

A Think Tank of Scientists

Adapting to Change: Managing Fraser sockeye in the face of declining productivity and increasing uncertainty

Bio-Sketches

Susan Allen is a physical oceanographer. Trained as a physicist, applied mathematician and fluid dynamicist, her early, and one of her continuing focuses is the dynamics of rotating flow over topography with particular emphasis on submarine canyons. Using theory, laboratory experiments, numerical simulations and collaborating with observationalists Dr. Allen has generated an overall picture of the pattern and strength of upwelling over submarine canyons. In the process her group has shown the limitations of numerical models in simulating advection of stratified flow over steep topography.

In collaboration with Douw Steyn, Susan has made contributions to the field of atmospheric buoyancy driven flow over and through mountains. In her third area of research, she has worked with biologists looking at the effect of physical processes on advection of zooplankton and the timing of the spring bloom in the Strait of Georgia.

Dr. Allen was a member of the steering committee of Canada GLOBEC, has sat on a number of CMOS committees including the Science Committee, and has been a member of CNC-SCOR and the DFO Science advisory committee. She has held a faculty appointment at UBC since 1990 where she teaches physical oceanography, ocean and atmosphere dynamics and numerical techniques. Susan is a co-investigator of the NSERC Strategic network *Canadian Healthy Ocean Network* (CHONe) that is focused on biodiversity science for Canada's three oceans.

Mark Angelo, Chair of the Pacific Fisheries Resource Conservation Council, is a noted river conservationist, outdoor leader, teacher and writer. He is the Chair of the Rivers Institute as well as Program Head of the Fish, Wildlife and Recreation Department at the British Columbia Institute of Technology. He is the founder and chair of BC Rivers Day, and also chairs World Rivers Day.

Mark is a recipient of the Order of Canada and also holds the Order of British Columbia, in recognition of outstanding achievement in preserving Canada's waterways. He was the first recipient of the National River Conservation Award as Canada's most outstanding river conservationist in the past decade and he received the inaugural United Nations Stewardship Award. His involvement with conservation issues in British Columbia spans four decades and he has published close to 300 articles and editorials. In June 2009, Dr. Angelo received an honorary doctorate in science from Simon Fraser University.

Ken Ashley earned his BSc and MSc in Zoology, and MASc and PhD in Civil/Environmental Engineering from UBC. He worked for the Fisheries Research and Development Section of the BC Ministry of Environment for 25 years where he developed a variety of innovative lake aeration, lake and stream fertilization and habitat restoration solutions. From 2005-2007, Ken worked at the Greater Vancouver Regional District as Senior Engineer in the Utility Analysis and Environmental Management Division to learn about the deleterious effects of municipal wastewater discharges and drinking water withdrawals

on aquatic ecosystems. He returned to the Ministry of Environment in 2008 where he was the provincial contact for the Living Rivers Program and other habitat restoration /compensation programs. A member of the Salmon 2100 project team, Ken is currently an instructor at the BC Institute of Technology in the new undergraduate degree program in Ecological Restoration, and an Adjunct Professor of Civil Engineering at UBC, in addition to operating his own ecological engineering consulting company.

Patricia Gallagher is Director of Continuing Studies in Science, Director of the Centre for Coastal Studies, and Adjunct Professor in Biosciences at Simon Fraser University. Dr. Gallagher's research on salmon physiology and selective fishing conducted in partnership members of the BC commercial salmon fishing fleet, coastal communities and First Nations, the Province of BC and Fisheries and Oceans Canada was recognized in 2002 with the Vancouver Aquarium Murray A. Newman Award for Excellence in Aquatic and Marine Conservation Research which she received with Dr. Rick Routledge and Dr. Tony Farrell.

Formerly a professor in Biology at Memorial University of Newfoundland, Patricia has helped to develop a number of programs dealing with coastal and ocean resource sustainability issues in BC and Atlantic Canada. In 1998 she initiated the *Speaking for the Salmon* series of workshops, scientists' roundtables and think tanks focusing on linking science to policy for the future sustainability of Pacific wild salmon. Dr. Gallagher is a member of the Science Advisory Committee for the *Canadian Healthy Oceans Network* (CHONe), Board Member of Coastal Zone Canada, a co-founder and member of the steering committee of the *Canada Ocean Lecture* and a co-investigator on the Consortium for Genomic Research on All Salmonids (cGRASP) Genome Canada/BC funded research project based at Simon Fraser University and the University of Victoria.

Kees Groot was born in Modjokerto, on Java, Indonesia. After spending 3 years in a Japanese concentration camp during the Second World War, he studied biology at the Universities of Amsterdam and Leyden. He immigrated to Canada in 1956 and a year later joined the Fisheries Research Board of Canada (now DFO) as a fish behaviourist at the Pacific Biological Station in Nanaimo, BC. There, under the guidance of Dr. J.R. (Roly) Brett, he worked on problems related to a major threat to Fraser River salmon because of a proposal to build multiple dams on the main stem of the river for hydroelectric power. After this construction plan was rejected because of the high likelihood that migrating salmon stocks would be destroyed, his research focussed on long distance migration, orientation, and navigation of Pacific salmon. He used the data of these studies to obtain his PhD (cum laude) at the University of Leyden in 1965.

Dr. Groot served as Biological Director of the Netherlands Institute of Sea Research in 1966 and in 1968 he returned to Canada and the Pacific Biological Station. His studies there centered on: problems of Pacific salmon migration, specifically on how these fish find their way during long distance journeys; problems related to salmonid enhancement; and the potential effects of global climate change on west coast fisheries resources.

Dr. Groot has acted as research supervisor for numerous MSc and PhD candidates of Canadian and Dutch universities and has been a visiting professor at Simon Fraser University and the Bamfield Marine Station. He has also conducted Animal Behaviour workshops at the Pacific Biological Station, Malaspina University College, and the Rajamangala University in Trang, Thailand.

In 1993 Kees retired from DFO, became Scientist Emeritus, and started a private consulting business - Yellow Point Bio-Research.

Scott Hinch is a fisheries scientist in the Department of Forest Sciences and Centre for Applied Conservation Research at the University of British Columbia. He received BSc and MSc degrees from the University of Western Ontario and a PhD from the University of Toronto. Since joining UBC in 1994, he has developed two broad research programs: the study of salmon migration energetics, physiology, behaviour and survival; and, the study of land-use impacts on salmonids and their habitat. He collaborates extensively with colleagues studying physiology, biochemistry and genomics and uses an interdisciplinary approach to tackle pressing issues in the conservation and management of Pacific salmonids.

Dr. Hinch has been studying Fraser River sockeye salmon ocean and freshwater migrations for the past 16 years and has participated in several past inquiries into 'missing salmon'. He continues to lead an interdisciplinary research team investigating the early migration and high mortality phenomenon in late run Fraser sockeye, and the effects of climate change on Fraser sockeye.

Scott works closely with fisheries agencies to help guide management and policy implementation. He recently was a co-recipient of the American Fisheries Society Fisheries Management Division Award of Excellence "in recognition of his research groups' inspirational leadership and outstanding contributions to the fields of fisheries science, education and aquatic biology." He teaches several undergraduate and graduate courses dealing with fish conservation and management.

Jeffrey Hutchings undertook graduate studies at Memorial University of Newfoundland (MSc 1985; PhD 1991). Following postdoctoral research at the University of Edinburgh (1991-92) and at Fisheries & Oceans Canada in St. John's (1992-94), he accepted a faculty position at

Dalhousie University in 1995 where he is Professor of Biology and Canada Research Chair in Marine Conservation & Biodiversity. Dr. Hutchings' field research on the ecology and evolution of salmonid fishes has taken him from Newfoundland and the Maritimes (Atlantic salmon, brook trout) northward to Ellesmere Island, Nunavut (Arctic char). His salmonid work centres on questions pertaining to life history evolution, behavioural ecology, population biology, and conservation genetics.

Dr. Hutchings is Chair of the Committee on the Status of Endangered Wildlife in Canada (COSEWIC), Canada's national science advisory body responsible for assessing the status of species at risk. He is Chair of the *Royal Society of Canada (RSC)* Expert Panel on *Ocean Climate Change and Marine Biodiversity* and served as a member of the *RSC* Expert Panel (2001) that provided advice to the federal government on genetically modified organisms in Canada. He is serving, or has served, on the editorial boards of seven scientific journals, including *Canadian Journal of Fisheries and Aquatic Sciences*; *Proceedings of the Royal Society of London B*; and *Evolutionary Applications*. He is incoming Vice-President (2010-2011) and President (2012-2013) of the *Canadian Society For Ecology and Evolution*.

Mike Lapointe has a Bachelor of Science degree in Wildlife Management from the University of Maine and a Master of Science degree in Zoology (Fisheries) from the University of British Columbia. Mr. Lapointe has over 20 years experience in Salmon Assessment and Management. For the past 17 years, he has been a member of the Pacific Salmon Commission (PSC) staff, becoming its Chief of the Fisheries Management Division in 2002. As Chief, Mike leads a technical team of about 15 individuals that provide in-season assessments of return timing and abundance of Fraser River sockeye and pink salmon used by the bilateral Fraser River Panel to regulate harvests under the terms of the Pacific Salmon Treaty between Canada and the

United States. In addition to in-season duties, Mr. Lapointe and his staff assist the Panel in developing pre-season plans and liaise with agency staff from both countries in areas related to salmon assessment and management.

Connie Lovejoy completed her BS in Botany at the University of California Davis and her Doctorate at Université Laval in Biological Oceanography. Following a postdoctoral position in Barcelona (Spain) at the Institut de Ciències del Mar in molecular oceanography, in 2004 she joined the Department of Biology, Université Laval in Québec City where she is now a tenured professor. Dr. Lovejoy has published over 50 papers in peer-reviewed scientific journals and is considered a leading authority of biodiversity of marine microbes, including phytoplankton, protists, bacteria and Archaea. Her particular interest is the link between microbial communities and physical oceanographic processes. Connie is a co-investigator of the NSERC Strategic network *Canadian Healthy Ocean Network (CHONe)* that is focused on biodiversity science for Canada's three oceans.

Nathan Mantua is a Research Associate Professor in the School of Aquatic and Fishery Sciences, adjunct faculty in Atmospheric Sciences and Marine Affairs, the Co-Director of the Center for Science in the Earth System at the University of Washington, and a research scientist with the PNW Station of the US Forest Service. He has been a member of the UW's Climate Impacts Group since 1995. His research focuses on climate impacts on the water cycle, forests and aquatic ecosystems, and how climate information is or isn't being used in resource management decisions.

Nathan received a BS from the University of California at Davis in 1988, and a PhD from the UW's Department of Atmospheric Science in 1994. He spent one year as a postdoctoral Fellow at Scripps Institute of Oceanography working on a pilot project for the

International Research Institute for Climate Prediction. In April 2000, he received a Presidential Early Career Award for Scientists and Engineers for his climate impacts research and public outreach activities. He was a member of the PICES panel on Fisheries and Ecosystem Responses to Recent Regime Shifts in the North Pacific, spent six years serving on the US GLOBEC scientific steering committee, and was a member of the National Research Council's panel on the Alaska Groundfish Fishery and Stellar Sea Lions. Dr. Mantua currently serves on the PICES physical oceanography and climate committee and is a member of the *Royal Society of Canada (RSC)* Expert Panel on *Ocean Climate Change and Marine Biodiversity*.

Catherine Michielsens has a PhD in fisheries stock assessment from Imperial College, University of London (UK). For the past ten years Dr. Michielsens has been developing Bayesian assessment methods for both Atlantic and Pacific salmon stocks. Two years ago she joined the Pacific Salmon Commission to integrate the various pieces of information and data on Fraser River Sockeye salmon within the in-season assessment of the different stocks and extend the assessment to account for risk and uncertainty when providing management advice.

Arne Mooers is Associate Professor of Biodiversity at Simon Fraser University. Dr. Mooers received his training from McGill and Oxford Universities and previously held research positions at the Zoological Museum of Amsterdam, the University of British Columbia, and is a past fellow of the Institute for Advanced Study in Berlin. He is the incoming Chair of the Biodiversity and Conservation Committee, and a member of the Executive Committee, of the *Canadian Society for Ecology and Evolution*, and he is lead author of a review of the Species at Risk Act for the Federal Parliament. Arne's expertise is in phylogenetics, comparative evolutionary biology and ways to quantify biodiversity for conservation. (www.sfu.ca/~amooers)

Alexandra Morton is the director of the Salmon Coast Field Station in the Broughton Archipelago where she has lived and conducted research for 26 years. In addition to her well-known research on orca whales, Alexandra has authored or co-authored seventeen peer-reviewed scientific papers on impacts of salmon farms.

The author of a number of books and a Registered Professional Biologist, Alexandra is the recipient of the Roderick Haig-Brown Conservation Award (2005), the Vancouver Aquarium's Murray A. Newman Award for Excellence in Aquatic Conservation (2006), and the Roland Michener Conservation Award (2008) among others. Ms. Morton was part of a research team that was the last to see the 2009 sockeye as they migrated out of the Strait of Georgia.

Craig Orr is a behavioural ecologist and the Executive Director of the Watershed Watch Salmon Society, where he promotes salmon conservation and public outreach. Dr. Orr has served as Associate Director of Simon Fraser University's Centre for Coastal Studies, Chair of BC Hydro's Bridge Coastal Restoration Program, Vice-Chair of the Habitat Conservation Trust Fund, and technical reviewer for the Pacific Salmon Endowment Fund, Pacific Salmon Commission, National Marine Fisheries Service, Fisheries and Oceans Canada, Vancouver Foundation, Friends of the Environment Foundation, and others. He also currently chairs the Pacific Marine Conservation Caucus, and the Monitoring and Compliance Panel of the Integrated Salmon Dialogue Forum.

With Watershed Watch Craig has focused on a broad array of habitat and harvest issues, participating in numerous water use planning activities (Coquitlam Water Use Plan Consultative Committee, BC Hydro Fisheries Advisory Team, First Nations Water Use Planning Committee, Kwikwetlem Salmon Restoration Program), harvest planning committees (Integrated Harvest Planning Committee, Williams' 2004 Sockeye Review

Panel, Fraser Salmon Table, BC Aboriginal Fisheries Commission (selective fisheries coordinator), and other initiatives. Dr. Orr has worked extensively on the issue of aquaculture impacts for nearly a decade, authoring numerous technical reports and peer-reviewed studies, researching lice infestations on juvenile sockeye, and serving as science coordinator for the Coastal Alliance for Aquaculture Reform, where he oversees collaborative research and louse monitoring programs with Marine Harvest Canada.

Randall M. Peterman is a Professor in the School of Resource and Environmental Management at Simon Fraser University. He holds a Canada Research Chair in Fisheries Risk Assessment and Management. Dr. Peterman's research focuses on quantitative methods to improve the understanding and management of fish populations, particularly in the presence of uncertainties and conservation risks. His research group specializes in developing and applying quantitative methods to improve fisheries management, mostly related to Pacific salmon, through using large data sets, simulation models, Bayesian and other statistical methods, and formal decision analysis. Most relevant to this workshop is his group's past research on developing and comparing the methods for pre-season forecasting of abundances that are used by salmon management agencies on the west coast of North America.

Randall's group has received several international awards for the quality of its research. Randall has served on various policy advisory groups and helped to write the 1995 United Nations Food and Agriculture Organization's *Precautionary Approach to Capture Fisheries* and he is a member of the *Royal Society of Canada (RSC) Expert Panel on Ocean Climate Change and Marine Biodiversity*. <http://www.rem.sfu.ca/faculty/peterman.htm>
<http://www.rem.sfu.ca/fishgrp>

John Reynolds is a professor at Simon Fraser University, where he holds the Tom Buell BC Leadership Chair in Salmon Conservation and Management. His research focuses on understanding connections between salmon and their ecosystems, emphasizing implications for conservation and sustainability. This includes research on numerous streams in both the Fraser Basin and in the Great Bear Rainforest.

Dr. Reynolds has held a wide range of scientific advisory positions, including the BC Pacific Salmon Forum and the Skeena Independent Science Review Panel. He has written five books and over 150 scientific articles on ecology and conservation. In 2000, he was awarded the FSBI Medal by the Fisheries Society of the British Isles, and in 2003 he received the J.C. Stevenson Award from the Canadian Conference for Fisheries Research. <http://www.sfu.ca/reynolds>

Brian Riddell is the CEO and President of the Pacific Salmon Foundation. After receiving his PhD from McGill University in 1979, Dr. Riddell joined the Science Branch of the Pacific Biological Station (DFO), in Nanaimo BC. After 30 years of service to the public service of Canada he recently retired from the Department and joined the Pacific Salmon Foundation.

In science, Dr. Riddell is recognized for his work in population genetics of Pacific salmon culminating in the completion of Canada's Policy for the Conservation of Wild Pacific Salmon in 2005. However, he is likely best known for his ability to interact with a wide range of organizations and peoples, and his numerous advisory roles. Most notable are his efforts for the Pacific Salmon Treaty (1985) and his chairmanship of the Chinook Technical Committee for 20 years, work with the US National Research Council (Upstream: Salmon and Society in the Pacific Northwest. 1996) and advising on science and salmon conservation in the Pacific Northwest.

Throughout his career, Brian has established a strong reputation for objective accurate advice to senior management and integrity with all users and conservation groups in Canada and throughout the North Pacific region. He has also participated in program management since early in his career, becoming the Head of Pacific Salmon Research and Stock Assessment in British Columbia and the Yukon in 2005.

Since 1989, Dr. Riddell has received seven Public Service awards for his work in salmon conservation and management. He is a member of the of the *Royal Society of Canada (RSC)* Expert Panel on *Ocean Climate Change and Marine Biodiversity*.

Marvin Rosenau has a BSc and an MSc in Zoology, University of British Columbia, and a DPhil in Biological Sciences from the University of Waikato, New Zealand. Over the last 25 years he has worked in the field of fisheries in academia, consulting companies and agencies, including the BC Provincial Fisheries program as a research and management biologist and technician. In 1986 Marvin was a sockeye salmon stock-assessment technician for the Pacific Salmon Commission. Much of his subsequent agency work has focused on habitat and flow-restoration for stream and lake-rearing fishes, including Alouette Reservoir sockeye. Marvin worked extensively on lower Fraser River fisheries and habitat issues from the 1990s to early 2000s as a BC Ministry of Environment biologist.

Dr Rosenau has also acted as a Director for the Fraser Valley Salmon Society and the Fraser River Sturgeon Conservation Society and has authored or co-authored a number of scientific papers and numerous manuscript reports, including seven major habitat studies for the Pacific Fisheries Resource Conservation Council. He received the Vancouver Aquarium Murray A. Newman Award for Excellence in Aquatic Conservation (1999) and the BC Wildlife Federation Ted Barsby Conservationist of the Year Award (2009).

Currently, Marvin is an instructor of Fish Ecology and Management and Environmental Monitoring courses, and supervises student studies in the Fish, Wildlife and Recreation Program at the British Columbia Institute of Technology.

Rick Routledge develops and applies statistical methodology in population biology and renewable resource management. Current projects include (i) coordination of and participation in ecosystem research on the British Columbia Central Coast, and (ii) collaborative research on interactions between fish farms, sea lice, and wild Pacific salmon.

Dr. Routledge has also worked with the Pacific Salmon Commission on alterations to their hydroacoustic estimation of fish passage in the Fraser River, and has developed models for generating theoretical insight on mixed-stock fisheries, extinction risks, and incorporating uncertainty into forest management decisions. He served on the Fraser River Sockeye Public Review Board in 1994-1995, and was a founding member of the Pacific Fisheries Resource Conservation Council.

Rick has been a faculty member at Simon Fraser University since 1980, and served as Chair of the Department of Statistics and Actuarial Science from 2004 to 2007. He was a co-recipient of the Vancouver Aquarium Murray A. Newman Award for Excellence in Aquatic and Marine Conservation and Research in 2002.

Michael Staley, BSc, MSc, Registered Professional Biologist, completed his post graduate work at the Institute for Animal Resource Ecology at UBC under Dr Carl Walters where he also spent several years as a research associate working mainly on population dynamics and fisheries management issues related to Fraser River sockeye.

For the past 20 years he has worked as a fisheries advisor for First Nations in BC. He is currently the senior biologist with the Fraser River Aboriginal Fisheries Secretariat. Michael has been a member of the Fraser River Panel Technical Committee since 1993 and participates on the technical working group for the Fraser River Sockeye Spawning Initiative.

Ken Wilson is a representative of the Marine Conservation Caucus, serving on the Integrated Harvest Planning Committee, and the Canadian caucus of the Pacific Salmon Commission's Fraser Panel. After completing his post graduate work at the University of BC in 1980, Ken began his career with DFO, Fraser River Division, as a fisheries manager and stock assessment biologist, leaving in 1997 to assume responsibilities as the Stock Management coordinator for the Fraser River Aboriginal Fisheries Secretariat. In this capacity, Mr. Wilson chaired the Fraser Watershed Stock Management Committee and served on the Marine Fish Species Specialist Group of the Committee on the Status of Endangered Wildlife in Canada (COSEWIC).

Howie Wright is the Fisheries Manager for the Okanagan Nation Alliance Fisheries Department and has been working with the ONA since 1999. He is from the Gitksan Nation near Hazelton, BC. He has a Master's of Science degree in Resource Management and Environmental Studies with the Institute for Resources and Environmental Studies at the University of British Columbia. His graduate research examined the in-lake interactions of sockeye, kokanee, and *Mysis relicta* in Skaha and Osoyoos Lakes.

Mr. Wright is a member of the First Nations Fisheries Council and is a Registered Professional Biologist with the College of Applied Biology in BC. He is also a member of the Canadian Okanagan Basin Technical Working Group, and is a previous member of the Marine Fishes Species Specialist Committee for the Committee on the Status of Endangered Wildlife in Canada (COSEWIC), and the Fisheries and Oceans Canada (DFO) National Science Advisory Council.