanctuaries. These reaches include lower Clover Creek from Lake Steilacoom to McChord AFB, Morey Pond, Morey Creek, Spanaway Creek, Spanaway Lake, upper Morey Creek (aka Coffee Creek) and, possibly, Tule Lake. However even here there are formidable barriers to overcome. First and foremost is the degraded and polluted condition of Spanaway Lake. This Lake is a producer of cyanobacteria toxins that render much of Spanaway Creek, Tule Lake, and parts of Morey Creek inhospitable to salmon, wildlife and people. This is not a natural condition. It was brought about by reliance on on-site septic systems by residents living around and upgradient (via groundwater flow) of the lake and exacerbated by surface water management practices.

Other obstacles to overcome in order to restore salmon runs in this corridor will be (1) removal of salmon migration route blockages, i.e., Morey Pond dam and invasive species, (2) identifying and managing off stream groundwater fed salmon smolt refuges along the corridor, (3) the summer and fall cooling of Spanaway Creek water by withdrawing supplemental cold water from sufficient depth in Spanaway Lake to augment the warm water flowing from its surface, and (4) managing the shallow aquifer level in the vicinity of the marshes adjacent to McChord AFB so as to assure minimum base flow in lower Clover Creek and adequate flushing action in Lake Steilacoom.

## Conclusion

To effect meaningful salmon restoration in the Clover Creek Basin will require that the current faith based approach to salmon habitat restoration that is occurring in middle stem Clover Creek and the North Fork be replaced by a science based approach to salmon habitat restoration in the Spanaway Lake to Lake Steilacoom corridor of Clover Creek.

# PugetSoundPartnership

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**From:** Glen Hemerick

**Date:** 04/18/2008

**Comment:** I am trying to send pictures of two lakes after plankton release. long lake was toxic 2003. free of toxic algae 2004,2005,2006 after plankton release each year. . until 2007 when the wa legislature gave nearly one million dollars to two men to treat long laKE WITH PESTICIDES. i stopped treating long lake. but in 2006 the kitsap county health dpt requested me to release plankton into toxic kitsap lake and into red tide paralytic hood canal. both successful.