Agenda Item D.1
Situation Summary
June 2010

CURRENT HABITAT ISSUES

The Habitat Committee (HC) will meet on Thursday, June 10 and Friday, June 11, 2010. On Thursday, a subcommittee of the HC will meet with the Salmon Technical Team to discuss the Sacramento River overfishing report. Following that meeting, the HC will meet to discuss California Central Valley and Klamath River salmon issues. The HC has prepared a draft letter on the Ocean Power Technologies (OPT) wave energy project off Reedsport (Attachment 1) and a draft of the Western Straits of Juan de Fuca (WSJF) coho overfishing report, which was triggered last year when WSJF coho were placed under an overfishing concern (Attachment 2).

Council Action:

Consider comments and recommendations developed by the HC at its June 2010 meeting.

Reference Materials:

1. Agenda Item D.1.a, Attachment 1: Draft letter on the Reedsport OPT Wave Park project.
2. Agenda Item D.1.a, Attachment 2: Draft WSJF coho overfishing report.
3. Agenda Item D.1.b, Supplemental HC Report.

Agenda Order:

a. Agenda Item Overview **Kerry Griffin**
b. Report of the Habitat Committee **Fran Recht**
c. Reports and Comments of Advisory Bodies and Management Entities
d. Public Comment
e. **Council Action:** Consider Habitat Committee Recommendations

PFMC
05/21/10

Agenda Item D.1.a
Attachment 1
June 2010

Filed electronically: June ____, 2010

Kimberly D. Bose, Secretary
Federal Energy Regulatory Commission
888 First St. NE
Washington, D.C. 20426

Re: Reedsport OPT Wave Park Project, FERC No. 12713

Dear Secretary Bose:

The Pacific Fishery Management Council (Council) offers the following comments in response to "Reedsport OPT Wave Park Project, FERC No. 12713" (Project) Ready for Environmental Analysis notice. The Council asks that its earlier comments on this project (submitted to the Federal Energy Regulatory Commission (FERC) on November 21, 2007 and attached here again for convenience) also be made a part of this record. Those comments provide background to our Federal responsibilities, interests and concerns about the Project's potential impacts to Council-managed fisheries and the ecosystem.

We appreciate the efforts of FERC and others to work through the Settlement Agreement process. Some of the concerns mentioned in our November 2007 letter are being addressed through that process. However, we remain concerned about some issues. Given the lack of information about the environmental impacts of this new technology, this project must use adequate precaution, consider existing information on resource impacts, and consider the cumulative effects of multiple wave projects in the California current system.

Our primary concerns related to this project are:

- electromagnetic field (EMF) impacts on California Current species, including cumulative effects and the characterization of the scientific literature
- impacts of sound generated by the project
- environmental baseline and monitoring studies
- the proposed adaptive management process

EMF impacts

A comprehensive literature review on EMF for U.K. offshore wind energy (which has similar projected EMF emissions to wave energy) provided in the COWRIE 1.5 Report (Gill et al, 2005) concluded that there are many EMF-sensing species and that many are likely to experience cellular and/or behavioral responses to the EMF field generated by wind farm cables (Gill et al. 2005). This report also noted that EMFs of a magnitude within detectable ranges of EMF-sensing animals would be produced by industry

standard power cabling, even if buried to several meters, unless specific cabling configurations are capable of reducing EMF fields.

More specific findings from the only *in situ* experiment (COWRIE 2 report) (Gill, 2009) concluded that elasmobranchs exhibited noticeable behavioral responses to the electric (E)-field associated with energy cables, and could potentially detect the E-field for several hundred meters from the source (Gill et al. 2009). The UK studies indicate that cable shielding for EMF emissions is project-specific and requires *in situ* studies to test shielding effectiveness and species-specific responses. However, with respect to cable burial depth, COWRIE 2 updates the previous report's findings that EMF emissions are stronger than previously believed, and that there is no burial depth that will reduce the EMF below threshold levels for certain EMF-sensing species. These findings underscore concerns for potential impacts of EMF effects on EMF-sensing species.

There is little or no knowledge of EMF sensitivity thresholds for most EMF-sensing species likely to be found in the project area. Many of these are Council-managed species. OPT proposes to rely on known EMF ranges and the limited literature available on behavioral responses of "surrogate" species, rather than determining threshold values and responses for species likely to occur in the project area. In order to establish triggers for the adaptive management process proposed by the applicants, and to develop tangible mitigation measures, threshold values need to be established for project-area species at various life stages. *In situ* monitoring and experimental studies of behavioral responses are needed to determine the nature of any observed effect. (Any sensitivity studies and monitoring activities should include EMF strengths at least as great as those generated at periods of higher sea states, when EMF strengths will be higher.)

Salmon, green sturgeon and leatherback sea turtles listed under the Endangered Species Act are all EMF-sensing species that are likely to migrate through the project area. The Council's fisheries are impacted by the status of such listed species, and special consideration should be given to studying EMF effects on these and any other listed species.

As the COWRIE reports are the most comprehensive reports on EMF emissions and impacts for offshore energy, they should be considered as guidelines for studying and monitoring the impacts of this project. Additionally, as the COWRIE 2 Report was published several months prior to the release of this notice, its findings should be incorporated into the project's environmental assessment (EA).

Cumulative Effects of EMF

The COWRIE Report (Gill et. al, 2005) identified a number of information gaps regarding other sources of EMF emissions in the marine environment (such as telecommunications cables, power cables, pipelines, submarine power cables, etc.). This information is important to understanding the extent of anthropogenic EMF fields, including the cumulative impacts of other proposed offshore energy development. This information should be gathered and analyzed and effects should be mitigated.

Characterization of the Scientific Literature

The review of scientific studies on EMF and EMF-sensing species cited by OPT in the EA revealed several instances where the results and/or conclusions were inaccurately characterized (see Appendix A) or not utilized effectively to forecast possible impacts of EMF. These lead the reader to conclude that EMF represents no significant concern, which is not the case. Although all studies cited were not reviewed, the inaccurate representation of the reviewed literature raises the question of whether other cited literature was inaccurately represented. This is important because settlement negotiations and study plans were based in large part on the findings of the literature review. The Council suggests a verification of the literature by an independent peer review process.

Impacts of Sound on Fish

Some Council-managed fishes rely on sound to navigate, feed or avoid predation. Pacific herring, an important prey species for some Council-managed fish, is one species known for having highly developed hearing.

The EA addresses acoustic emissions as a potential impact on cetaceans, but does not appear to address acoustic impacts on fish species. The EA references only one scientific study for acoustic impacts to fish (Hastings and Popper 2005). However, in a subsequent scientific review, the study's authors note that the metrics they had employed to characterize sound impacts on fish were not necessarily appropriate (Popper and Hastings, 2009). Additionally, Popper and Hastings (2009) note that most of the studies they reviewed had significant problems in their methodologies and interpretation of results, and many lacked peer review. Despite advances in the current state of knowledge about acoustic emissions from anthropogenic sources, there is little data on species-specific responses, such as hearing loss, tissue damage, feeding behavior, mating behavior, predator avoidance and migration. Popper and Hastings (2009) conclude that the lack of available data makes it very hard to extrapolate data from one sound type or species to another, and note that "the only useful studies on the effects of sound on fish behavior must be done with field observations where the movement of fish can be observed and quantified before, during and for an extended period after exposure to sounds."

There is little evidence then to allay the Council's concerns regarding the impacts of acoustic emissions from the OPT wave energy project on fishes found in the project area. The Council suggests the need to characterize acoustic emissions, determine species-specific sound thresholds, and evaluate responses for species of concern in the project area. Additionally, techniques to dampen sound impacts should be employed where possible. Monitoring the acoustic emissions and species responses, and developing mitigation measures, should be included the adaptive management process where species responses are deemed significant.

Environmental Baseline and Monitoring Studies

We are concerned that the methodology used for OPT's baseline sampling does not provide adequate time to develop accurate baseline data.

Specifically, OPT proposes to conduct surveys of selected fish and invertebrate species in the project area prior to installation of the 10-PowerBuoy Array. The data from these surveys are intended to serve as baseline data for evaluating potential effects of the project. OPT proposes to use BBACI (Beyond Before-After-Control- Impact) statistical analyses to add reliability to the detection of environmental disturbance. These analyses require that the area not be disturbed prior to completion of baseline sampling.

However, given that wave energy buoy installation is planned for 2010 (one buoy and associated mooring infrastructure) and 2011 (nine-buoy array), and given the high natural variability of many marine fish and invertebrate populations, this schedule does not provide adequate time to develop accurate baseline data. Without such a baseline, meaningful estimates of pre-installation interannual variability or "average" abundance for many species cannot be determined. This lack of adequate baseline data will likely make it difficult to detect changes in abundance due to wave park development. In fact, no estimate of natural variability will be possible with only one year of pre-installation baseline data, therefore the BBACI analyses will not provide meaningful results to determine if any changes are due to wave energy impacts or other variables. This is not adequate. Additionally, control sites should be established beyond the boundary of the proposed Phase III build-out to support long-term monitoring of Phase II.

Adaptive Management Process

OPT proposes an adaptive management strategy to address unforeseen project impacts, but the only document describing this strategy is the Adaptive Management Process Overview, which does not provide specific threshold values (e.g. percent decrease in species abundance) for biological studies that would trigger additional impact studies or project modifications. The Council believes it is necessary to establish these triggers before the project begins to ensure that there are no unacceptable impacts.

Relevant Literature

In addition to the salmon fishery management plan that is referenced in the Reedsport project materials, the Council also has comprehensive fishery management plans for groundfish, highly migratory species and coastal pelagic species that should be taken under consideration as part of this project. All of the Council's fishery management plans are accessible from the Council website at http://www.pcouncil.org.

Other references to relevant literature are included in Appendix A.

In closing, we appreciate the opportunity to comment. We hope the Council's comments are useful for the EA analysis.

Sincerely,

D.O. McIsaac, PhD
Executive Director

Attachments:

Council letter to FERC, November 21, 2007
Appendix A

APPENDIX A:
Studies Reviewed in FERC Project License Application No. 12713, Volume II: Issues Assessment; Issue No. 2 – EMF; Appendix C (December 15 2009)

Mann et al. (1988) and Walker et al. (1988)

OPT cited Mann et al. (1988) and Walker et al. (1988) as having found magnetic sensing material in four species of salmon and finding no such material in sockeye salmon. In fact, both study's sole objectives were to study magnetite crystals in sockeye salmon, and both studies found magnetic-sensing crystals in sockeye, concluding that sockeye are capable of detecting changes in the geomagnetic field.

Quinn and Brannon (1982)

OPT accurately cited Yano et al. (1997) that: "no observable effect [was noted] on the horizontal and vertical movements of chum salmon when the magnetic field was altered," but then followed this with a misleading citation of Quinn and Brannon (1982) that they "*further concluded* [that] while salmon can apparently detect B [magnetic] fields, their behavior is likely governed by multiple stimuli as demonstrated by the *ineffectiveness* of artificial B field stimuli." Quinn and Brannon (1982) did not conclude that artificial B field stimuli were 'ineffective'. They did indeed note other environmental cues, such as celestial features and polarization patterns as mechanisms for influencing orientation, however, their experimental results demonstrated that when the magnetic field was altered, salmon smolts actually changed their orientation 56 degrees from the unaltered orientation.

World Health Organization (2005)

OPT cited the World Health Organization (WHO) (2005) that effects of EMF from subsea cables "does not appear to be significant on electro-sensitive species." There was no mention of marine fauna in the WHO report. The report discussed EMF impacts from transmission lines on human health.

Scottish Executive (2007)

OPT cited the *Scottish Executive* (2007) for its citing of CMACS Report (2005) (which cites the COWRIE 1.5 Report): "Results of research of effects of EMF showed that navigation and migration of Atlantic salmon is not expected to be impacted by the magnetic field produced by an underwater cable." The COWRIE Report 1.5 (Gill et al. 2005) included a summary of industry reports which generally did not show there would be negative impacts to salmon. However, COWRIE authors include Atlantic salmon as a priority species, warranting further investigation of EMF impacts because of their utilization of nearshore waters. They note that an impact on magnetic sensing species

could be trivial (change in swimming direction) or serious (delay in migration), depending on the magnitude and persistence of the magnetic field. They also discuss possible encounters with E fields during critical periods or life stages when they are dependent on electric cues to detect benthic prey and mates, predators, or migratory routes.

Literature cited in this letter not included in the EA

Gill, A.B., Huang, Y., Gloyne-Philips, I., Metcalfe, J., Quayle, V., Spencer, J. & Wearmouth, V. (2009). COWRIE 2.0 Electromagnetic Fields (EMF) Phase 2:EMF-sensitive fish response to EM emissions from sub-sea electricity cables of the type used by the offshore renewable energy industry.Commissioned by COWRIE Ltd (project reference COWRIE-EMF-1-06). www.offshorewind.co.uk

Popper, A.N. and Hastings, M.C. (2009). The effects of human-generated sound on fish. Integrative Zoology; 4: 43-52.

Pacific Fishery Management Council

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Donald K. Hansen, Chairman — Donald O. McIsaac, Executive Director

November 21, 2007

Ms. Kimberly D. Bose, Secretary
Federal Energy Regulatory Commission
888 First Street NE
Washington, D.C. 20426

Michael Murphy
Director of Renewable Energy - Alternative Technologies
Devine Tarbell & Associates, Inc.
970 Baxter Blvd.
Portland, ME 04103

Re: Reedsport OPT Wave Energy Park (FERC No. 12713)

Dear Secretary Bose and Mr. Murphy:

The Pacific Fishery Management Council (Council) is one of eight regional fishery management councils established by the Magnuson-Stevens Fishery Conservation and Management Act (MSA) of 1976, 16 USC 1801et seq. The Council manages fisheries in the Exclusive Economic Zone off the States of California, Oregon, and Washington, working closely with relevant state and tribal governments to coordinate sound fisheries and habitat management practices. Off the Pacific Coast, the Council has prepared federal fishery management plans for salmon (five species); groundfish (more than 80 species), coastal pelagic species (eight species); and highly migratory species (12 species). These fishery management plans have been implemented through federal regulations issued by the National Marine Fisheries Service (NMFS), National Oceanic and Atmospheric Administration (NOAA), and U.S. Department of Commerce.

The Council is aware that several preliminary permit applications to install wave energy facilities off Oregon have been filed with the Federal Energy Regulatory Commission (FERC). While the Council recognizes the need to conserve existing energy resources and find innovative solutions for renewable energy, it is concerned that this new technology be developed appropriately with regard to fishery resources. The Council is not opposed to hydrokinetic energy projects or other energy development *per se*, but as fishery resource managers, we wish to ensure that any development proposal that might impact fish, their habitat, or fisheries is assessed appropriately to minimize adverse impacts. In this regard, the Council wishes to engage early in FERC's development of a wave energy licensing program to help ensure a thorough review process and realistic timeline for addressing adverse impacts to Council-managed species and marine habitats.

The Reedsport Ocean Power Technologies (OPT) Wave Energy Project (FERC Preliminary Application Document No. 12713) is one of the first long-term license application processes for a wave energy project in the United States, and is likely to set a precedent for wave energy projects elsewhere in the U.S. Therefore, it is particularly important that this project be carefully planned and executed. The comments provided below are directed to the Reedsport project, but are applicable to any wave energy project proposed off the West Coast.

The Council has a responsibility to comment on such projects when there may be impacts to fish habitat. Under the MSA, each fishery management plan prepared by the Council must describe and identify essential fish habitat (EFH), minimize to the extent practicable adverse effects on such habitat caused by fishing, and identify other actions to encourage the conservation and enhancement of such habitat. "Essential fish habitat" is defined as "those waters and substrate necessary to fish for spawning, breeding, feeding or growth to maturity." Furthermore, the MSA *requires* the Council to comment on and make recommendations to FERC concerning any activity that, in the Council's view, is likely to substantially affect the habitat, including the EFH, of an anadromous fishery resource under its authority. The Pacific Council *may* comment and make recommendations to FERC on actions that may affect the habitat, including EFH, of any non-anadromous fishery resource under its authority.

Additionally, the Council is moving towards ecosystem-based fishery management planning, as per the newly reauthorized MSA. Through such an approach, management decisions will include relationships of fish stocks with predators, prey and competitors; the effects of oceanographic and climate conditions on populations and communities; and the effects of fishing and other anthropogenic activities on habitats.

In accordance with these responsibilities, we offer the following comments on the Reedsport wave energy project.

1) Precautionary Approach: The Council recommends that FERC take a precautionary approach with the development of this new technology. Location and design criteria should avoid unnecessary risks until more is known about the impacts of this technology and which wave energy design will yield the least environmental risk. We request that FERC seek to site this project, and other wave energy projects, in less biologically rich or sensitive areas.

2) Scale of Projects and Cumulative Effects: The scale at which wave energy projects are being considered in the Pacific Northwest, with essentially no knowledge of their effects on marine species and the environment, is of great concern to the Council. Not enough testing of wave energy technology has occurred to allow us to understand the impacts of even a single project; yet several entities have submitted preliminary permit applications encompassing a large percentage of the nearshore marine environment. Multiple wave projects distributed along the coast could disturb species whose migration through or within these areas is a key biological requirement. Additionally, the cumulative effects of multiple projects on marine animals and habitats are unknown. A large number of projects could compromise healthy ecosystems, and should be evaluated at a regional ecosystem scale before projects are installed.

3) *Impacts to Fisheries and Species:* Access to wave energy parks will likely be limited for reasons of safety and liability, and as a consequence, fishing is likely to be prohibited in these areas. Fisheries in the Reedsport area include commercial nearshore hook and line, recreational salmon, recreational bottom fish, and commercial Dungeness crab. These fisheries involve both state- and federally-managed species. Spatial data for most of these fisheries is lacking, making it difficult to estimate the economic impact that this stage of the Reedsport project, and expanded or subsequent wave energy projects, will have on the local fishing industry. Potential impacts include reduction in total fishing effort, lost productivity (economic impact), and displacement of fishing effort to areas outside the closure area. Displaced fishers will likely concentrate their efforts on areas immediately outside the wave park boundary, resulting in increased pressure on fish, crab and habitat in those areas. These indirect yet profound changes should be included in the project's assessed impacts.

To address economic impacts on the fishing community, the Council encourages wave energy developers to work with fishery sectors to identify important fishing areas and to minimize the placement of wave energy facilities in these areas. In addition, potential economic losses should be estimated as part of this and future applications.

The specific location of wave energy facilities will have the potential to differentially impact commercial and recreational fishing fleets that target fishing grounds at variable distance from safe harbors and from shore (e.g., day boats vs. trip boats). It is essential that the social and economic effects of these aspects of the fisheries be considered and that stakeholders within the fishing industry participate in the process.

It is not clear if the Reedsport project intends to consider all marine species in its studies of environmental effects. While species or stocks protected under the Endangered Species Act (ESA) or Marine Mammal Protection Act require special consideration, the project should also examine impacts to overfished stocks as well as species with specialized or unique ecological requirements (e.g., green sturgeon).

4) Essential Fish Habitat Information is Inadequate as Baseline Data: The Preliminary Application Document (PAD) for the Reedsport project suggests that EFH designations could be used as the basis for assessing impacts from wave energy projects on fish species and their habitat. While EFH does define the environmental parameters (depth, temperature, latitude, substrate type, etc.) that support the various life stages of a species, EFH does not define where a species actually exists or the relative value of one area over another. EFH alone cannot be used to determine impacts on fish species. It will be necessary for the applicant to conduct *in situ* baseline studies within the proposed project area to characterize the species community and determine relative importance of local habitats. Baseline studies should be conducted prior to a final decision on site location to minimize unnecessary impacts, and prior to project construction.

5) Overall Footprint of the Reedsport Project: The Council is concerned about the size and location of the proposed Reedsport project and the effect this will have on area fisheries. According to the PAD, the Phase II site is proposed to occupy an area of 0.26 sq. mi. within the longer-term, Phase III project area of three miles by one mile. The Council recommends that the

Phase II site (0.26 sq. mi.) be located so as to minimize environmental and fisheries impacts. If this project results in a navigational closure, the smallest area possible should be used. Additionally, in order to minimize the size of the area needed, standards for high energy-efficient turbine design should be implemented, and license conditions should require upgrading facilities within the license period as technology improves. Although not proposed at this time, the Phase III proposal of 200 buoys occupying up to three square miles is of greater concern to the Council and will require a more in-depth review process.

Additional comments on project management and environmental concerns are summarized below and provided with more detail in Appendix A.

The Council recommends specific project development and management requirements related to:

- Baseline studies on biological and physical characteristics
- A site-specific monitoring plan
- Addressing cumulative impacts from multiple projects
- Efforts to minimize emissions from electro-magnetic, acoustic and light sources
- Adaptive management conditions
- A decommissioning plan

The Council provides comments on concerns related to:

- Alteration in species composition and abundance in and around the project area, including trophic level impacts
- Electromagnetic fields
- Acoustical effects
- Collision, entanglement and entrapment
- Seafloor scouring
- Project site location
- Habitat alterations
- Effects on spawning habitat
- Areas of concentrated prey species
- Changes to habitat quality
- Physical dynamics of habitat displacement
- Release of toxins and chemicals

Knowledge of potential impacts of this technology is rapidly developing. Oregon State University's Hatfield Marine Science Center recently hosted a scientific forum of 50 scientists to consider the range of potential environmental impacts of wave energy (http://hmsc.oregonstate.edu/waveenergy/index.html). We hope the Council's comments are helpful to FERC in developing this new licensing program and that a wave energy program takes advantage of the collective wisdom of the scientists and resource managers.

Sincerely,

D. O. McIsaac, Ph.D.
Executive Director

JDG:kam

cc: Council Members
Habitat Committee
Mr. John DeVore
Mr. Chuck Tracy
Ms. Heather Brandon
Mr. Jim Seger
Dr. Kit Dahl
Mr. Merrick Burden
Ms. Jennifer Gilden
FERC Service List for Docket P-12713

APPENDIX

Project Development and Management

a. Baseline biological and physical data

In the context of living marine organisms and dynamic environments, "baseline" is not a static point in time, but rather a "trend analysis" that takes into account natural variability, both temporal and spatial. Baseline information on the biological and habitat resources at the project site allows for a) characterization of species community, diversity, and abundance and habitat; and b) a benchmark on which to monitor and measure short- and long-term effects of wave energy structures on natural resources. Additionally, features such as current convergence zones, migration corridors, spawning and settlement aggregations, and other essential habitat factors that are unique or specific to the project area should be identified. Baseline information for reference or control areas is also needed. To account for changing climatic conditions, El Nino/La Nina weather patterns, hypoxia events, and other annual environmental variables, baseline data are needed over a five-year period.

Baseline information of particular interest to the Council includes:

1) Characterization of the substrate
2) Characterization of the benthic and epibenthic invertebrate communities on which several Council-managed species prey
3) Characterization of the entire fish community, including forage species during spring, summer and winter to account for seasonal migration patterns

b. Site-Specific Monitoring Plan to monitor changes to the biological and physical environment

As there are no other full-scale wave energy projects in the U.S. on which to gauge environmental impacts, a comprehensive monitoring plan is needed for the Reedsport project. This plan could serve as a template for subsequent project as well. The monitoring plan should be developed in coordination with state and federal regulatory agencies. The monitoring plan should also include a requirement for monitoring following decommissioning, should that occur.

c. Determine and manage for cumulative impacts of multiple projects

The cumulative impacts of multiple wave energy projects along the coast are unknown. Factors such as size, spacing, spatial relationship to littoral drift, currents, etc. may have unforeseen impacts on the overall dynamics of the nearshore environment. Cumulative impact studies should be developed as part of a larger, regional wave energy program, incorporating expertise in the fields of physical and biological oceanography, marine geology, marine ecology and fisheries.

d. Establish industry standards for construction of wave energy devises to minimize emissions from electro-magnetic, acoustic and light sources

Standards should be established for construction of all wave energy devices to minimize electromagnetic, acoustic and light emissions in order to reduce exposure of susceptible marine species to such impacts. Such a standard protocol could minimize or eliminate the need to evaluate their utility with each new wave energy proposal.

e. License condition requiring adaptive management

As wave energy technology is relatively new and will continue to evolve with studies and advances in technology, environmental impacts remain unpredictable. To best manage wave energy projects for unforeseen impacts, a management and monitoring plan should be responsive, flexible, and adaptive to ensure that necessary safeguards for the marine environment are put in place as needed. In practice, this could include modifying existing equipment where demonstrated impacts are unacceptable or may be reduced. Adaptive management could also mean minimizing the size of the project footprint, if results can be achieved operationally in a smaller area.

f. License condition requiring project curtailment and/or decommissioning

If adaptation is unsuccessful, if ESA-listed species or sensitive species are taken, or if habitat impacts are beyond those anticipated, the project should be curtailed or decommissioned. Thresholds for such impacts should be set up front, before project implementation. Given the lack of knowledge about impacts of wave energy projects, a condition of impact review and mandatory consultation and response on at least a five-year basis during the license period should be included.

Impacts to Species and Habitat:

Species Concerns

a. Alteration in species composition and abundance in and around the project area

The installation of buoys, anchors and associated structures will add hard substrate to an otherwise uniform sandy environment, and could attract an entire community of rocky reef fishes and invertebrate species not normally present. The ecological consequences of such installations are unknown, but could include displacement of resident fishes. Another consideration is the potential increase in seabird and marine mammal activity in response to concentrations of prey organisms, and increased risk for collisions with structures while diving and swimming. As stated previously, it is necessary to establish the natural, baseline population to determine the relative habitat value of the area and to monitor changes throughout the permit period.

One particular concern is the survivability of salmonid smolts as they leave the Umpqua river estuary. Would wave energy devices alter current patterns such that prey species are affected? Another concern is for green sturgeon spawning in Rogue River and Klamath Rivers as they migrate along a narrow mid-shelf bathymetric corridor.

b. Electromagnetic fields

Electromagnetic fields (EMF) may impact organisms such as elasmobranchs, sea turtles, and marine mammals that use electric and/or magnetic senses in detecting predators and prey, orientating to ocean currents, and sensing their magnetic compass headings. Information on EMF emanating from wave buoys is lacking. Studies would be needed to evaluate the impacts of EMF on these species and evaluate the effectiveness of any device installed to minimize impacts.

c. Acoustics:

Fish and seabirds are highly sensitive to sound, and marine mammals use sound for communication and detection of prey. Sounds and vibrations created by movements of the structure above and below the water surface, along with acoustic guidance devices that may be deployed to direct marine mammals around the array, could disturb or displace fish, diving seabirds and mammals. Studies are needed to determine specific acoustic signatures of OPT's devices and site-specific ambient transmissions.

d. Collision, entanglement and entrapment:

All mobile marine animals are susceptible to collision, entanglement and entrapment. Assessment of these impacts would be necessary during and after construction, and modifications to the structural design may be necessary to reduce observed impacts.

Habitat Concerns

a. Project site location:

Wave projects should not be sited in or near areas that are known to be important ecological habitats (e.g., rare, sensitive, vulnerable).

b. Habitat alterations:

Artificial structure (i.e., fish aggregating devices) in what appears to be an otherwise uniform sand environment. Effects on species are noted above under Species Concerns (a).

c. Effects on spawning habitat:

It is unknown if the proposed area is located in fish spawning habitat. Changes in habitat dynamics, including current dynamics and sand movement, could have negative impacts on spawning success.

d. Areas with high concentrations of prey:

The nearshore area off Oregon is known is a highly productive area supporting high primary (plant) and secondary (zooplankton) production, as well as forage species (e.g., smelts and sandlance). Any loss of or disruption to this important forage area could have significant impacts on ecosystem productivity.

e. Changes to habitat quality:

Grain size, homogeneity, and amount of organic material in the sediment contribute to defining a habitat. These characteristics are likely to change as energy is removed from the wave train and finer sediments are deposited.

f. Physical dynamics of habitat displacement:

Wave energy facilities placed in the dynamic, nearshore environment may affect ocean currents, littoral drift, and beach accretion and erosion. ESA-listed Snowy plovers nest on beaches adjacent to the proposed project area. This critical habitat could be affected by changes in accretion or erosion. A model of the physical effects would help to identify potential impacts to species and to design impact avoidance measures or, if warranted, to develop species impact studies.

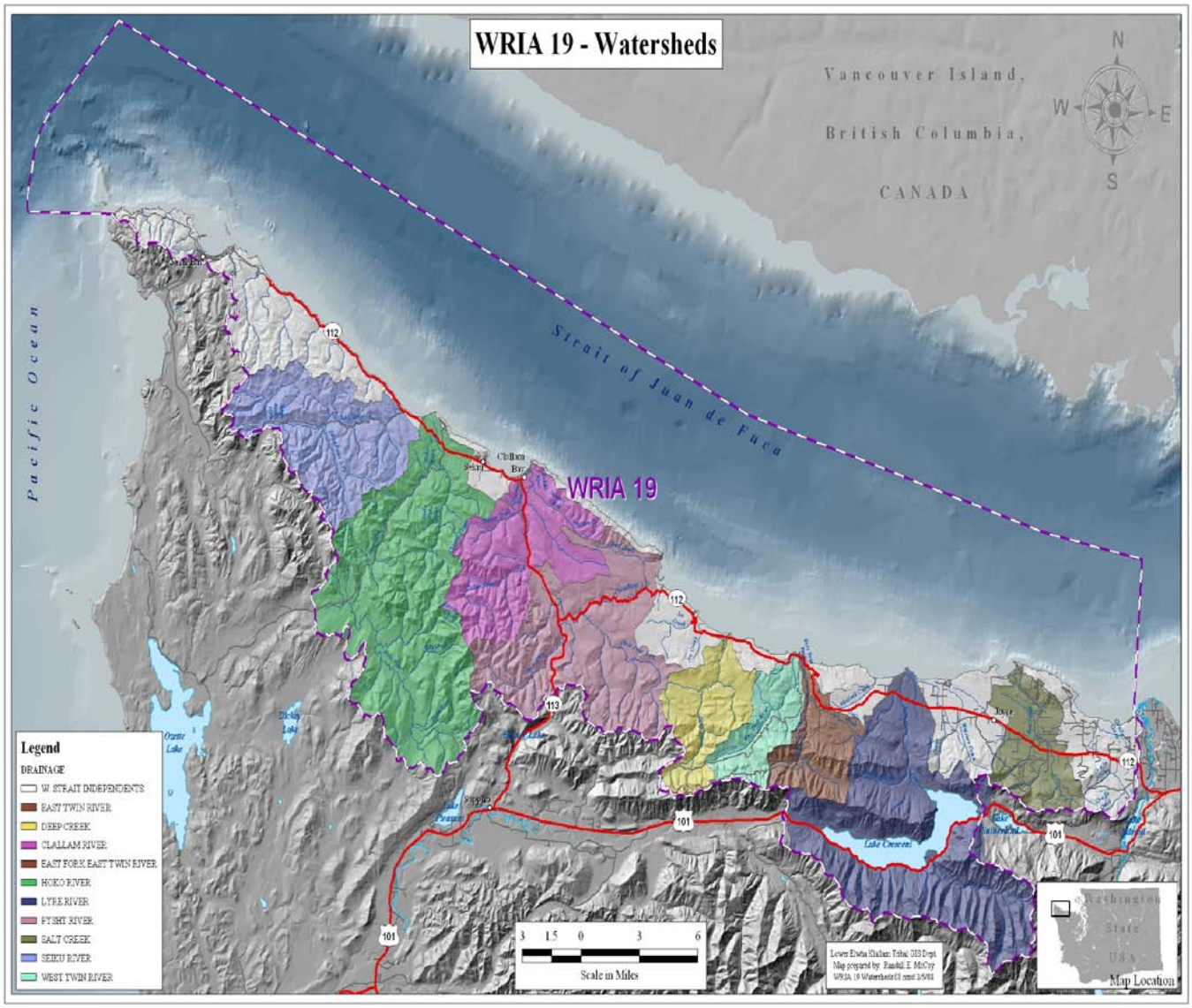
g. Toxins and chemicals:

The release of anti-fouling agents, chemical byproducts from the manufacture of project components, and chemicals associated with operation could contaminate habitat and impact species.

Habitat Committee Report on Western Strait of Juan de Fuca (WSJF)
Coho Overfishing Concern

"Essential fish habitat means those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity."

Magnuson-Stevens Act § 3



Executive Summary

In 2005, 2006, 2007, and 2008 the Western Strait of Juan de Fuca (WSJF) stock of coho salmon fell short of its conservation objective of 11,900 natural spawners despite a preseason expectation that the conservation objective would be met. This review of essential fish habitat (EFH) relevant to Western Straits of Juan de Fuca (WSJF) coho was initiated by three consecutive failures of spawning recruitment for this coho stock. The Pacific Fisheries Management Council (Council) Salmon Technical Team (STT) has determined that harvest mortality was insufficient to have caused the spawning recruitment failure. Consequently, a review of EFH is appropriate to determine which non-fishing factors caused or contributed to the failure. The salmon fishery management plan (FMP) Amendment 14 on EFH requires the Council to make recommendations to correct non-fishing factors affecting salmon survival.

Accordingly, this report contains recommendations from the Habitat Committee for the Council's consideration. The HC focused on the specific physical and biological processes that may have contributed to reduced survivorship at different life stages, as well as a review of current regulatory mechanisms in place to minimize cumulative impacts to EFH imposed by current land use practices.

Ocean Condition

Local oceanic conditions during the first year of ocean rearing factored prominently in the low survivorship for WSJF coho returns in 2005-2008. While no specific research has been directed at WSJF coho survivorship during marine residence in the Strait of Juan de Fuca (SJF), inferences can be made from the substantial work surrounding West Coast Vancouver Island (WCVI) Coho and Chinook populations. It found that local oceanic conditions during the first year of ocean rearing factored prominently in the low survivorship for WSJF coho returns in 2005-2008. This report reviews the evidence for such impacts.

Freshwater Condition

Altered flow patterns (hydrological regime) in some drainage basins within the WSJF contributed to the decline of coho escapement from 2005-2008. Due, in part, to local land use practices that have highly altered the natural landscape in the WSJF. Higher peak flows and extended periods of reduced base flow condition likely contributed to reduced survivorship from egg to emergence (increased bed mobilization) and influenced overall fitness of rearing juveniles (reduced habitat availability). The following occurred:

- Results from the intensively monitored watershed (IMW) study of three WSJF drainage basins indicate that this altered hydrology contributed to the early entry and extended residence of coho smolts in the Straits, at a time when there is low food availability and increased predation risk during RY05-08.

- Optimal freshwater rearing conditions for WSJF coho, as identified by Physical Habitat Simulation (PHABSIM) modeling, were rarely met across the WSJF, but were substantially less in several major drainages. The worst conditions were found in the

Clallam River with 5% and 3% of optimal coho rearing condition for RY07 and RY08, Sekiu River was 40% for RY08, and Salt creek at 11% and 8% for RY07 and 08.

- Increased turbidity, due partly from road related runoff and poor management practices can adversely affect overall fitness, foraging success, and growth rate of rearing freshwater coho. In the Hoko River, the largest drainage in WSJF, turbidity exceeded levels where coho foraging is completely inhibited on 72, 43, and 46 days during freshwater residence of the RY05-08 coho populations, respectively.

Existing Regulatory Framework

The cumulative impacts of local land use practices and the failure of regulatory mechanisms to ensure full fishery resource protection likely contributed to this failure. While difficult to quantify in terms of freshwater survival rates, or separate out the impacts during these years of interest, as compared to other years, these impacts are the most ubiquitous in the WSJF and play a large role in the overall health of the WSJF Coho population.

- The WSJF is dominated by commercial forestry (27% - 98% by watershed), much of which is regulated through the state's forest practice rules (Title 222 WAC). Though regulated under the state's forest practice rules, a recent evaluation by the Washington Department of Ecology (WDOE, 2009) for their effectiveness in bringing waters into compliance with state surface water quality standards is cause for concern. The Department found that the forest practices program lacked data that demonstrated whether current forest practice activities (such as timber harvest, road construction and maintenance, and fish passage barrier corrections) are improving conditions that will meet current state water quality standards. Furthermore, the department concluded, "After ten years, no studies have been completed or data collected that provide an indication of whether or not the forest practices rules are improving water quality or maintaining forested waters in compliance with the water quality standards. Similarly, data is lacking with which to conduct a thorough analysis of how effective operational and enforcement programs are in applying the forest practices rules."

- Washington Department of Fish and Wildlife (WDFW) conducted a pilot study in 2006 of compliance, implementation, and effectiveness of their Hydraulic Permit Approval (HPA) program including the WSJF area. This program, which issues permits for culverts and assures their proper design and function, is the primary mechanism used to ensure conditions necessary for coho passage (for both upstream and downstream migrating fish). The department concluded that "…the HPA program currently protects fish and fish habitat in large measure, and without the HPA program, we would see substantially more loss of fish life or habitat associated with the 4,000 projects permitted annually. However, they found that the agency's goal of achieving no net loss of habitat function and values is difficult to attain solely through the HPA permit process".

Outlook for future WSJF Coho runs may improve due to the following:

1. Marine survival indices including cooler sea surface temperatures and higher productivity of zooplankton prey in 2007 and 2008 suggest that conditions in the WSJF have improved substantially from 2003-2006. The strong relationship between zooplankton abundance and coho marine survival implies food availability for WSJF coho will improve and likely increase the numbers returning to spawn.

2. While estimates of the total escapement of WSJF RY09 coho have not been developed, early indications are it was a successful year with a large numbers of coho adults returning to spawn. Long term success requires that habitat availability and condition during years of spawner abundance maximize fresh water survival and outmigration.

3. Increase in salmon recovery efforts has led to significant habitat improvements in the WSJF. For instance, in the last few years many projects have successfully re-connected floodplain and estuarine habitat and modified channel morphology to improve riverine habitat complexity. These projects help create conditions that will increase survival through high-flow winter conditions, often a limiting factors for coho. Some examples of projects include :

- Acquisition and protection of Pysht River estuary
- Acquisition and protection of 22.5 acres of Pysht River channel migration zone.
- Engineered Log Jams (ELJs) in mainstem and S.F. Pysht River
- ELJ implementation in Hoko River
- Dike removal in Salt Creek estuary

Essential Fish Habitat Recommendations

1) Support efforts of the WDFW to improve HPA program, specifically the need for increased effectiveness and compliance monitoring of issued permits.

2) Support achievement of WDOE CWA Review milestones related to State of Washington Forest Practice program.

3) Support future restoration efforts in the WSJF that address limiting factors of coho salmon.

Habitat Committee Report on Western Strait of Juan de Fuca (WSJF)
Coho Overfishing Concern

Introduction

This review of essential fish habitat (EFH) relevant to Western Straits of Juan de Fuca (WSJF) coho was initiated by three consecutive failures to achieve the recommended escapement goal. The Pacific Fisheries Management Council (Council) Salmon Technical Team (STT) has determined that harvest mortality was insufficient to have caused the spawning recruitment failure. Consequently, a review of EFH is appropriate to determine which non-fishing factors caused or contributed to the failure. The salmon fishery management plan (FMP) Amendment 14 on EFH requires the Council to make recommendations to correct non-fishing factors affecting salmon survival. Accordingly, this report contains recommendations for the Council's consideration.

Essential Fish Habitat Description

Freshwater Habitat

The Western Strait of Juan de Fuca encompasses waters emptying to the Strait of Juan de Fuca west of the Elwha River, to the tip of Cape Flattery. The WSJF contains 27 salmonid-bearing watersheds that drain directly into the Strait of Juan de Fuca. The largest subbasin within the watershed is the Hoko River, followed by the Lyre, Pysht, Sekiu, and Clallam rivers.

Table 1. Western Strait of Juan de Fuca drainage basin areas (modified from Haggerty 2009).

Watershed	Basin Area (sq. mi.)	Percentage of WSJF
Colville, Whiskey, Field, Murdock, Joe, Jim, Butler, Falls, Olsen, Trettevick, Jansen, Rasmussen, Bullman, and Snow Creeks, Sail River, and Agency, Halfway, and Village Creeks	73.3	19.03
Salt Creek	19.1	4.96
Lyre River	67.9	17.63
East Twin River	13.6	3.53
West Twin River	12.6	3.27
Deep Creek	17.2	4.47
Pysht River	46.3	12.02
Clallam River	31	8.05
Hoko River	71	18.43
Sekiu River	33.2	8.62
Entire WRIA 19 area	385.2	100

The majority of the WSJF drains low elevation hills and mountains with maximum elevations ranging from 2,000 to 3,500 feet. The exception is the Lyre River subbasin, where maximum elevations approach 5,500 feet and a significant portion of the watershed is above 2,500 feet. The Lyre River subbasin is the only subbasin within WRIA 19 that contains alpine meadows and seasonal snow fields (Haggerty 2009). The climate varies widely throughout the WSJF, with higher annual precipitation to the west and at higher elevations (Figure 1).

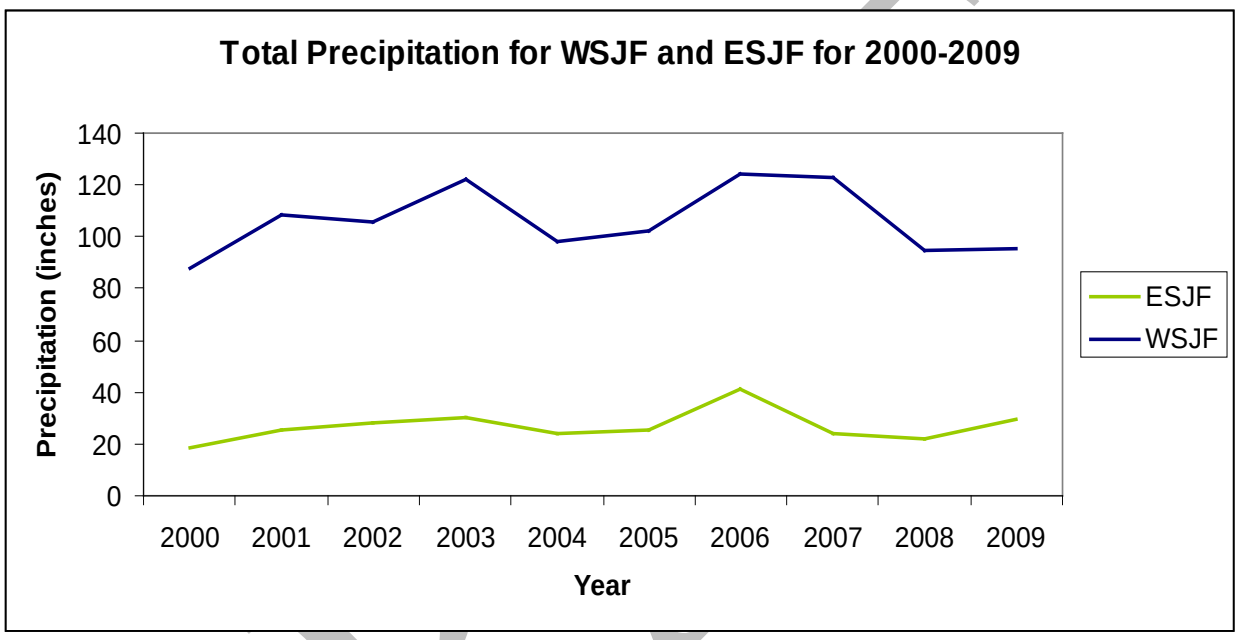


Figure 1. Annual total precipitation for the Strait of Juan de Fuca (PRISM 2010).

The climate as a whole can be characterized as temperate coastal-marine, with mild winters and cool summers. The majority of precipitation falls as rainfall from October through April. The eastern half of the watershed is much drier the western half. For example, the Salt Creek subbasin receives 35-55 inches of precipitation annually (McHenry et al. 2004), where as the Sekiu River subbasin receives 95-120 inches of precipitation annually (Lautz 2001). Subbasins such as the East and West Twin River and Deep Creek have intermediate precipitation levels averaging 75 inches per year (Stoddard 2002). Both the Eastern Strait of Juan de Fuca (ESJF) and WSJF had anomalous precipitation conditions during January and November of 2006 that would have likely had adverse effects on incubating coho during the ReturnYear (RY) 05 and the early run of RY06 (Figure 2). These conditions also would have impacted the rearing juveniles of RY04 and RY05.

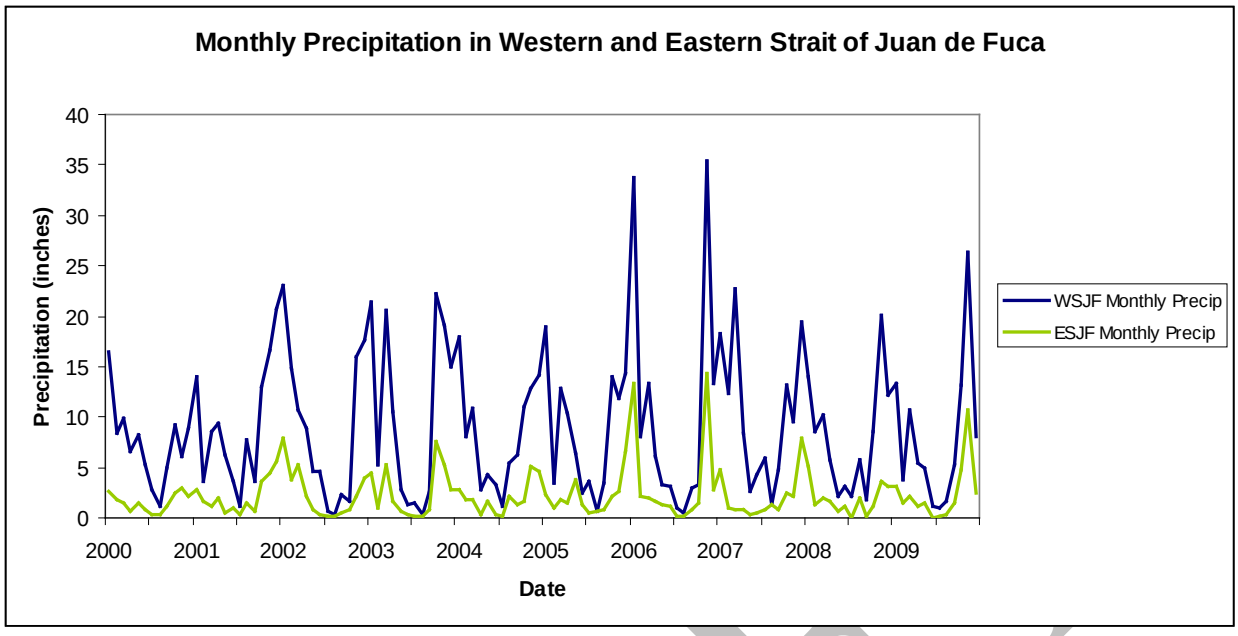


Figure 2. Monthly total precipitation for the Strait of Juan de Fuca (PRISM 2010).

The WSJF is a mix of sedimentary and basaltic volcanic rock types interspersed with glacial deposits. Bedrock units are generally orientated parallel to the Strait of Juan de Fuca, striking northwest in the western portion of the SJF and west-northwest in the eastern half. The rock units are generally youngest nearest the Strait of Juan de Fuca and oldest in the headwaters. Bedrock units are overlain by glacial deposits in many places throughout the watershed, but the most extensive glacial deposits occur closest to the Strait and/or east of the East Twin River. For example, glacial deposits occur across 18% of the watershed area but in the Salt Creek subbasin glacial deposits cover more than 35% of the basin (Haggerty 2009).

Optimal Coho Rearing Conditions (PHABSIM)

The WSJF Instream Flow studies were conducted by EES consulting using the Physical Habitat Simulation (PHABSIM) modeling approach, which is commonly referred to as the U.S. Fish and Wildlife Service Instream Flow Incremental Methodology (IFIM). Whenever feasible, the three-flow regression method was used to hydraulically model flows on the riffles; when necessary to extend the modeling range, the "one velocity-set" method was used to model either upward or downward.

Habitat Suitability Index (HIS) curves for coho life stages were provided by Ecology and WDFW in their most recent instream flow guidelines (WDOE, 2004). All life stages for coho salmon were used in the modeling effort.

Optimal freshwater rearing conditions for WSJF coho were modeled in 2005 (Blum 2005). The modeling effort used Physical Habitat Simulation (PHABSIM) to identify optimal flow conditions that would provide maximum rearing habitat for coho juveniles (Blum 2005). These conditions are rarely met across the WSJF, but were substantially less in several major drainages (Appendix A). The worst conditions were found in the Clallam River with 5% and 3% of

optimal coho rearing condition for RY07 and RY08, Sekiu River was 40% for RY08, and Salt creek at 11% and 8% for RY07 and 08.

Water Quality Conditions (Turbidity)

In 2004 the Makah Tribe installed three continuous turbidity monitoring stations in the Hoko drainage to evaluate long-term trends of suspended sediment and the acute and chronic effects on salmon. Ecology has also installed turbidity monitoring stations in Deep, East, and West Twin rivers in 2006.

Increased turbidity (metric used as a surrogate for suspended sediment) due partly from road related runoff and poor management practices can adversely affect overall fitness, foraging success (Barrett et al. 1992; Sweka and Hartman 2001a), and growth rate (Shaw and Richardson 2001; Sweka and Hartman 2001b) of rearing freshwater coho. Recent research suggests that turbid conditions above 100 Nepholometric Turbidity Units (NTU) can reduce foraging success while conditions over 400 NTU inhibit foraging completely for coho salmon (Harvey and White 2008). In the Hoko River, largest drainage in WSJF, turbidity exceeded 400 NTUs on 72, 43, and 46 days during freshwater residence of the RY05-08 coho populations, respectively (Makah Tribe unpublished report).

Washington Department of Ecology Clean Water Act Assurance Review

Land use in the WSJF is dominated by commercial forestry which is regulated through the State of Washington Forest Practices Act. The Forest Practice Board is tasked with utilizing science-based recommendations from the Adaptive Management program to inform necessary rule changes to the Forest Practice rules.

The Adaptive Management program was created to provide science-based recommendations and technical information to assist the Forest Practices Board in determining if and when it is necessary or advisable to adjust rules and guidance for aquatic resources to achieve the resource goals and objectives of the Forests and Fish Report. The Forest Practices Board may also use this program to adjust other rules and guidance. There are three desired outcomes:

- Certainty of change as needed to protect targeted resources;
- Predictability and stability of the process of change so that landowners, regulators and interested members of the public can anticipate and prepare for change;
- Application of quality controls to study design and execution and to the interpreted results.

The Forest Practices Adaptive Management Program is a multi-caucus program that includes representatives from state departments (including Fish and Wildlife, Ecology, and Natural Resources), federal agencies (particularly National Marine Fisheries Service, U.S. Fish and Wildlife Service, and Environmental Protection Agency), forest landowners, county governments, the environmental community, and tribal governments.

Representatives of these caucuses participate on two key Adaptive Management Program committees established by the Forest Practices Board: the Forests and Fish Policy Committee (Policy) and the Cooperative Monitoring, Evaluation, and Research Committee (CMER). The function of Policy is to develop solutions to issues that arise in the Forest Practices Program. These issues may be raised by science reports on rule or program effectiveness or policy questions on implementation of forest practices. Solutions may include the preparation of rule amendments and/or guidance recommendations. The purpose of CMER is to advance the science needed to support adaptive management.

Under Washington state law (Chapter 90.48 RCW) forest practice rules are to be developed so as to achieve compliance with state water quality standards and the federal Clean Water Act (CWA). The Department of Ecology (Ecology) has been designated as the state water pollution control agency for all purposes of the CWA, and has been directed to take all action necessary to meet the requirements of that Act. The Clean Water Act Assurances (CWA assurances) granted by Ecology in 1999 as part of the Forest and Fish Report (FFR) expired June 30, 2009. The assurances established that the state's forest practices rules and programs, as updated through a formal adaptive management program, would be used as the primary mechanism for bringing and maintaining forested watersheds into compliance with the state water quality standards.

The CWA Assurances review completed by Ecology summarizes the findings on the progress the state's forest practices program is making in bringing waters into compliance with state surface water quality standards (Chapter 173-201A WAC) and the federal Clean Water Act. This review is being used as the basis for determining whether or not to extend the CWA assurances into the future.

The Department found that the forest practices program lacked data that demonstrated whether current forest practice activities (such as timber harvest, road construction and maintenance, and fish passage barrier corrections) are improving conditions that will meet current state water quality standards. Furthermore, the department concluded, "After ten years, no studies have been completed or data collected that provide an indication of whether or not the forest practices rules are improving water quality or maintaining forested waters in compliance with the water quality standards. Similarly, data is lacking with which to conduct a thorough analysis of how effective operational and enforcement programs are in applying the forest practices rules." (WDOE 2009).

Washington Department of Fish and Wildlife HPA Program

The state Legislature gave the Department of Fish and Wildlife the responsibility of preserving, protecting, and perpetuating all fish and shellfish resources of the state. To assist in achieving that goal, the state Legislature in 1943 passed a state law now known as the "Hydraulic Code" (Chapter 77.55 RCW). Although the law has been amended occasionally since it was originally enacted, the basic authority has been retained.

The law requires that any person, organization, or government agency wishing to conduct any construction activity that will use, divert, obstruct, or change the natural flow or bed of state waters must do so under the terms of a permit (called the Hydraulic Project Approval-HPA)

issued by the Washington Department of Fish and Wildlife. State waters include all marine waters and fresh waters of the state, except those watercourses that are entirely artificial, such as irrigation ditches, canals and storm water run-off devices.

Damage or loss of fish and shellfish habitat results in direct loss of fish and shellfish production. The enactment of Chapter 77.55 RCW was recognition by the state Legislature that virtually any construction or work that affects the bed or flow of the waters of the state has the potential to cause habitat damage. The law's purpose is to see that needed construction or work is done in a manner to prevent damage to the state's fish, shellfish, and their habitat. By applying for and following the provisions of the HPA issued under Chapter 77.55 RCW, most construction activities and work that affect the bed or flow of state waters can be allowed with little or no adverse impact on fish or shellfish.

The major types of activities in freshwater requiring an HPA include, but are not limited to: stream bank protection; construction or repair of bridges, piers, and docks; pile driving; channel change or realignment; conduit (pipeline) crossing; culvert installation; dredging; gravel removal; pond construction; placement of outfall structures; log, log jam, or debris removal; installation or maintenance of water diversions; and mineral prospecting.

Major saltwater activities requiring an HPA include, but are not limited to: construction of bulkheads, fills, boat launches, piers, dry docks, artificial reefs, dock floats, and marinas; placement of utility lines; pile driving; and dredging.

It is important to emphasize that the above are only examples of major types of activities requiring an HPA and that any construction activity or work that uses, diverts, changes, or obstructs the bed or flow of state waters requires an HPA.

In 2006, Washington Department of Fish and Wildlife (WDFW) Region 6 completed a pilot study of compliance, implementation, and effectiveness of their Hydraulic Permit Approval (HPA) program. Region 6 includes all of the WSJF, thus these findings are readily applicable. Permits were appropriately conditioned for culvert size in 91% of projects, culvert slope in 64% of projects, and replenishing channel substrate inside the culvert in only 20% of projects. Permit applicants complied with the above conditions 38%, 57%, and 100% of the cases, respectively. The implementation success of these activities was uniform across all activities at 50% (WDFW 2007). The department concluded that "…the HPA program currently protects fish and fish habitat in large measure, and without the HPA program, we would see substantially more loss of fish life or habitat associated with the 4,000 projects permitted annually. However, the agency's goal of achieving no net loss of habitat function and values (WDFW POL-M5002) is difficult to attain solely through the HPA permit process" (WDFW 2007).

A more recently completed study showed that 30% of HPA permits issued to ensure fish passage resulted in barriers in relatively short time frames, and that some culvert design types may have performed more poorly than others (e.g., no-slope designs resulted in barriers in 45% of projects) (Price et al., 2010).

Nearshore

There is roughly 75.14 miles of shoreline beginning just west of the Elwha River out to Cape Flattery in Neah Bay. Along this shoreline are 19 stream-delta habitat complexes that vary in size and habitat composition (tidal marsh, tidal wetland, spits, etc) and range in degree of habitat alteration (Todd et al. 2006).

Most of these complexes west of the Pysht River are limited in natural habitat complexity, having little tidal marsh habitat nor significant channel networks. The mouths of these rivers (Hoko, Sekiu, and Clallam) tend to be completely exposed to high wave energy and seasonally will close off due to littoral sediment drift and low base flow conditions during the summer and early fall (Todd et al. 2006).

The two largest estuarine complexes along the WSJF are the Pysht River and Salt Creek. Both estuaries have spit features and include substantial tidal marsh areas. At least half of the Pysht Estuary tidal marsh has been altered or converted to an upland vegetation type (Figure 3).

Figure 3. Pysht River estuary (WDNR 1995 photo; taken from Todd et al. 2006).

The Hoko river, largest drainage throughout the WSJF, has also seen significant alteration along the nearshore (Figure 4). The lower reach of the mainstem river is hypothesized to have been anthropogenically altered sometime between 1920 and 1940. The channelization of this lower meander would have been done as a "deliberate management decision to more efficiently transport logs through a significantly shorter and less sinuous reach of channel" (Todd et al. 2006).

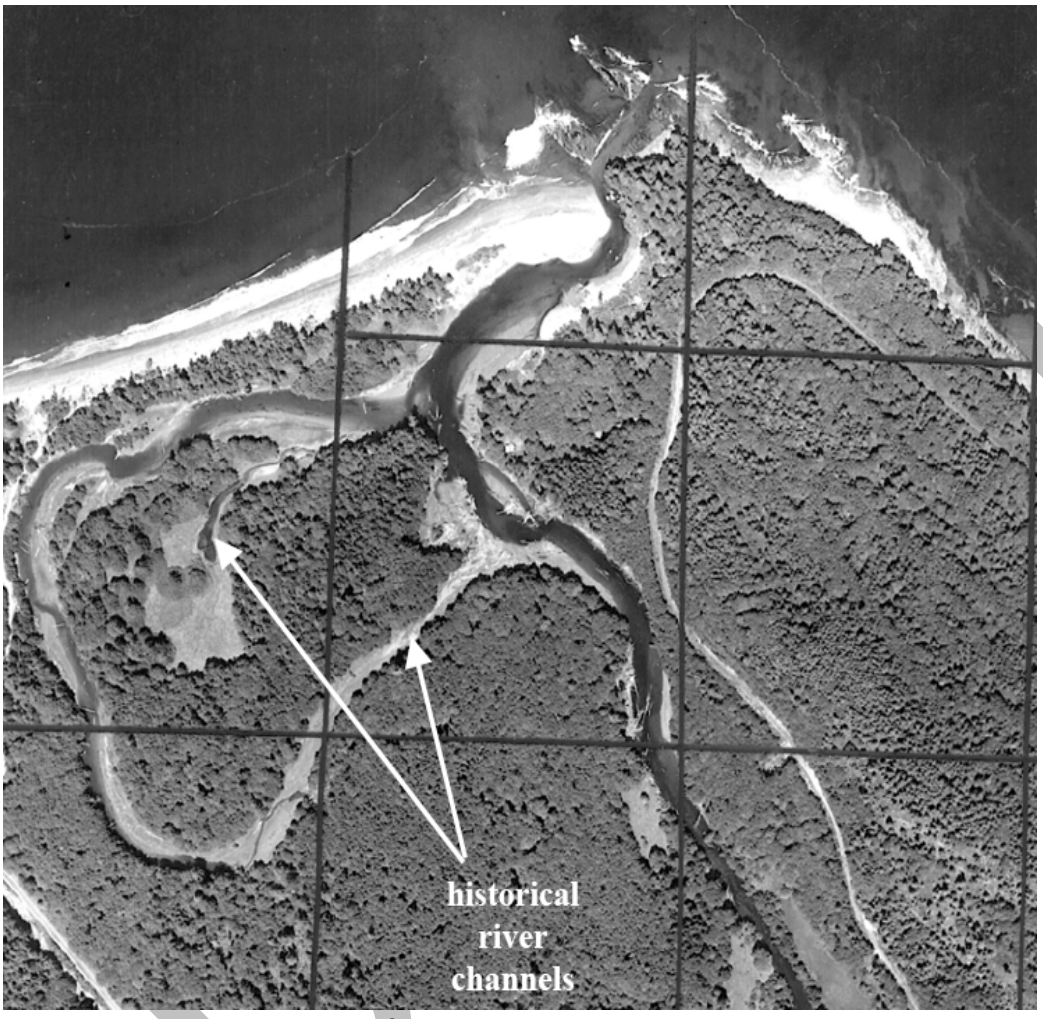


Figure 4. 1957 Aerial photo of the Hoko River mouth.

An additional modification to the nearshore is the roughly eleven miles of shoreline that is armored to protect Highway 112. The armoring extends from the east end of the Makah reservation to the Sekiu River. Impacts from this highway include potential destabilization of shoreline sediment sources and increases in landslide activity (Todd et al. 2006).

Intensively Monitored Watersheds (IMW)

The Intensively Monitored Watershed project is a joint effort of the Washington Departments of Fish and Wildlife and Ecology, NOAA Fisheries, EPA, Lower Elwha Klallam Tribe and Weyerhaeuser Company and is financially supported by the Washington Salmon Recovery Funding Board. The premise of the IMW project is that the complex relationships controlling

salmon response to habitat conditions can best be understood by concentrating monitoring and research efforts at a few locations. Focusing efforts on a few locations, including drainages in the WSJF, allows enough data on physical and biological attributes of systems to be collected to allow the detection of the effects of restoration treatments on salmon production.

Coho utilization of nearshore habitat in the WSJF is not well understood. Only recent research (2005-2010) efforts have targeted the WSJF nearshore, and only indirectly focused on coho salmon. PIT tag data from coho salmon in the WSJF Intensively Monitored Watersheds (IMW) indicate that emigrating smolt move along the nearshore environment and re-enter freshwater habitat in adjacent drainages (Roni et al 2009). Tagged coho from the East and West Twin rivers were found to move between drainages in every year during the tagging study (2005-2009). In an effort to evaluate the spatial extent of this movement, PIT tag antennaes are proposed for Deep Creek, a drainage west of the East and West Twin rivers.

Subyearling coho emigrated from natal drainages as early as October. For example, peak emigration of Return Year (RY) 08 E/W Twin river juveniles occurred on November 6th, 2006 coinciding with the fifth largest recorded flood event since 1974. Of the 69 tagged adults that returned in RY07 and RY08, few have been adults from the fall emigrants (Roni et al. 2009), raising concerns regarding early entry and extended residence in the straits, especially with regard to food availability and increased predation risk.
In a broader study of WSJF nearshore utilization, RY08 Chinook smolts were collected from numerous nearshore habitats and found to be genetically linked to distant regional populations. Specifically, a genetic sub-sample of the Chinook smolts were found to be of Columbia River (48%) and Puget Sound (44%) origin. The remaining samples originated from the Washington Coast and Klamath River Reporting Groups (Kassler and Warheit, 2008). These findings illustrate the importance of WSJF nearshore habitat not only to local salmon populations, but to those populations moving throughout the region.

Ocean Conditions

The literature set for marine EFH and ecosystem studies is extensive. Much of the literature focuses on the relationship of OPI coho to the marine ecosystem. Logerwell et al (2003) showed significant relationships between survival to adults and pre-smolt winter sea surface temperatures, Spring transition date to upwelling ocean conditions, first ocean spring/summer ocean conditions (sea level), and first winter sea surface temperatures. Logerwell et al (2003) point out that these elements are independent. Good or exceptional survival brood years will experience most or all of these criteria in their favorable phase.

Hickey (2008) discusses the differences in productivity of the northern end of the California Current System and concludes there is a five-fold increase in average coastal chlorophyll concentration from Northern California to Southern Vancouver Island.

Ocean year 2005 saw poor conditions for salmon production. The ONI values averaged 0.4 from April to July (weakly warm), and downwelling occurred with southerly winds in mid-July. Hickey reports that productivity, as measured by chlorophyll, remained higher in the Northern

end of the California Current during this event. Brood year 2003 Western Straits Coho, if they went straight west, experienced this set of ocean conditions.

The Canadian Department of Fisheries and Oceans Science Advisory Secretariat reports on the state of the Pacific Ocean provide graphs of copepod and euphasiid abundance for southern Vancouver Island (CDFO 2009). This information coupled with the methods of Logerwell (2003) provide a basis for predicting, or explaining as is the case for this review, marine survival of coho.

Strong predictive capabilities are found between the relationship of specific zooplankton species that require "cool" sea surface temperature (SST) and juvenile salmon survival rates. A marine survival index has been developed that related SST and zooplankton abundance to survival rates of several juvenile salmon species (State of the Ocean Report, SAS 2009). During the critical first year after ocean entry of the WSJF populations of concern (RY2005-2008) warm summer SST and low zooplankton abundance predominated, resulting in the index reaching a 30-year high in the summer of 2005 (Figure 11; State of the Ocean Report, SAS 2009).

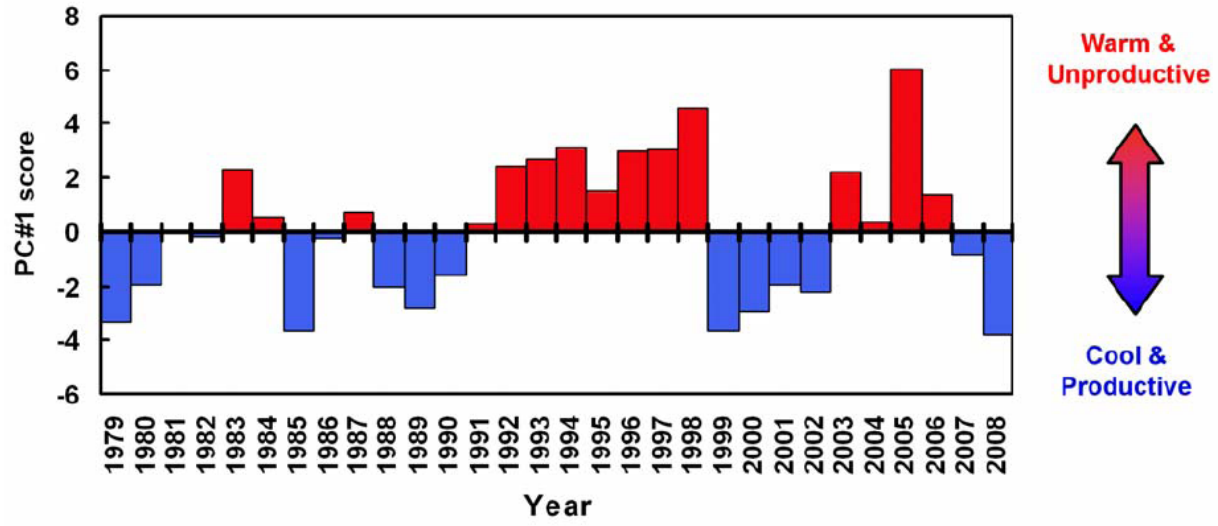


Figure 11. Time series of scores of the marine survival index in coastal waters off Vancouver Island.

Beetz (2009) finds wild coho marine survival responded to more physical and biological variables and in a weaker fashion than hatchery coho. She also shows that interior coho from Puget Sound and Strait of Georgia depend on ocean conditions of their first winter and second spring. Boreal shelf copepods were more strongly related to interior coho marine survival, while sub-arctic copepods were related strongly to coastal coho marine survival.

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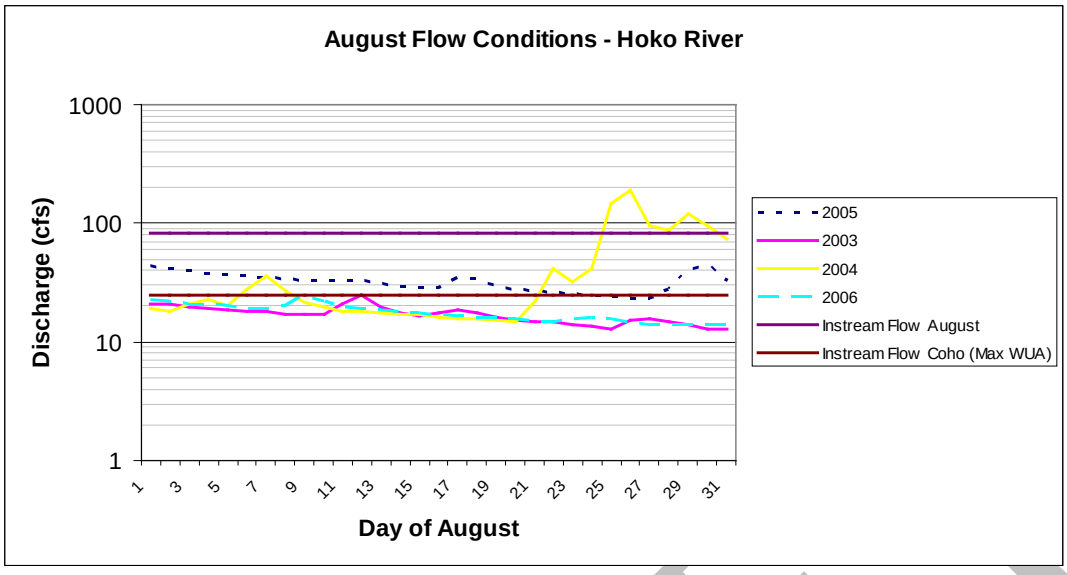
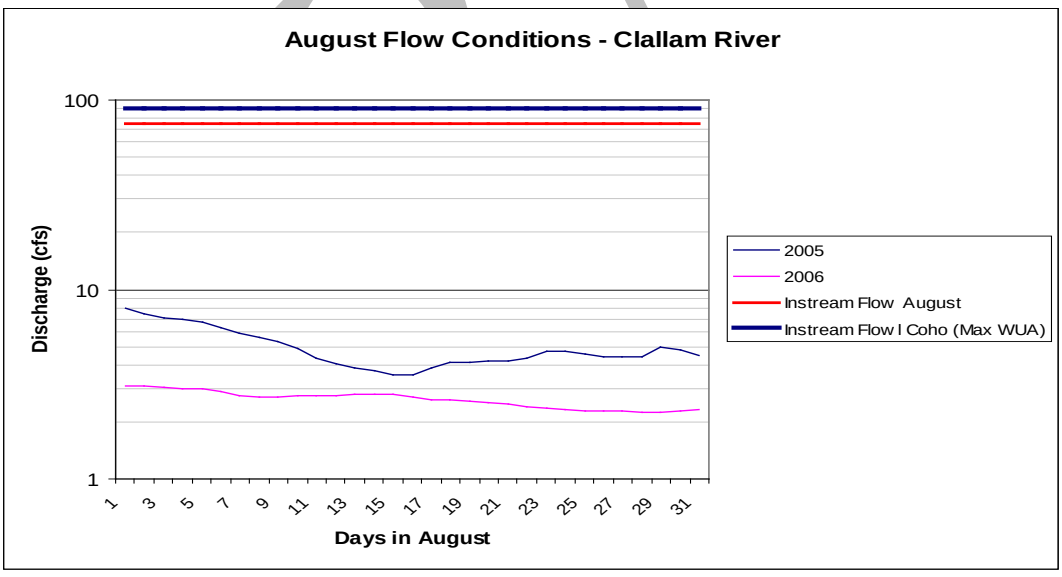
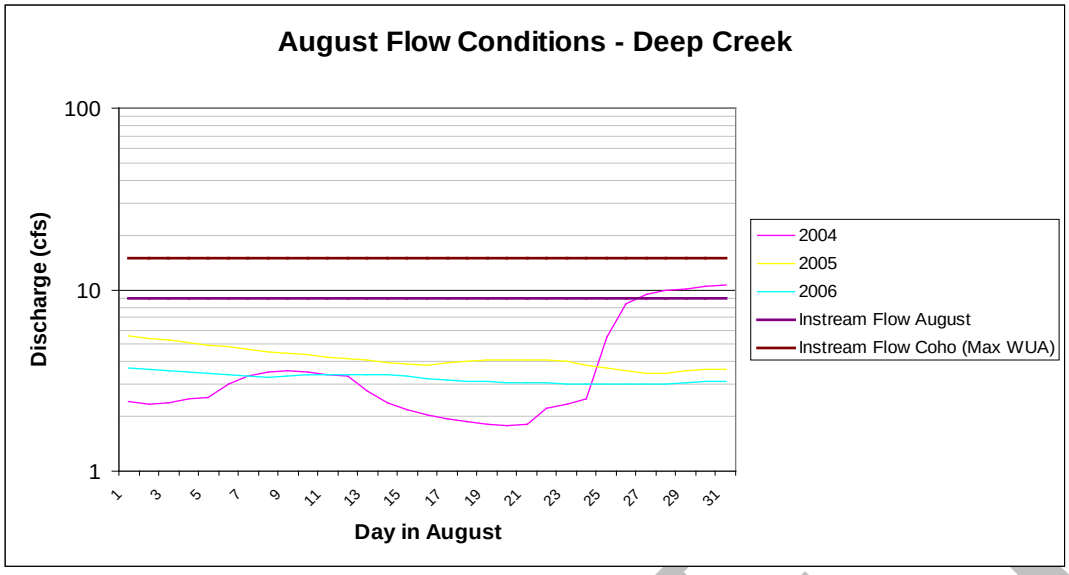
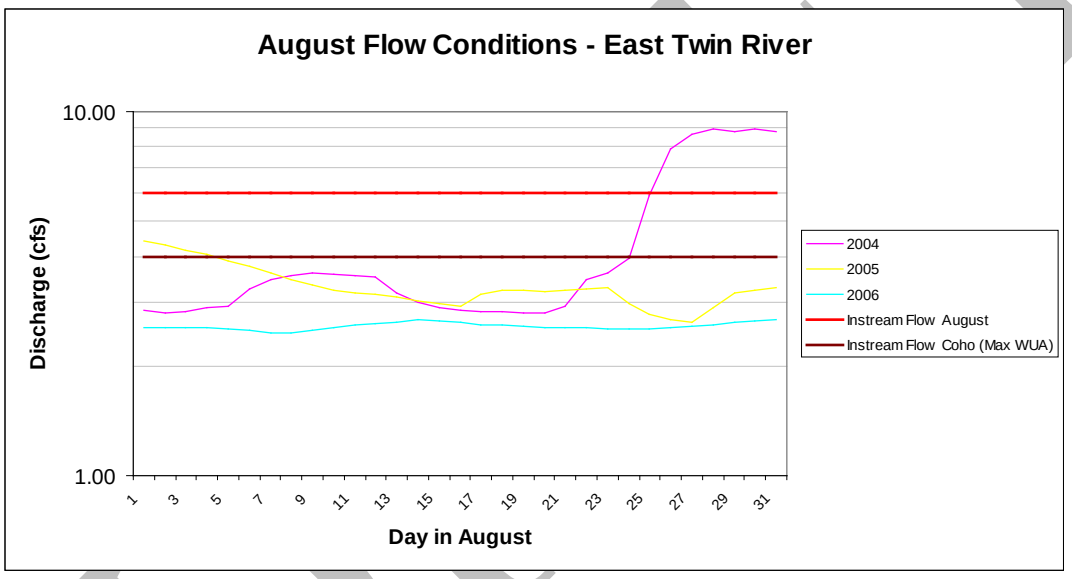
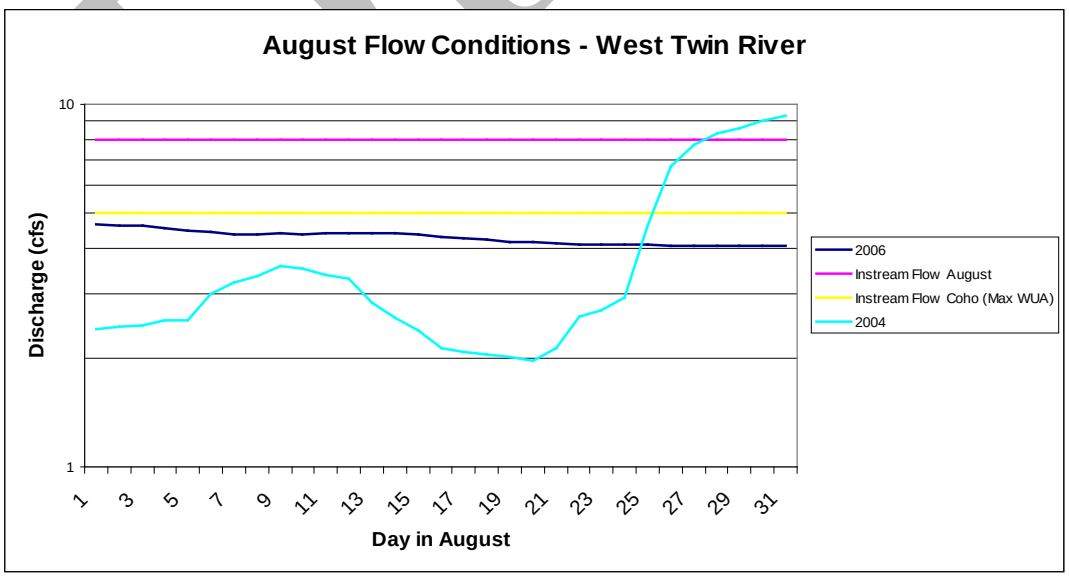
Appendix A

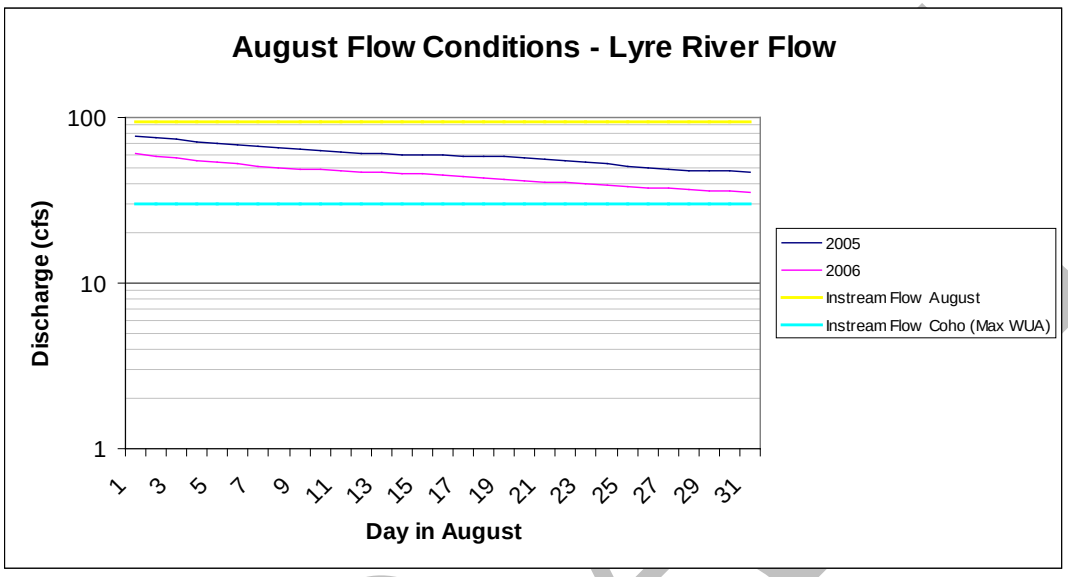

August Flow Conditions - Hoko River
Discharge (cfs)
1000
100
10
1
1 3 5 7 9 11 13 15 17 19 21 23 25 27 29 31
Day of August
2005
2003
2004
2006
Instream Flow August
Instream Flow Coho (Max WUA)

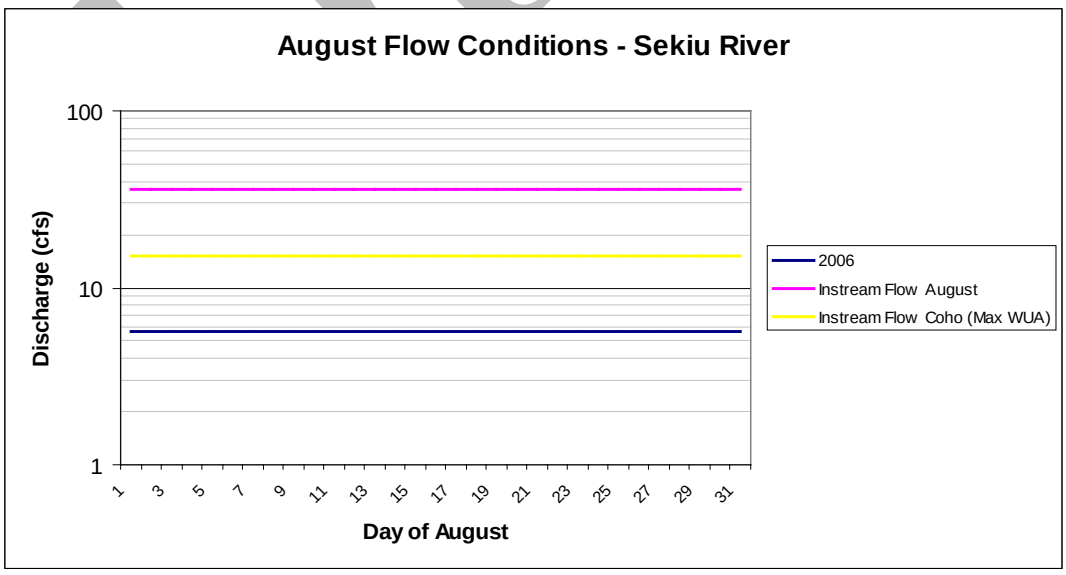

August Flow Conditions - Clallam River
Discharge (cfs)
100
10
1
1 3 5 7 9 11 13 15 17 19 21 23 25 27 29 31
Days in August
2005
2006
Instream Flow August
Instream Flow I Coho (Max WUA)

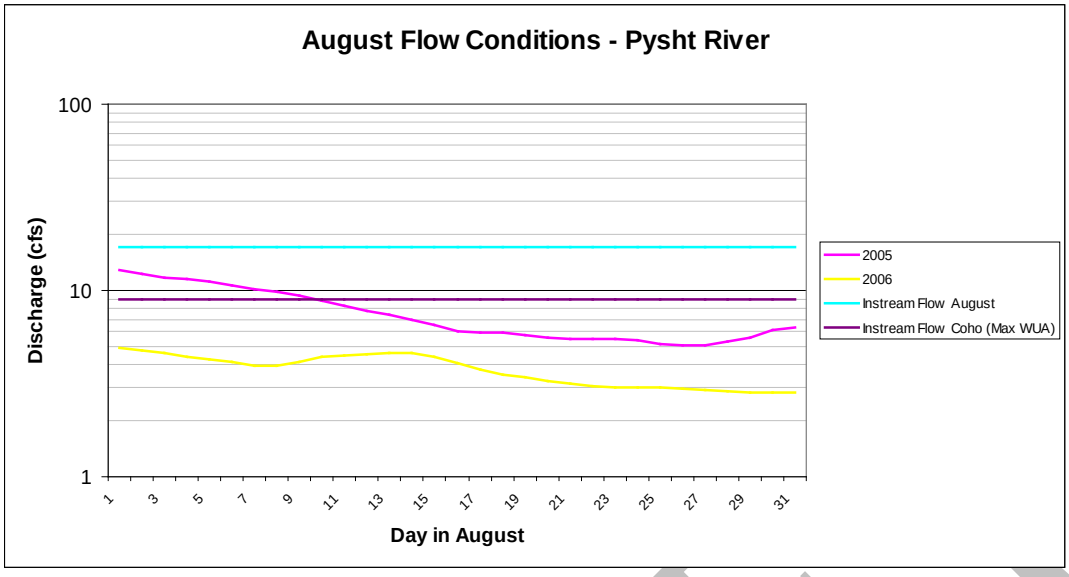

August Flow Conditions - Deep Creek
Discharge (cfs)
100
10
1
1 3 5 7 9 11 13 15 17 19 21 23 25 27 29 31
Day in August
2004
2005
2006
Instream Flow August
Instream Flow Coho (Max WUA)


August Flow Conditions - East Twin River
Discharge (cfs)
10.00
1.00
1 3 5 7 9 11 13 15 17 19 21 23 25 27 29 31
Day in August
2004
2005
2006
Instream Flow August
Instream Flow Coho (Max WUA)


August Flow Conditions - West Twin River
Discharge (cfs)
10
1
1 3 5 7 9 11 13 15 17 19 21 23 25 27 29 31
Day in August
2006
Instream Flow August
Instream Flow Coho (Max WUA)
2004


August Flow Conditions - Lyre River Flow
Discharge (cfs)
100
10
1
1 3 5 7 9 11 13 15 17 19 21 23 25 27 29 31
Day in August
2005
2006
Instream Flow August
Instream Flow Coho (Max WUA)


August Flow Conditions - Sekiu River
Discharge (cfs)
100
10
1
1 3 5 7 9 11 13 15 17 19 21 23 25 27 29 31
Day of August
2006
Instream Flow August
Instream Flow Coho (Max WUA)


August Flow Conditions - Pysht River
100
10
1
Discharge (cfs)
1
3
5
7
9
11
13
15
17
19
21
23
25
27
29
31
Day in August
2005
2006
Instream Flow August
Instream Flow Coho (Max WUA)

HABITAT COMMITTEE REPORT

Salmon Overfishing Reports
The Habitat Committee (HC) drafted a review regarding the Western Strait of Juan de Fuca (WSJF) Coho Habitat which is in the briefing book (Agenda Item D.1.a, Attachment 2). This review summarizes the factors likely to have influenced the failure of this stock to meet escapement goals for the years 2005, 2006, and 2007. Key findings of the review include: adverse ocean conditions, significant floods and suboptimal base flows in the affected brood years, and suspended solid concentrations that inhibit foraging success.

The draft HC recommendations from this review are:

1. **Support efforts of the WDFW to improve hydraulic project approval (HPA), program specifically the need for increased effectiveness and compliance monitoring of issued permits.**
2. **Support achievement of Washington Department of Ecology (WDOE) Clean Water Act (CWA) Review milestones related to State of Washington Forest Practice program.**
3. **Support future restoration efforts in the WSJF that address limiting factors of coho salmon.**

Sacramento Fall Chinook Overfishing Review
Members of the Habitat Committee and Salmon Technical Team met to discuss and coordinate the preparation of the Sacramento River fall Chinook overfishing report. The group:

- reviewed the list of data used in the Lindley et al. collapse report of 2009 to evaluate which data sets to update for the new report and assigned responsibilities for data updates;
- decided to use the existing format of Lindley et al. for the new report; and
- set a timeline for tasks, discussed holding a meeting in California for late summer, and will provide a status report to the Council at the November meeting.

U.S. Fish and Wildlife Service is currently conducting a review of hatchery release strategies at Coleman National Fish Hatchery that will be available to inform this new report.

Coho Salmon Population Trends-- Mid-Klamath Basin
The HC heard a presentation by Morgan Knechtle with the California Department of Fish and Game (CDFG), regarding population trends of Southern Oregon Northern California Coast Coho (SONCC). SONCC coho are currently listed as a threatened species under both Federal and State authorities. The CDFG has operated video fish counting facilities on the Shasta River and Scott River watersheds, both mid Klamath basin tributaries, since 2001 and 2007 respectively to enumerate abundance and describe run characteristics.

CDFG reported that two of three SONCC cohorts in the Scott River are critically low while a general decline was noted in all three cohorts of Shasta River SONCC. In fact, two of three cohorts in the Shasta River are functionally extinct. Both the Scott River and Shasta River coho salmon populations are identified in the SONCC Recovery Plan as independent core populations, which indicate their high level of importance to the long term success in the evolutionarily significant unit.

The HC recommends the Council write a letter to California Department of Water Resources, CDFG and National Marine Fisheries Service stressing the urgent need to provide adequate water quantity and quality for survival of these stocks under eminent threat of extinction. Additionally we recommend consideration be given to establishing a conservation hatchery\captive broodstock program to preserve the genetic integrity of these populations.

Wave Energy

The HC drafted a letter to the Federal Energy Regulatory Commission (FERC) for the Ocean Power Technology (OPT) wave energy project for Council review (Agenda Item D.1.a, Attachment 1). This project located off Reedsport, Oregon will cover approximately 30 acres and will be located about 2.5 miles off the coast in waters from 50' to 225' in depth.

OPT's project application to FERC includes two phases. Phase I will occur this summer, which involves the installation of one buoy and its associated moorings. Phase II will occur during summer 2011, and involves installing an additional 9 buoys connecting the 10-bouy array to the power grid. Phase III will be covered under a future permit application and is being proposed as a 100-buoy array.

As this is to be the first offshore wave energy project in US waters, it may very well establish a precedent for other proposed U.S. offshore energy projects, including the other 19 hydrokinetic projects pending off Washington, Oregon, and California. The HC feels the standards of FERC's review and scrutiny of future wave energy applications will likely be influenced by this application.

The Council's letter should be filed in response to FERC's Ready for Environmental Analysis (REA) notice which was issued June 1 for a 90 day comment period. This REA notice informs the public that FERC deems the application adequate for preparation of a National Environmental Policy Act document. In light of the Settlement Agreement process, FERC is planning to issue an Environmental Assessment, not an Environmental Impact Statement. Although there is a 60-day public comment period once the environmental assessment is released, it is appropriate for the Council to comment at this time, as earlier comments will more likely influence the process.

Regarding other wave energy developments, the State of California and FERC have entered into a Memorandum of Understanding to assure communication and coordination of wave energy siting and reviews. An updated list of wave energy proposals is on the Council's website. The HC recommends that the Council approve the letter.