

April 13-15, 2007



# 2007 Fisheries and Marine Ecosystems Graduate Student Conference

Camp Elphinstone  
Gibsons, British Columbia, Canada



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# Welcome from the Co-chairs

Welcome to the 2007 edition of the Fisheries and Marine Ecosystems (FAME) Network graduate student conference. This year, the Fisheries Research Group at the School of Resource and Environmental Management, Simon Fraser University, is pleased to be hosting graduate students in fisheries research from across North America and beyond. This is the first time that the FAME conference has been hosted on British Columbia's beautiful Sunshine Coast, and we hope that you enjoy your time here.

Fisheries and marine ecosystem research is broad in scope, and this diversity is reflected in the range of oral and poster presentations at this year's FAME conference. Presentations this year include issues in conservation, marine ecology, fisheries stock assessment and management, fisheries economics, and institutional arrangements, among others. The continuation of the conference's tradition of interdisciplinarity offers participants the opportunity to learn from each other and improve the future of fisheries and marine ecosystems. We encourage you to take full advantage of this opportunity by engaging others in discussing your research interests.

Thank you all for coming, and enjoy the conference!

Aaron Springford  
Pier van Dishoeck

FAME 2007 conference Co-chairs.



# Organising Committee

The 2007 FAME Conference was organized by the following committee of SFU School of Resource and Environmental Management Fisheries Research Group students.

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# Keynote Speaker



**Dr. Paul Kariya**

Pacific Salmon Foundation

Paul Kariya's experience in the BC fishery dates back to childhood in Ucluelet where he helped his father, a commercial fisherman, and a founding member of the Ucluelet Fishing Company, on their troller. With first hand knowledge of the issues being faced by fishing communities on Canada's West Coast, Kariya's professional career has included various positions within the Department of Indian Affairs and Northern Development, the Department of Fisheries and Oceans, the BC Treaty Commission, Fisheries Renewal BC and, most recently, Pacific Salmon Foundation.

Paul is a graduate of UBC, 1975. He completed his MA and PhD in Geography at Clark University, Worcester, Massachusetts in 1987. As an applied academic, his research interests have been in community development, social justice and resource values and ethics.

The Pacific Salmon Foundation is a non-profit, charitable organization that has funded volunteer-driven projects in communities throughout the province. Since its inception in 1987, the Foundation has committed over \$5.5 million to support more than 674 salmon conservation projects, and has matched these funds with money and in-kind contributions from other sources for a total value of over \$35 million. These projects include habitat restoration, capital improvements to small community hatcheries, watershed planning, education/public awareness, various types of resource inventories and assessments and the development of community capacity for salmon restoration. The Foundation has established a reputation as a protector and advocate for Pacific salmon resources and is represented on domestic and international committees concerned with salmon restoration and enhancement.

# FAME Network Directory

## 2007 Update

### **FAME Network Co-Chairs**

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### **FAME Network Mission Statement**

The primary objective of the FAME Graduate Student Network is to facilitate communication among graduate students studying the science and management of fisheries and marine ecosystems.

Currently there is no framework to address the collective needs of graduate students in this field.

The FAME Network will fill this gap by:

- Instituting a yearly conference to bring together graduate students studying the science and management of fisheries and marine ecosystems;
- Publishing a synopsis of the annual conference on the web, summarizing research directions and collective views for the future of fisheries science and management;
- Establishing a website to link graduate student programs, so students can find out about research by students with similar interests at other schools;
- Informing graduate students from other schools about local conference and employment opportunities;
- Acting as a focal point for employers to advertise fisheries-related jobs.

### **FAME Network Website**

[www.sfu.ca/fame/](http://www.sfu.ca/fame/)



# Oral Abstracts

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## Session 1: Stakeholder Collaboration and Institutional Structures

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### Evaluating evaluation frameworks for participatory decision-making processes

Neil Davis

Resolving different, sometimes conflicting objectives among stakeholders regarding the use of limited fisheries resources is one primary challenge for sustainable fisheries management; developing well-informed management strategies that respect democratic ideals is another. Involving stakeholders in more participatory forms of decision-making is increasingly employed in resource management as a promising means of addressing these challenges. However, these participatory processes are rarely evaluated to determine their strengths and weaknesses and whether they are the most appropriate approach. Partly in recognition of this deficiency, numerous evaluation frameworks have been proposed within the past 10 years to facilitate systematic examination. As part of thesis research evaluating the collaborative development of a management plan for BC groundfish fisheries, I examine existing evaluation frameworks and ask the following questions: how do the purposes of evaluation vary? Are proposed evaluation criteria similar across frameworks (i.e., is there agreement about the goals of participatory decision-making)? What are the empirical or theoretical underpinnings of these criteria? Does it make sense to integrate the most common or important criteria into a single framework? Careful consideration of these questions can help to make sense of a growing literature and inform the development of an evaluation framework appropriate for my research.

*Keywords: evaluation, participatory planning, fisheries management*





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## **Cooperative Conservation: A comparison of successful marine, freshwater and terrestrial projects**

Kathleen Herrmann

Over 150 cooperative conservation case studies have been compiled in a White House Center for Environmental Quality (CEQ) report called “Faces and Places of Conservation: Profiles in Citizen Stewardship.” This report defines cooperative conservation as ‘common sense conservation of the Nation’s lands, waters, and wildlife by people from every walk of life. It is rooted in collaborative decision-making, shared governance and bottom-up action (p. 2).’ These case studies span a broad range of activities ranging from coastal estuarine restoration to protection of threatened and endangered species. The case studies were chosen based on three distinct criteria; the degree of innovation of the project provides for practicing cooperative conservation, the extent to which the project output or lessons are transferable to other areas, situations, and projects, and finally the extent to which the project is an outstanding exemplary representative of cooperative conservation. This report provided a unique opportunity to examine a large set of grassroots cooperative conservation projects pre-selected by managers to represent innovative partnerships with a high likelihood of success. Utilizing this report as my primary data set, I have interrogated the data using a set of variables including project characterization, target resource, project initiator, type of approach, regulatory program response, scope of purpose, type of action, project locus, and spatial scale. I plan on presenting the results of this analysis in the context of theoretical predictions to examine how marine, freshwater/watershed, and terrestrial projects may differ in their approach to successful cooperative conservation.

*Keywords: conservation, collaboration, policy analysis, watershed, marine, planning*

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## **A strategy for marine environmental education of tourists and residents: assessment and design of signage in Island and Jefferson Counties, Puget Sound**

Katrina Lassiter

Marine environmental education (MEE) can be a method for instilling a sense of stewardship in tourists and recreationists. Structured interviews with tourists and residents were conducted in the Puget Sound region of Washington state to examine interpretive signage as a vehicle for MEE that integrates a marine environmental philosophy (MEP). A MEP contains three components: environmental science, ethics, and aesthetics. Interviewees were asked questions about current signage and how they would design future signs based on the three components of a MEP. Results of the assessment of current signage revealed that the signs conveyed strong scientific and ethical messages determined by 88% and 100% of interviewees respectively, but a weak aesthetic message as found by 70% of interviewees. Based on the future design interviews and the sign assessment, a MEP should be transmitted through a sign in the following ways: clear and explicit description of the marine ecosystem, an explanation of potential human impacts to the ecosystem, and a description of the complexity and uniqueness of the ecosystem to inspire aesthetic appreciation of the environment. Therefore, interpretive signage can educate tourists and residents about the marine environment through a MEP that promotes understanding, informed behavior, and appreciation.

*Keywords: marine environmental education, stewardship, marine environmental philosophy, interpretive signage*



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## **Session 2: Social and Economic Analysis of Fisheries**

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### **Coastal community resource management: Tools for assessing sustainability**

Ahmed Khan

Coastal zones and coastal communities are highly complex because of their bio-physical characteristics, multiple user activities and varied governance systems. These regions therefore pose a couple of management challenges including: monitoring and assessing sustainable ocean use patterns, conflicts between user groups, designing institutional frameworks, and providing communities with tools for resiliency during (for e.g.) resource depletion or climatic hazards. This research will attempt to use an Integrated Spatial Dynamic Model (ISDM) to investigate coastal and marine resource uses, their economics, human interactions and community involvement in different geographic regions in Canada (NL) and elsewhere. The goal is to map and assess coastal stress, identify and develop ocean indicators and provide an integrated framework for policy formulation towards good governance and enhancing community resilience.

*Keywords: ICM, valuation, community resilience, sustainability indicators and governance.*

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### **Evaluating fishery policy outcomes using social indicators: preliminary results from a case study of the British Columbia groundfish fisheries**

Danielle N. Edwards

The implementation of various policy initiatives in British Columbia fisheries has had many impacts on both the fisheries and the communities that rely on fisheries. Evaluating the outcomes of policy can be difficult because of data limitations and the problem of confounding due to concurrent regulatory changes and non-fisheries specific social and economic conditions. I developed an outcome evaluation framework to address the important issue of fisheries policy evaluation given these limitations based on a retrospective analysis of trends for social and economic indicators. I use the BC groundfish fisheries to demonstrate the evaluation approach.

*Keywords: evaluation framework, groundfish*



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## **Retrospective bioeconomic analysis of Fraser River sockeye salmon fishery management**

A Dale Marsden, Steven JD Martell, and U Rashid Sumaila

*Presented by: Dale Marsden*

Many Fraser River sockeye salmon stocks show large cycles in abundance from year to year, but the causes of these cycles are not clear. As a result, these stocks have historically been managed under the hypothesis of cyclic dominance, i.e., maintaining the cyclic behaviour of the stocks. Biological studies and changes in management have revealed that the potential yield of the off-peak parts of the cycle could be much higher than was previously thought. We analyzed past management performance in this fishery, examining how much more profitable the fishery could have been had managers and scientists known then what we know now. We used stock-recruitment data as the basis of the biological dynamics, and used prices, fishing costs and discounting to incorporate economics. We then simulated the fishery under a variety of fisheries management regimes. We found that the fishery could have been 40-200% more profitable than it was historically if relatively simple management rules had been implemented. However, we found that there would have been relatively little additional increase in profit if managers had also know in advance the so-called recruitment anomalies, i.e., the deviation of actual recruitment from that predicted by the deterministic model.

*Keywords: sockeye salmon, cyclic population, fisheries management, fixed harvest rate policy, fixed escapement policy*

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## **Session 3: Managing Commercial Fisheries**

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### **A preliminary investigation of factors affecting discard estimates in the at-sea observer program for British Columbia trawl fisheries**

Matthew Grinnell, Sean Cox, and Rick Stanley

*Presented by: Matthew Grinnell*

The at-sea observer program (ASOP) for monitoring multi-species trawl fishing activity in British Columbia (BC) has provided 100 % on-board observer coverage since 1996. The ASOP in combination with an individual vessel quota system makes fishers financially accountable for marketable discards and may contribute to relatively low discard rates in the BC trawl fishery. An important assumption underlying the use of at-sea observer data is that reports of discarding activity are unbiased. However, the nature of the at-sea observer workplace may be conducive to certain types of biases such as pressure on the observer by skippers to under-report financially damaging discard activity or under-reporting of discards for trawl tows that are not directly observed. If such biases exist, discards and total mortality imposed by fishing may be under-estimated for certain fish species. This paper evaluates the strength of evidence for discard reporting biases in the British Columbia trawl fishery at-sea observer program. We analyze tow-by-tow observer records (1996-2006) to test for possible biases and determine the magnitude of potential impact on total catch estimates.

*Keywords: Trawl fisheries discards observer bias*



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## **Consequences of implementing an electronic monitoring system on logbook compliance and fishing fleet composition**

Jonathan Cummings, W.K. de la Mare, Danielle N. Edwards, Jessica Finney, Matthew Grinnell, Cameron MacKenzie, Nathan Millar, Andrew Taylor, and Pier van Dishoeck

*Presented by: Jessica Finney, Andrew Taylor, and Cameron MacKenzie*

The collection of verified at-sea catch data is an important component of fisheries monitoring and management. Traditionally, these data requirements have been met by at-sea observers. However, there are several drawbacks to such programs, including labour supply challenges, insufficient space on smaller vessels, and high program costs. Recently, electronic monitoring (EM) audit programs have been introduced as a lower cost alternative. An EM audit program consists of video cameras that capture the fishing activity on the deck, a GPS tracking system to record time and location, equipment to monitor fishing gear activity, and a logbook recorded by the fisherman. A proportion of the video is reviewed and compared to the logbook. When there is agreement between the two data sources, the logbook is taken as the official trip record. When there is not agreement, the video is subject to additional review, at a cost paid by the fisherman. Despite the potential advantages of an EM program, there are several uncertainties associated with implementation: efficiency, compliance, and effects on fleet composition. To address these uncertainties, we used a simulation modeling approach to evaluate outcomes of EM system implementation on a hypothetical fishery. Specifically, we asked what incentive / disincentive structures would result in 'good' compliance (logbook data accuracy) with minimum impacts on fleet composition (e.g., number of vessels; number of firms owning vessels). Finally, we assessed EM system efficiency by comparing monitoring costs to the value of the fishery.

*Keywords: Electronic monitoring program, fleet composition, investment, behaviour, at-sea catch*

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## Session 4: Ecology and Management

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### **Confounded! Confounding factors of high mortality and extended residency of coho smolts in the Strait of Georgia**

Michael Melnychuk, David Welch, and Carl Walters

*Presented by: Michael Melnychuk*

Causes for recent declines in abundance and total marine mortality rates of coho salmon are not well understood but likely involve periods of high mortality soon after ocean entry. We conducted a large-scale acoustic tracking study to monitor the downstream and early ocean migrations of juvenile salmonids through the Strait of Georgia ecosystem. We implanted acoustic transmitters into coho smolts from two hatchery populations migrating into Georgia Strait and two wild populations migrating into Queen Charlotte Strait from northeast Vancouver Island Rivers. In contrast to steelhead and sockeye salmon smolts, which migrated rapidly out of the Strait of Georgia system, coho smolts were rarely detected on the ocean receiver lines after they entered saltwater. Mortality during the downstream freshwater migration was higher for the Strait of Georgia populations (23-95%) than the northeast Vancouver Island populations (8-23%), which was largely attributed to longer in-river migration distances. Smaller body sizes of coho smolts contributed to higher freshwater mortality than found in other salmonid species. Estimates of early ocean mortality were confounded by unknown levels of summer-winter residency in Georgia and Queen Charlotte Straits in areas between lines of acoustic receivers, and are further complicated by alternative rearing histories among populations.

*Keywords: marine mortality, coho salmon, migration*

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### **Collateral effects of sea otter extirpation and re-introduction on temperate marine reef fish populations**

Russell Markel and Stefan Dick

*Presented by: Russell Markel*

Extirpation of top predators that initiate trophic cascades can have substantial collateral effects on populations dependent upon producer-derived resources, but these effects have received little attention. Kelp forests worldwide provide critical recruitment and nursery habitat for many temperate marine fishes and are often regulated by the abundance of herbivorous sea urchins. We investigated the effects of sea otter (*Enhydra lutris*) extirpation and re-introduction on juvenile black rockfish (*Sebastes melanops*) populations, via red sea urchins (*Strongylocentrotus franciscanus*) and kelp forests (*Macrocystis integrifolia*), along the west coast of Vancouver Island, British Columbia, Canada. We compared urchin density, *Macrocystis* forest size, and juvenile black rockfish abundance and condition, between sites with and without sea otters. Where otters are present we found that urchins are rare, *Macrocystis* forests are up to 50 times larger, and juvenile black rockfish densities and total production are more than five times greater than at sites where otters are absent. However, an inverse relationship between juvenile rockfish abundance and condition suggests that high densities of juvenile rockfish in the otter-present region may cause density-dependent growth and delay the size-dependent transition from zooplanktivory to piscivory.

*Keywords: trophic cascades, collateral effects, sea otters, kelp forests, juvenile rockfish, recruitment, growth*



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## **Photosynthetic performance determine the abundance of four intertidal seagrass species in Central Philippines**

Shao-Lun Liu, Danilo T. Dy, We-Lung Wang

*Presented by: Shao-Lun Liu*

In this study, the pulse amplitude modulated fluorometry was conducted to measure the photosynthetic performance of four different seagrass, *E. acoroides*, *T. hemprichii*, *H. uninervis*, and *Ha. ovalis*, in the central Philippines multi-specific seagrass bed. Some environmental and biological variables were also measured. Compared with the environmental variables (light intensity, water depth, pH, nutrient, and turbidity), the biological variables (leaf density, light absorption ability, and chlorophyll a concentration), and the photosynthetic differences ( $F_v/F_m$  and  $ETR_{max}$ ) between the upper intertidal and lower intertidal populations in these four different species, we found that different seagrass species possessed different physiological strategies to adapt the low light limited environment. All of them, except for *H. uninervis*, can increase light absorption ability under the low light condition. *E. acoroides* increase the light absorption via the increment of chlorophyll a concentration, while *T. hemprichii* and *Ha. ovalis* probably increase the light absorption by changing the leaf morphologies. Based on the regression analysis, the positive correlation between leaf density and  $F_v/F_m$ , and leaf density and  $ETR_{max}$  showed that the photosynthetic performance would have the influence on the relative abundance of each species among the multispecific seagrass bed.

*Keywords: chlorophyll fluorescence, heat-tolerant ability, photosynthetic performance, Philippines, seagrass*

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## **Hierarchical influence of protection-duration and site location on reef fish diversity patterns**

Jonathan A. Anticamara and Amanda C.J. Vincent

*Presented by: Jonathan A. Anticamara*

Understanding spatio-temporal patterns and drivers of species diversity is becoming a more important research area as we try to address current issues of diversity loss, recovery, and management. Here we will contribute to the expansion of current knowledge on changes in reef fish diversity within no-take marine protected areas (MPAs). Our research is distinctive because of the following: (1) we tracked the changes in diversity of multiple (eight) study sites that fell along gradients of protection-duration and also fell along gradients of distance from the mainland, (2) we conducted intensive sampling (i.e. monthly) on the eight study sites using standardized methods for a three year period, and (3) we used both univariate and multivariate analyses techniques to quantify changes in several diversity indices and curves to measure diversity changes within and across the eight study sites. Our results suggest that factors and processes related to reef site location had stronger influence on reef fish diversity than protection-duration. For example, we observed higher reef fish species richness in offshore sites than inshore sites regardless of protection-duration. Our results suggest that site location is important in the design of MPA networks if the MPA objectives include diversity recovery and management.

*Keywords: Conservation, Danajon reefs, marine ecology, marine reserves, Philippine reefs, spatial heterogeneity*



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## Session 5: Conservation Issues in Marine and Freshwater Ecosystems

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### The problem of biodiversity for fisheries management

Ashleen J. Benson and Sean P. Cox

*Presented by: Ashleen J. Benson*

The ecological justification for conserving biodiversity that has featured prominently in the development of international conventions and policies is characterized by widely ranging hypotheses and disparate results. Nonetheless, this line of argument has yielded both political and global economic imperatives that now set the agenda for fisheries management. Fisheries science has yet to feature prominently in the development of biodiversity policies and objectives, but given its unique position at the interface between ecological theory and application, we contend that fisheries science has perhaps the most to offer in this regard. It has been observed that environmental problems arise from the negative net impact of many small decisions, including the focus on single species management (Odum, 1982). In our opinion, the apparent incompatibility of traditional fisheries science and biodiversity conservation does not arise from a myopic focus on single species per se, rather, problems arise from a preoccupation with the level of production of a population, and a failure to consider spatial and sub-population-level impacts in management. We offer an interpretation of biodiversity that is consistent with the theory of fisheries science, and suggest an operational approach for incorporating biodiversity-type objectives into future fisheries management strategies.

*Keywords: biodiversity and you*

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### Washington, Oregon, and California domestic ballast water regulations: Is exchange at 50 miles adequate?

Nissa Ferm

The spread of non-indigenous aquatic organisms is no longer an international problem but has become a serious domestic issue. It is known that ballast water is a major vector for the transport of these organisms. The west coast of the continental United States has the most invaded aquatic environment, San Francisco bay. In order to mitigate the risk of non-indigenous organisms transported through ballast water, regulations have been enacted in the states of Washington, Oregon and California requiring domestic vessels transiting from one state to another performs an open ocean exchange 50 miles off shore. Is fifty miles oceanic enough for exchange? It has been debated whether this distance is appropriate; due to the complex micro scale oceanic processes and coastal mesozooplankton dispersal patterns that occur within the fifty mile zone on the continental shelf. The study is conducting transects from Long Beach, CA to the Straights of Juan de Fuca, WA that go from zero to eighty nautical miles offshore; during the two distinct wind and oceanographic patterns of the west coast. Taking fine (80µm) and coarse (303µm) zooplankton tows at even intervals. Mesozooplankton will be enumerated and identified to species when possible and categorized as oceanic, coastal, or cosmopolitan. It is hoped that this observational study will elucidate whether domestic ballast water regulations on the west coast of the continental United States do enough to reduce the spread of non-indigenous and coastal mesozooplankton with in it.

*Keywords: Ballast water, Invasive species, Regulations*



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## **An evaluation of extinction risk criteria for Pacific salmon stocks**

Erin Porszt

Individual salmon stocks need to be managed effectively in order to maintain biocomplexity and thus the resilience of the species as a whole. My research question is how can we manage Pacific salmon stocks to avoid them becoming at risk of extinction. A Ricker stock-recruitment model with random variation was run over Monte Carlo simulation trials, to determine the probability of extinction for theoretical salmon populations. This demonstrated the effect of initial population size, stock productivity, and harvest rate on the probability of extinction. This can be applied to individual salmon stocks as the knowledge of extinction risk may result in more effective management.

*Keywords: extinction risk, threatened/endangered, salmon*

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## **Session 6: Impacts on Fisheries from Human Development**

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### **Strategies for developing a fish friendly shoreline on Lake Washington**

Gregg Casad, Dave Fries, Ruth Howell, Kelli Roberts, Bryan Russo, Angela Wallis, and Thomas Leschine

*Presented by: Gregg Casad*

Located within a major urban area, Lake Washington is the second largest natural lake in the state of Washington at approximately 21,500 acres. Ecologically, the lake serves an important role for several runs of salmon species, most notably the run of the endangered Chinook salmon on the Cedar River. However, as a highly urbanized lake with an estimated 82% of the >80-miles of shoreline hardened with 2,500 docks and piers, the current shoreline conditions create a non-functional riparian habitat detrimental to migrating salmon populations and particularly rearing juvenile Chinook. In the fall of 2006, a team of University of Washington graduate students joined representatives from NOAA's Sand Point facility to assess barriers to fish-friendly restoration projects along Lake Washington's shoreline. The team created a spatial socio-economic characterization of Lake Washington, inventoried the regulatory framework, and interviewed private property owners to assess potential barriers to conducting fish-friendly restoration. These interviews focused on identifying potential barriers such as regulatory and permitting obstacles, information asymmetry, perceived risks to property, and life-cycle costs of shoreline projects. This research serves as an initial step towards designing and implementing an outreach program intended to educate and encourage soft shoreline restoration in Lake Washington.

*Keywords: Urban lake restoration, shoreline policy, property owner outreach, incentives*





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## **Developing biological guidelines for habitat management of Dungeness crab**

Wendy Fisher and Don Velasquez

*Presented by: Wendy Fisher*

Puget Sound has a wealth of species that occur at harvestable densities, providing food, employment, and recreational activities to the surrounding human populations. However, human population growth around Puget Sound has resulted in detrimental shoreline development that destroys critical habitat for shellfish populations. To manage impacts of anthropogenic pressures on these species, it is crucial that natural resource policy-makers have sufficient data and biologically reasonable guidelines on which to base decisions. Washington Department of Fish and Wildlife (WDFW) Priority Habitat and Species (PHS) Management Recommendation documents are developed as comprehensive reports on critical species and are available to assist habitat biologists in decision-making. The WDFW Habitat Program currently lacks a complete and accessible PHS document for Dungeness crab, which limits the effectiveness of managers in placing limits on or developing mitigation strategies to compensate for potentially destructive practices to Dungeness crab. Under the supervision of a WDFW fisheries biologist, I am completing the PHS document for Dungeness crab, which includes a review of all available data on ecology, habitat use, and impacts of shoreline development. Based on this review, we are making recommendations for best management practices for Dungeness crab.

*Keywords: habitat management, Dungeness crab*

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## **Juvenile salmonid stock assessment in an adaptive management context**

Pier van Dishoeck, Sean Cox, Mike Bradford, and Paul Higgins

*Presented by: Pier van Dishoeck*

The Bridge River is a regulated system near Lillooet, British Columbia. Dam completion in 1960 severely affected fluvial ecosystems by diverting flows into the adjacent Seton watershed. In 1996, BC Hydro initiated an active adaptive management experiment to examine trade-offs between fish production and hydro-power generation. Given competing water demands, the research questions of key importance are: 'does more water produce more fish?', and if so, 'what is the form of this response?' Two of five planned flow treatments have been completed to date. In addition to other metrics, the study is collecting juvenile salmonid stock assessment data. The challenge is to detect a treatment effect despite high spatial and temporal variability. To this end, my research examines the performance of depletion estimators used to generate annual population indices from the sample data. The talk will present progress to date, as well as planned analyses designed to test the larger dataset for a treatment effect.

*Keywords: stock assessment, adaptive management*

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## Session 7: Assessment of Fish Populations

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### **Evaluating Fraser River Sockeye management adjustment models: explicit valuation of management under uncertainty**

Jonathan Cummings

Sockeye salmon fishery management entails a trade-off between maximizing the value of salmon harvest, and conservation of salmon species. This trade-off is minimized when management actions are robust to; variation in the state of salmon stocks, and the costs associated with unachieved conservation and harvest objectives. In order to minimize this trade-off and select robust management, the management adjustment models on which spawning escapement target selection is based must also be robust to these conditions. Using model evaluation methods and decision analysis incorporating uncertainty the Fraser River Management Adjustment Models will be evaluated. Management adjustment models select the additional amount of escapement necessary beyond the base target escapement level to achieve the target escapement. This additional escapement is the result of en route mortality during salmon migration due to river conditions, and uncertainty in the achieved harvest levels. A variety of models incorporating different environmental conditions as parameters have been produced to predict the appropriate management adjustment. These models will be ranked for their fit relative to historic conditions. The value of additional sample information and the value of including uncertainty in the management under the top models will be assessed. This talk presents future research.

*Keywords: sockeye, value of information, management, model evaluation, escapement*

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### **Bayesian hierarchical models for the analysis of spatial fishery data**

Aaron Springford and Sean Cox

*Presented by: Aaron Springford*

Classical fisheries stock assessment methods implicitly assume a spatially homogeneous population whose spatial distribution remains constant over time. It is now recognized that the distribution of many fish populations is in fact heterogeneous in space, and changing in time. Current fisheries monitoring practices in many regions of the world include precise measures of fishing location, thanks to the use of onboard global positioning systems. However, many current assessments of stock status do not include an examination of the spatial pattern of abundance indices such as catch per unit effort (CPUE). This aspatial approach neglects a large amount of information that could be made available to fisheries managers. Alternatively, some current stock assessments misspecify the stochastic properties of the spatial pattern in question, leading to flawed inference of stock status and diminishing the quality of advice presented to managers.

We present a Bayesian framework for analyzing spatial fishery data that includes correlation between observations made at different points in space. We suggest that our framework can improve stock assessment by properly including spatial effects in the analysis. Although Bayesian hierarchical models can be difficult to apply to large spatial datasets in practice, they can provide insight into quantities of interest. As an illustrative example, simulated data from the randomstratified British Columbia sablefish (*Anoplopoma fimbria*) trap survey was used to calculate a probabilistic CPUE density surface. The surface was then used to: (1) infer the distribution of sablefish over the B.C. coast, and; (2) to calculate an index of abundance based on CPUE density.

*Keywords: Stock Assessment Methods, Spatial Analysis, Kriging, Bayesian Analysis*

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## Estimating size selectivity in the B.C. Sablefish fishery from tag-recapture data

Katrina Assonitis and Sean Cox

*Presented by: Katrina Assonitis*

Understanding the relationship between size and susceptibility to capture by different gear types can be a challenging aspect of managing a fishery. However, quantifying the relative probability that a fish of length  $l$  from the population is captured is a critical component of fishery assessments and a key aspect of sustainable fisheries management. In this study, we use data from multiple tagging experiments to estimate selectivity by length for three different gear types (trap, trawl and longline) employed in the Pacific sablefish (*Anoplopoma fimbria*) fishery in British Columbia, Canada. Our results show that the commercial longline fishery selects for the largest size classes of sablefish with peak selectivity occurring between 85 and 90 cm fork length. Selectivity in the commercial trap fishery peaked at intermediate length classes between 60 and 70 cm fork lengths while the trawl fishery selected for the smallest sizes of sablefish with peak selectivity occurring around 50 cm, below the minimum size limit of 55 cm. Tagging studies can provide direct and reliable estimates of gear selectivity, assist fishery managers in predicting the impacts of various gear types on stock abundance and aid in the development of robust harvest strategies for commercially important groundfish species.

*Keywords: sablefish, tagging, selectivity*



# Poster Abstracts

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## **Shoreline armoring in relation to parcel size & shape on Vashon-Maury Island**

Justin Boevers, Katrina Lassiter, and Mary Ramirez

Vashon-Maury Island (VMI) is an unincorporated rural community in central Puget Sound that is included in a shoreline change analysis conducted through the Puget Sound Nearshore Ecosystem Restoration Project. VMI contains almost 50% of King County's shoreline, with a lower population density and a slower population growth rate than the county averages. The residential development on VMI has remained mostly rural and is a defining characteristic of the island. Constraints such as water availability, difficulty of travel to and from the island, and a desire to retain a rural identity has limited growth. However, as ferry transportation enables more convenient commuting, technology allows for more telecommuting opportunities, and property values relative to neighboring Seattle are reasonable, this once somewhat isolated community is becoming more desirable and faces development issues that already exist among many other coastal communities. This analysis concludes that residential development is the primary driver of shoreline change on VMI. Furthermore, the size and shape of shoreline parcels, resembling a configuration of 'piano keys,' is correlated to the frequency of shoreline armoring. With an increasing demand to live on VMI, residential shoreline development and shoreline armoring should expand, resulting in increasing negative impacts on nearshore ecosystem processes

*Keywords: Vashon - shoreline - armoring - residential - development*

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## **Strategies for developing a fish friendly shoreline on Lake Washington**

Gregg Casad, Dave Fries, Ruth Howell, Kelli Roberts, Bryan Russo, Angela Wallis, and Thomas Leschine

(see abstract in Oral Abstracts)

*Keywords: Urban lake restoration, shoreline policy, property owner outreach, incentives*

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## **Consequences of implementing an electronic monitoring system on logbook compliance and fishing fleet composition**

Jonathan Cummings, W.K. de la Mare, Danielle N. Edwards, Jessica Finney, Matthew Grinnell, Cameron MacKenzie, Nathan Millar, Andrew Taylor, and Pier van Dishoeck

(see abstract in Oral Abstracts)

*Keywords: Electronic monitoring program, fleet composition, investment, behaviour, at-sea catch*

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## **Subsidies to global fisheries**

Ahmed Khan, U. Rashid Sumaila, Louise The, Reg Watson, Gordon Munro, Peter Tydemers, and Daniel Pauly

Fishery subsidies greatly impact the sustainability of fishery resources, as they contribute directly or indirectly to the build-up of excessive fishing capacity, thereby undermining the sustainability of marine living resources and fishing livelihoods. Using a recently developed database of fisheries subsidies for 144 maritime countries spanning 1995-2005, an annual fisheries subsidy amount was computed using a bottom-up approach. Our analysis suggests that global annual fisheries subsidies for 2000 were between US\$ 30 - 34 billion, nearly two times the earlier World Bank estimate of US\$14-20 billion. We found that fuel subsidies make up about 20-25% of total global fisheries subsidies, and that the proportion of subsidies contributing to excess fishing capacity globally is US\$ 22 billion or about 68% of the total. Regionally, Asia and Europe provided the highest amount of fisheries subsidies of about US\$ 17 billion and US\$ 5.5 billion, respectively. These results imply that global fishing enterprises can, in the aggregate, absorb up to US\$ 32 billion of negative profit before they begin to obey the laws of economics, and withdraw from fishing. The results from this study also have policy implications for fisheries subsidy reforms at the WTO and in achieving sustainable fisheries management.

*Keywords: Global fisheries, subsidies, overcapacity, overfishing, WTO.*

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## **Demographics of Alaska Communities Most Involved in Commercial Fisheries**

Christina Package and Jennifer Sepez

Most communities in Alaska are involved in commercial fisheries in some way. We selected the 136 most involved using indicators such as landings, permits and vessels. This poster describes the demographics of these commercial fishing communities including patterns of community size, age, gender, race and ethnicity, as well as characteristics of their fisheries involvement, including commercial, recreational, and subsistence. Findings include that the majority of these fishing communities have populations of 400 or less, and that we see distinctive population structure characteristics for seafood processing communities (more working age males) and Alaska Native communities (more elders and children).

*Keywords: fisheries, fishing communities, demographics, community profiles, Alaska*



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