

2001-2003 Report

restoring
fisheries

conserving
aquatic life

rebuilding
ecosystems

researching
options

The Fisheries Centre
University of British Columbia



Forewords



I want to extend my congratulations to the members of the Fisheries Centre for the contributions they have made to sustainable development and management of the world's fisheries. The Centre brings together government and non-government agencies, First Nations, and the UBC community in an exemplary model of how to address regional and global issues through multidisciplinary research and collaborative teaching. Surrounded as we are by British Columbia's considerable natural resources, it is sometimes easy to ignore the enormous challenges posed by dwindling resources and growing demand, but these pages offer an optimistic vision for a secure and prosperous future.

Dr Martha Piper
President, University of British Columbia



Since its inception 12 years ago, the Fisheries Centre has joined the ranks of the world's leading interdisciplinary research units. The work reviewed in this report is a testament to the excellence of the Centre's members, who have shown remarkable drive and enthusiasm as they tackle some of the most challenging economic and ecological issues of our time. We are proud to provide continuing support for the Fisheries Centre, which will soon be moving to a new home in the Aquatic Ecosystems Research Laboratory, thanks to the support of the Canada Foundation for Innovation.

Dr Frieda Granot
Dean, Faculty of Graduate Studies



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Director's Introduction

It is my pleasure and honour to present this second report of the Fisheries Centre, its members and their activities and output from 2001 to 2003. The Centre was founded in 1993 and its establishment and the expansion of its research activities are documented in a report covering the period 1993 to 2000.¹ Since then, members have made notable advances in meeting our mission goals and they continue to contribute to the Centre's reputation as a global leader in fisheries research. This report presents its members, units and their activities and output for the period from 2001 to 2003.

The units and/or research groups within the Fisheries Centre are: *Back to the Future*; the *Fisheries Economics Research Unit*; the *Marine Mammal Research Unit*; the *Quantitative Modeling Group*; *Project Seahorse* and the *Sea Around Us Project*. Each is led by one faculty member, supported in most cases by one or more post-doctoral fellows or other mid-level researchers, a number of graduate students and support staff, as is typical of most centres of excellence at research universities. We differ, however, from otherwise similar institutions in the extent of the collaboration among these units and groups. This collaboration, which also includes the Aquatic Ecosystems Science Section of the British Columbia Ministry of Water, Land and Air Protection, manifests itself at various levels: co-supervision of graduate students, collaborative research funded by jointly submitted proposals and a shared commitment to what have become our guiding principles: *restoring fisheries; conserving aquatic life; rebuilding ecosystems; and researching options*.

Our record covers the publishing gamut, from articles in the most prestigious peer-reviewed journals to books, magazines, newsletters and other media aiming at a broad audience. We also host a seminar series, workshops, conferences and open houses to share our research findings, foster collaboration and engage the public in debates surrounding fisheries issues. Indeed, we believe that a wide range of activities devoted to public awareness is a necessary complement to research on the exploitation and state of natural resources.

Contrary to a still widespread belief, there is more to the study of fisheries than the biology of fish. Fisheries science involves the ecosystems within which exploited species live, the manner in which humans interact with these ecosystems, and even the manner in which these interactions are governed. It was Dr Tony Pitcher, Director from shortly after the Centre was founded to mid 2003, who first recognized the need for a Fisheries Centre with strong interdisciplinary focus and guided its development for its first decade. This report is a testament to his vision and determination, and we take this opportunity to thank him for staying the course.



Daniel Pauly
Director
Fisheries Centre

¹ Copies of the 1993-2000 report are available upon request from office@fisheries.ubc.ca, along with additional copies of the present report.



Fisheries Centre Mission and Activities

The Fisheries Centre's mission statement, developed in 1993, is still relevant today:

Our planet's fisheries have reached their ecological limits. Furthermore, those increasingly scarce and depleted biological resources are affected by diverse human, economic, political and social activities. Future policy and planning essential to the successful stewardship of global fishery resources must be based on research that encompasses many traditional disciplines, acknowledging human as well as biological and environmental perspectives.

The Fisheries Centre members undertake a number of collaborative activities to fulfill its mission, including:

- Publications of academic research based on grants and contracts;
- Instruction and supervision within the UBC Faculty of Graduate Studies;
- Workshops and meetings, and publications based upon them;
- Sponsorship of public and professional seminars;
- Professional training;
- Public outreach including media releases, public lectures and open houses;
- Developing policy recommendations;
- Catalyzing the establishment of MPAs;
- Participation in local, regional and international initiatives that contribute to better management of fisheries and aquatic ecosystems.

Over the last three years, the Centre held three international and three domestic workshops, and three training programs. Some costs have been met from grant funding, but many have been sponsored by outside agencies. The workshops have drawn researchers and policy-makers from around the world and generated a range of publications, from *Fisheries Centre Research Reports* to special issues in peer-reviewed journals.



The Centre hosts a weekly seminar series during the fall and winter semesters. Sponsored by a grant from the British Columbia government, it allows the Centre to bring in speakers from Canada and internationally as well as local researchers covering topics from fish ecology to fisheries ethics. The series also provides students and members with a forum to present internal works-in-progress for peer-review. The Centre also hosts the prestigious Larkin Lecture, held every two years.

The Larkin Lectures

The Larkin Lectures are held in memory of the late Professor Peter Larkin and funded through an endowment established by his colleagues, family and friends. The Larkin Lectures for the 2001 to 2003 period were:

Dr Dayton Lee Alverson, NRC Seattle, USA: "The Good, the Bad and the Ugly: Factors Influencing the Scope and Quality of Fisheries Science and Management Decisions" (2001)

Dr Yvonne Sadovy, Department of Ecology & Biodiversity, The University of Hong Kong: "Trouble on the reef: tackling a vulnerable and undervalued fishery" (2003)



Aboriginal Fisheries

Recent studies indicate that First Nations may have contributed significantly to the spread of salmon populations since the last Ice Age, increasing the complexity of habitats and ecosystems and stabilizing resource throughout their territories. First Nations now look to these ecosystems for the future social, economic, and spiritual renewal of their cultures. Their relationship with governments and society at large is evolving through the media, litigation, industry and collaboration with the scientific community.

In 1997, the UBC Fisheries Centre, UBC First Nations House of Learning and the BC Aboriginal Fisheries Commission (www.bcafc.org) joined forces to make university science more relevant to First Nations communities, accelerate enrolment of Aboriginal graduate students and explore practical and respectful ways to incorporate First Nations' traditional knowledge and values in aquatic ecosystem management. One example is Stephen Watkinson of the Tsimshian Nation, who received a master's degree for his thesis on the importance of salmon carcasses to freshwater and forest habitats. An independent review of the First Nations House of Learning cited this collaboration as an "exemplary model" for other UBC units to follow in their dealings with First Nations.

The partnership was a direct contributor to the conferral of an honorary degree on Chief Simon Lucas in 2002. Chief Simon also received a National Aboriginal Achievement Award in 2003 for his lifetime contribution to conservation and consensus-building in the BC fishery.

The partnership is responsible for 16 publications by First Nation authors and co-authors. It has hosted several valuable conferences, including "Putting Fishers' Knowledge to Work", which was attended by 200 people from 33 countries and 36 First Nations and Aboriginal organizations and which has led to a book nearing publication, and the Education for Aboriginal Fisheries Science and Ecosystem Management Workshop on ways to accelerate enrolment of Aboriginal students in ecosystem science, both in 2001. Members also work closely with colleagues in the *Back to the Future* unit in northern B.C.

Current initiatives include the proposal of the world's first Endowed Chair of Aboriginal Fisheries to catalyze student enrolment and collaboration with First Nation communities and securing credible First Nations input into UBC's soon-to-be-built Aquatic Ecosystems Research Laboratory. The Fisheries Centre's record of collaboration with First Nations was a key to the approval of this ~\$15 million project. The Unit is also engaged in an ongoing search for scholarship funding for graduate students, assisting prospective master's students from the Nuxalk Nation and preparing an Aboriginal session at Fourth World Fisheries Congress and parallel Aboriginal Fisheries Session at the UBC Longhouse.

Participants at the Millennium Ecosystem Assessment Marine and Coastal Cross-Cutting Workshop hosted by the Fisheries Centre in April 2003



Back to the Future



Over the past three years, Tony Pitcher's students, research assistants and post-doctoral scientists have been concerned primarily with devising quantitative policy objectives for sustainable fisheries that take account of both fisheries outputs and ecosystem integrity. They have been using, and helping to develop, a methodology based on whole-ecosystem simulations, supported by the development of evaluation techniques, including the rapid appraisal method *Rapfish*. Most group members have been associated with the *Back to the Future* project sponsored by *Coasts Under Stress*, with various aspects of the *Sea Around Us Project*. In addition, several have carried out analyses of unreported fishing in case study areas, while another has collaborated with the New England Aquarium on research on bluefin tuna movements and schooling. Our work on a series of Hong Kong contracts came to an end during this period with the publication of spatial ecosystem analyses of alternative human-made reef closures. New work on spatial analysis has commenced in collaboration with New South Wales fisheries and Commonwealth Scientific and Industrial Research Organization of Australia, and with the University of the Azores, Portugal.



Tony Pitcher
Director



Nigel Haggan

Members of the group have organized workshops in La Paz, Mexico, with three institutes in the Gulf of California; in Sydney, Australia, with over 70 fisheries researchers and six institutes; in Prince Rupert, BC, and in Haida Gwaii, with aboriginal fishers and non-governmental organization; and, for *Sea Around Us*, at UBC with international researchers on Antarctic ecosystem models. Members of the group attended a NATO workshop in Antibes, France, on strategic management in marine ecosystems and conducted interviews aimed at gathering local environmental knowledge in Prince Rupert and Haida Gwaii.

Eny Buchary was awarded an IDRC Fellowship with which to conduct her fieldwork in Komodo and Bali, and Robyn Forrest was awarded a University of Sydney scholarship. Cameron Ainsworth wrote successful proposals to WWF and the BC Government. Dr Melanie Power left to take up a postdoc with the Centre for Applied Ethics, and Dr Nathaniel Newlands has a postdoc in the Maths Dept, both at UBC. Ms Aftab Erfan moved to take up a Phd offer in another University. Ms Foulkes went to study medicine. Mr Richard Stanford took up a post with a UK Coastal Conservation Trust. Dr Sheila Heymans, Ms Louisa Wood, and Dr Jacqueline Alder moved to other projects in the Fisheries Centre. Dr Marcelo Vasconcellos left for a fisheries officer position at FAO. Dr Tonny Wagey moved to a position with the Indonesian Government in Jakarta. Professor Tony Pitcher gave Keynote addresses at conferences in Chicago, Darwin, and the Azores, went on sabbatical with FAO in Rome, served as Chair of the Program Committee for the Fourth World Fisheries Congress, and was awarded the Beverton Medal by the Fisheries Society of the British Isles.



The BTF workshop team enjoys breakfast in La Paz, Mexico, 2001.

www.fisheries.ubc.ca/projects/btf



B.C. Land, Water and Air Protection



Bruce Ward

The Fisheries Centre houses 12 members of the Aquatic Ecosystems Science Section of the BC Air Protection. The section conducts research on freshwater fisheries management, fish habitat restoration, fish forestry interactions, and fish culture techniques. In addition, an active focus on conservation biology supports British Columbia's goal of maintaining and enhancing the province's fish and wildlife species and their habitats.



Jordan Rosenfeld



Dan Hogan

British Columbia has over 200,000 small (<1 ha) lakes, hundreds of larger lakes and wetlands, and thousands of kilometres of rivers and streams. This resource is the basis of a sport fishery for more than 400,000 anglers. In addition, abundant freshwater habitats provide spawning and rearing opportunities for British Columbia's salmon, steelhead and several other fish species native to BC. The province's complex geography and glaciation history produced a province rich in natural resources and biodiversity values. Managing these resources in a sustainable manner requires the development of ecosystem-based management tools along with data and Geographic Information Systems that support government and industry decision-making systems.



Sheldon Reddekopp



Debbie Aird

Freshwater habitat restoration is an area of research area where British Columbia has been a world leader. Defining the relationships between habitat structure, nutrient dynamics and growth and survival of juvenile fish populations has allowed for the development of realistic restoration options for several "at risk" lake and stream-dwelling fish populations.



Tom Johnston



Eric Parkinson

The partnership between the province of BC and the Fisheries Centre and other units of the University of British Columbia has resulted in support for hundreds of graduate students as well as fostering a collaborative research environment between government scientists and university faculty for more than 50 years. This association will be of increasing importance as the stresses on our natural environment continue to increase, and the need for science-based decision-making assumes a greater role in government.

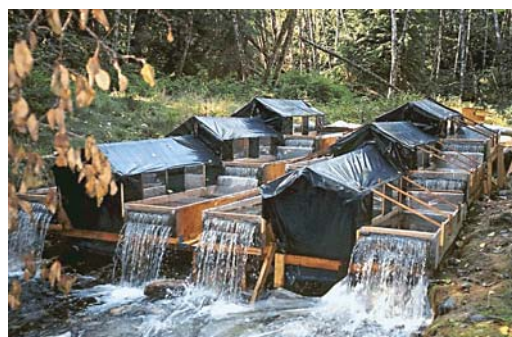


Art Tautz

www.agf.gov.bc.ca/fisheries



Theresa Godin



Experimental stream habitats for studying juvenile coho salmon growth



Ken Ashley



Quantitative Modelling Group

The *Quantitative Modeling Group* focuses on population and ecosystem dynamics and sustainable resource management. Its members develop a range of models exploring terrestrial and aquatic ecosystem interactions and stock assessment methodologies. In collaboration with other projects at the Fisheries Centre, the University of Wisconsin and the US National Marine Fisheries Service, they are exploring the utility of *Ecopath with Ecosim* (EwE) as fisheries management tools. Recent studies include the ecological effects of fishing, optimal management strategies given ecosystem considerations and the utility of marine protected areas given species behaviour, effort distribution and environmental spatial heterogeneity. Models have also been developed to evaluate the utility of tagging in stock assessment, ecosystem effects of nutrient loading in Florida Bay and effort dynamics in multispecies fisheries. Terrestrial modeling has focused on predator-prey interactions of large mammal systems in human-altered landscapes, focusing on the interactions among woodland caribou, moose and wolves and potential management strategies to reverse the decline of woodland caribou.

Research questions are also addressed through field programs. For example, the group has been instrumental in helping Australia's Fisheries Research and Development Corporation design pilot projects for the development of remote tissue collection and genetic mark-recapture for the narrow-barred Spanish mackerel *Scomberomorus commerson* and the feasibility of genetic tags for monitoring fisheries. Recently, projects utilizing acoustic telemetry in southern British Columbia to study the patterns of early ocean mortality and migration of juvenile Pacific salmon have been implemented. Over the next several years, in collaboration with several fisheries scientists (see www.coml.org/descrip/post.htm), the program will be expanded to monitor the movements and assess juvenile mortality of several salmon stocks within the Georgia Basin. In collaboration with the British Columbia Ministry of Water, Land and Air Protection, individuals in the group have been researching the relationship between fisheries impacts and multiple stable states in interior small lakes in B.C. This project's aim is to explore the "cultivation-depensation" mechanism proposed as an explanation for the non-recovery of certain stocks, such as Northern cod, and to provide insight into mechanisms responsible for species composition changes in aquatic ecosystem. Over the last several years the group has been working with B.C. Hydro to address key uncertainties in water use management planning. Recent work, in conjunction with MOTE Marine Laboratories Florida, has focused on the development of the monitoring programs required to evaluate the benefit of marine enhancement.

Villy Christensen and Ben Wilson testing acoustic telemetry equipment in English Bay.



Carl Walters
Director



Robert Ahrens
Lecturer



Picking gillnet during experimental depletions of rainbow trout at Chester Lake, Bonaparte Plateau, near Barriere B.C.





Fisheries Economics Research Unit



Rashid Sumaila
Director

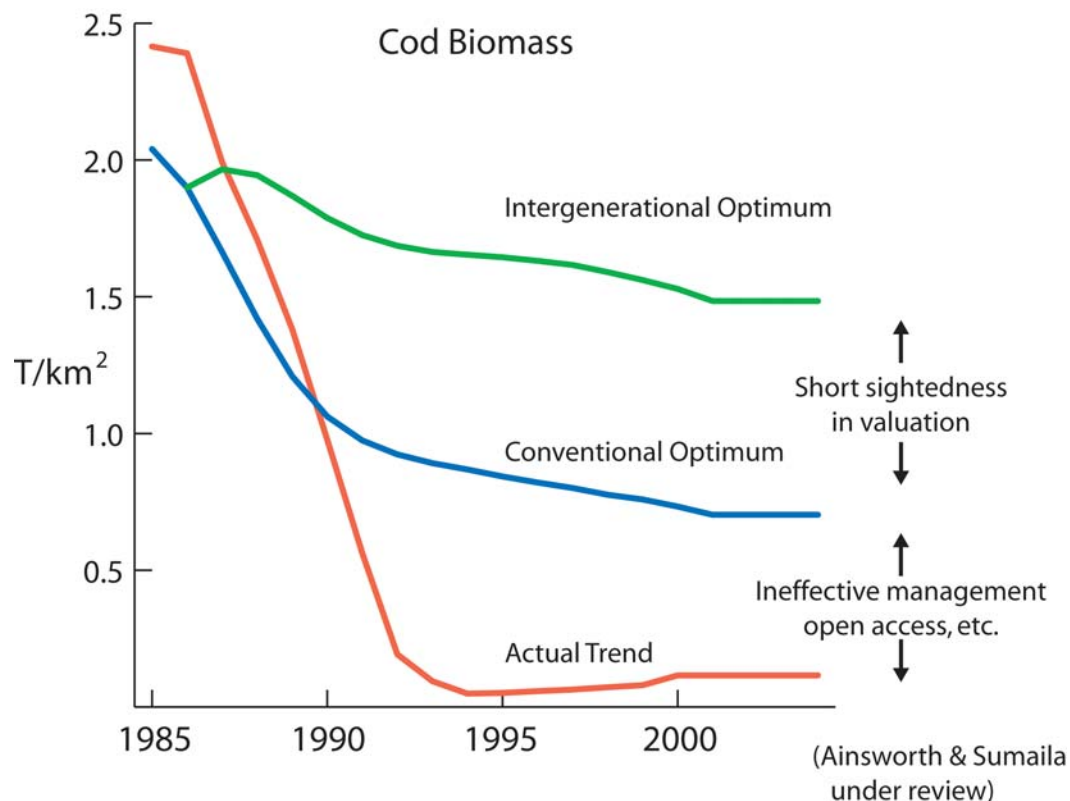


Gordon Munro
Professor
Emeritus

The *Fisheries Economics Research Unit's (FERU)* guiding principle is “fisheries benefits for all generations.” The Unit uses economic tools to address issues relating to the management of aquatic resources for the benefit of current and future generations, while maintaining ecosystem integrity.

Members, who collaborate with colleagues within and outside of UBC, have diverse research interests, ranging from fundamental economic theory to applied empirical studies. Key areas of interest include: (i) the effects of subsidies on fisheries; (ii) valuation of natural resources, in particular, on appropriate methods of considering future benefits from resource use; (iii) economic determinants of illegal, unreported and unregulated (IUU) fishing; (iv) bioeconomic modeling; (v) economics of marine protected areas; (vi) economics of aquaculture; (vii) economics of shared fish stocks; and (viii) globalization, fish trade and marine ecosystems.

Although less than two years old, the Unit has already begun to capture the attention of both scientific colleagues and funding agencies. It has attracted funding from a range of national, intergovernmental, and non-governmental organizations. The North American Association of Fisheries Economists recently gave *FERU* its seal of approval by selecting the Unit as host to the 2005 NAAFE Forum. Similarly, *FERU* is prominently involved with the World Fisheries Congress in May 2004.



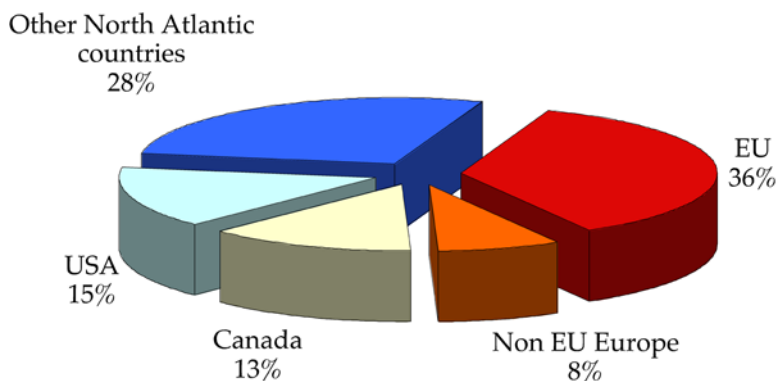
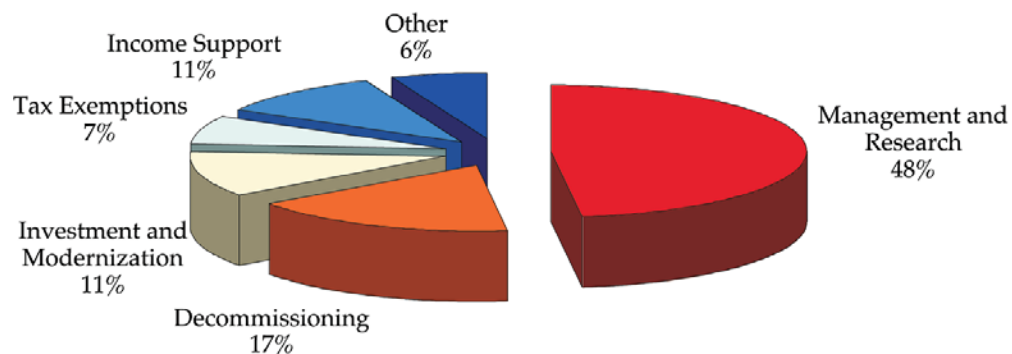
Changes in catches under three fishing regimes from 1985 to 2004.



Current *FERU* projects include:

- The Benguela Current Large Marine Ecosystem (BCLME) project, funded by the Global Environmental Facility of the United Nations. The project will determine the optimal harvesting ratio between trawled and longline hake in order to extract maximum socio-economic value from these resources, while ensuring long-term sustainability of hake stocks in the ecosystem;
- The US Marine Ecosystem Valuation project, funded by OCEANA. The project will estimate the value of US marine ecosystems, accounting for the problems associated with traditional economic valuation, in order to obtain a measure of the “worth” of the ecosystems;
- Global economic analysis of fishing, funded by the Sea Around Us Project. This work involves research on a global price database, subsidies, ecosystem valuation, illegal, unreported and unregulated (IUU) fishing and global fish trade;
- Economics of IUU fishing project, funded by the OECD. This project explores the possible drivers of risk and the costs associated with fraud, avoidance and apprehension in relation to IUU fishing activities. The study will establish how IUU fishing vessels take costs and benefits (monetary and social) into account when deciding whether to engage in IUU fishing or not;
- Net benefits from the sablefish aquaculture in British Columbia project, funded by the Canadian Sablefish Association. A collaborative project with John Volpe of the University of Alberta explores the potential costs and benefits of introducing sablefish farming in BC.

Currently eight graduate students are associated with *FERU*, and all are active participants in the projects listed above.



www.feru.org

Distribution of North Atlantic fisheries subsidies by percentage in 1997.





Marine Mammal Research Unit



Andrew Trites
Director



Rebecca Barrick
Research Assistant



Karin Bodtker
Research Assistant



Volker Deecke
Post-doctoral Fellow



Edward Grev
Researcher



Sylvie Guénette
Research Associate



Rod MacVicar
Research Assistant



Chad Nordstrom
Research Assistant



David Rosen
Research Associate



Pamela Rosenbaum
Manager



Lisa Skinner
Research Assistant

The *Marine Mammal Research Unit* is integrated within the Fisheries Centre and works with other departments and institutions, combining specialties in a coordinated effort to provide independent research and advice on matters related to marine mammals. Members investigate interactions between humans and marine mammals, marine mammals as indicators of ecosystem change, and the natural history, biology and conservation of marine mammals. *MMRU* research focuses on five areas: population dynamics, energetics and physiology, dietary analyses, behaviour and ecology, and simulation modeling. The multi-disciplinary research program contains three components: field studies, captive animal studies, and data analysis and laboratory studies.

Captive animal studies focused primarily on the nutritional and energetic consequences for marine mammals faced with changes in the types and quantities of prey available to them. *MMRU*, in collaboration with the Vancouver Aquarium Marine Science Center (VAMSC), received a Canadian Foundation for Innovation grant with matching funds from the British Columbia Knowledge Development Fund (BCKDF) to renovate the marine mammal research facilities at the VAMSC and to establish an Open Ocean Research Station in 2003. The research colony at the VAMSC increased to 13 Steller sea lions with the addition of five pups in 2003. Studies at the VAMSC provided data about growth, energetics and nutritional requirements that could not be established in the wild. They also provided a means of testing and developing techniques for studying free-ranging marine mammals such as estimating metabolism from heart rate, and reconstructing diet from fish bones found in fecal remains. The Open Ocean Research Station allows research to be conducted with trained sea lions swimming freely in the ocean accompanied by researchers.

Field Studies in Alaska focused primarily on filling in missing pieces of the Steller sea lion life history to help understand why populations in the Gulf of Alaska and the Aleutian Islands continue to decline. These included documenting the timing of moulting, and estimating the length of time that sea lions spend searching for food in summer and winter in increasing and decreasing populations. Other studies in Alaska analyzed the calls of killer whales to distinguish pods. Field studies in British Columbia assessed the impact of whale watching on killer whales, and the effects of gillnet fisheries on harbour porpoise.



Steller sea lion captive research





Harbour seals



Gordon Hastie
Post-doctoral
Fellow



Susan Heaslip
Research
Assistant



Sheila Heymans
Post-doctoral
Fellow



Ruth Joy
Biostatistician



Renee LaRoi
Web Designer

Simulation studies and analyses of historical data sets were undertaken to estimate the food requirements of sea lions and identify critical habitat for whales in British Columbia. Trophic overlaps between marine mammals and commercial fisheries were mapped, and the diets of fin, sei and sperm whales were described. Significant reviews were also published which examine the ecological effects of regime shifts in the North Pacific, and the nutritional-stress and disease hypotheses that have been proposed to explain the decline of sea lions in the North Pacific. Other reviews of food web theory, predator-prey relationships, marine mammal trophic levels, and cultural transmission within maternal lineages of killer whales were also undertaken. Finally *MMRU* researchers prepared species status reports on sea lions, sei whales and killer whales to assist the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) with listing decisions.

MMRU continued to administer the North Pacific Universities Marine Mammal Research Consortium, which unites marine mammal research at the Universities of Alaska, British Columbia, Washington, and Oregon State. The Unit also continued to host an annual Symposium on B.C. Marine Mammals, which provides a forum for local researchers, members of the fishing industry, ecotourism operators, and the public to meet and discuss current issues and research related to marine mammals in British Columbia. *MMRU* graduate students hosted meetings of The Society for Marine Mammalogy's Student Chapter, Northwest Region, which includes students from universities in Washington, Oregon, B.C. and Alaska. Unit members also assisted in hosting the 14th Biennial Conference on the Biology of Marine Mammals, which brought 1,700 researchers to Vancouver in 2001 and provided an opportunity to showcase the research being undertaken at UBC.



Humpback whale

www.marinemammal.org



Dominic Tollit
Research
Associate



Graham Wallace
Research
Assistant



Ben Wilson
Research
Associate



Lindsay Wilson
Research
Assistant



David Gummesson
Research
Assistant



Arliss Winship
Researcher



Mary-Ann Lea
Post-doctoral
Fellow





Amanda Vincent
Director



Shannon Charney
Operations
Assistant



Sarah Foster
Research
Assistant



Brian Giles
Research
Assistant



Melissa Grey
Research
Assistant



James
Hrynshyn
Communications
Coordinator



Project Seahorse

Project Seahorse advances marine conservation through a comprehensive research and management program rooted in securing a future for intriguing fishes, and their marine ecosystems. What began as studies on the behavior and ecology of seahorses has grown to embrace a broad array of initiatives for many marine species and systems. The team conducts fundamental biological and social research, manages subsistence fisheries, redresses habitat loss, adjusts international trade, and communicates broadly. By the time Dr Amanda Vincent brought Project Seahorse to the Fisheries Centre in July 2002, the team had grown to 40 biologists, anthropologists and community development specialists, many of them based in the Philippines. Team members are also active in Australia, Hong Kong, Portugal, the U.K., and the U.S. Uniting them is the knowledge that the proximate threats facing seahorses – destruction of habitat, overfishing and incidental capture – are common in marine ecosystems, and that the potential solutions are of general benefit in marine conservation.

Global cooperation among communities, scientists, non-governmental organizations and regulatory authorities is essential if fisheries are to be better managed. Among Project Seahorse's significant accomplishments is a recent precedent-setting decision by the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) to add seahorses to its list of regulated species. Immediately following the landmark seahorse decision, CITES revisited and approved proposals to list two species of shark, thus providing a valuable new tool for international fisheries management. Project Seahorse served as lead technical advisor in the seahorse negotiations, was chair of the seahorse working group at CITES, and is now helping to implement the listing, with support from the fishing and trading communities.

In the Philippines, research and management have helped Project Seahorse catalyze establishment of new community-managed no-take marine protected areas, bringing the total to twelve. Project Seahorse also assisted in creation of a powerful alliance of subsistence fishers, and a crafts cooperative to assist seahorse fishing families to move to environmentally sustainable supplementary livelihoods. Work on seahorses continues apace, too, with a new rapid assessment program laying the basis for CITES

implementation. Activities in the Philippines are now coordinated by the new Project Seahorse Foundation for Marine Conservation, a registered Filipino non-governmental organization.

The Project Seahorse team is also busy elsewhere in the world:

- Team researchers based in Canada and the Philippines are investigating the scope of the world's non-food fisheries, site-selection methodologies for marine protected areas, the



Monitoring an MPA in the Philippines





The Project Seahorse Foundation for Marine Conservation Philippines team: Back row from left: Messenger Alfie Bartolo, Director Amado Blanco, Biologist Brian Cabrera, Biologist Roger Bayutas, Social Researcher Joel Erediano, Bookkeeper Lorena Mabatid, Community Organizer Alen Mondido, Policy Officer Erwin Brunio, and Community Organizer Pert Aulixio; Front row from left: Livelihood Coordinator Rachel Malabanan, Finance Officer Lourdes Labrada, Information and Education Officer Mia Apurado, Biologist Amida Macansantos, Biologist Armi May Torrechilla and Administrative Assistant Michelle Ban.

management of fisheries at both the large and small scale, and underlying evolutionary processes that maintain biodiversity.

- The marine medicinals program officer in Hong Kong has attracted broad support for trade adjustment within the traditional Chinese medicine community, which processes most of the world's dried seahorses and other marine species.
- The Australian program has been involved in monitoring and advising on bycatch in the substantial trawl fisheries, as well new research on seahorses themselves.
- Work in Portugal is allowing assessment of the effects of non-selective fishing gear and habitat change on seahorses, which are abundant in the lagoon.
- Working from the U.K., Project Seahorse has helped engage a consortium of more than 75 of the world's public aquaria in marine conservation, using seahorses as flagship species for research and education outreach.

Project Seahorse has embraced cooperative scientific ventures with partners and collaborators that include the John G. Shedd Aquarium in Chicago, Zoological Society of London, University of Tasmania, World Wide Fund for Nature and TRAFFIC TRAFFIC East Asia.

www.projectseahorse.org



Bob Hunt
Research
Assistant



Jean Marcus
Post-doctoral
Scientist



Denise McCorry
Post-doctoral
Scientist



Sue Mulligan
Administrative
Assistant



Jorma Neuvonen
Operations
Director



Hippocampus denise

Photo courtesy Denise Tackett



Heather Hall
Associate
Director
London
Zoological
Society



Samuel Lee
Marine
Medicinals
Officer
Hong Kong



Keith
Martin-Smith
Research Fellow
University of
Tasmania



Heidi Shuter
Administrative
Assistant





Sea Around Us Project



Daniel Pauly
Director

The *Sea Around Us Project (SAUP)* assesses large-scale impacts of fishing on marine ecosystems and finds solutions to the challenges they pose using a variety of tools including ecosystem modeling, mapping, economic and policy analyses and public outreach. Its work extends on our knowledge and understanding of the impacts of fishing on marine environments globally.

Sea Around Us Project's tools for mapping global catches make it possible to look at landings spatially. This work established that China inflated its fish landing statistics with an overall correction of lower global fish landing totals. The findings, published in *Nature* (2001), motivated calls for more reliable fisheries statistics and better management globally.



Villy
Christensen
Researcher

The Project quantifies the ecosystem impacts of fisheries at the ocean-basin level, i.e., at a larger scale than ever attempted before. A map-based approach allows us to draw basin-wide inferences from numerous local observations synthesized from mass-balance food web modeling. We estimate that the biomass of high trophic-level fishes in the seemingly well-regulated North Atlantic declined by an order of magnitude in the last century. The results demonstrate that in the most-studied and most-regulated ocean basin in the world, the decline in fishery catches is associated with increasing fishing. Thus, it is not surprising that fisheries throughout the world, are unsustainable (*Nature*, August 2002). The Project collaborates with Professor Walters on developing the Ecopath with Ecosim (EwE) ecosystem modeling approach. EwE is the world's de facto standard for modeling ecosystem based management of fisheries, with 2500 registered users of the software in 124 countries, over 200 hundred published applications, and some 30 graduate theses in various universities based on the approach. Ecosystem modeling is an integral aspect of the work of the *Sea Around Us*, and we cooperate extensively with colleagues around the world to support the move towards an ecosystem approach to fisheries. The ecosystem modeling work serves as an integrating factor with members of the Sea Around US collaborating with colleagues in all the other units of the Centre on joint projects or thesis work.



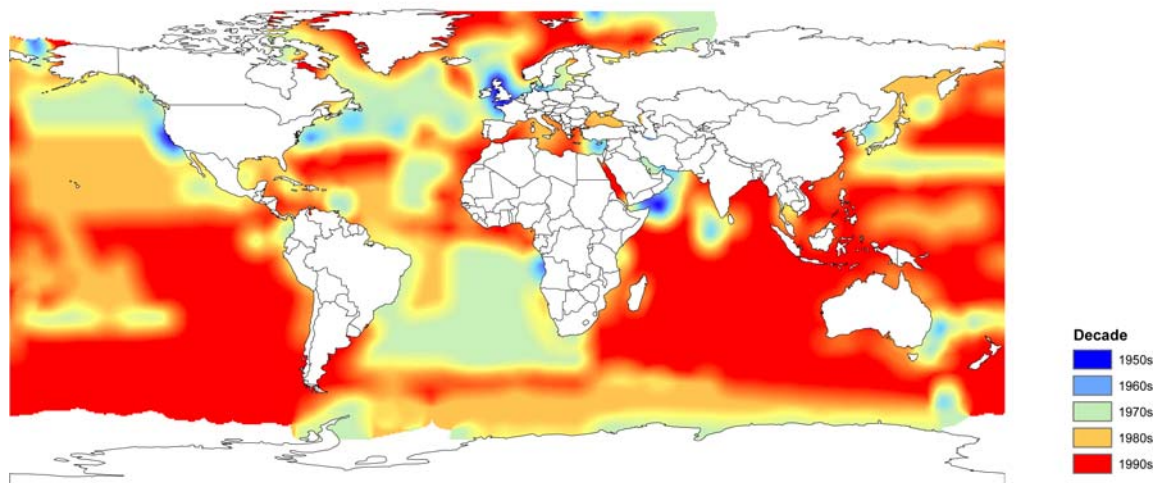
Reg Watson
Researcher



Jackie Alder
Researcher



Maria Lourdes
(Deng)
Palomares
Researcher



Decade with the maximum fish and invertebrate landings.



Assessment of southeast Atlantic fisheries culminated in 2002 in the International Symposium on Marine Fisheries, Ecosystems and Societies in West Africa, under the title “Half a Century of Change.” Held in Dakar, Senegal, the gathering produced an unprecedented Consensus Statement (see www.seaaroundus.org/Dakar) summarizing important points of agreement between representatives from Northwest Africa and other countries. It recognized that the strong decline of fishes over recent decades was due to fishing pressure and that a substantial reduction in overall fishing effort is required for the fisheries to be able to continue to exist.

Reconstruction and clarification of catch data from the Caribbean, Central America and South America enabled the *Sea Around Us Project* to investigate the long-term impact of fishing from the southeast Caribbean to Brazil and, using a newly documented set of *Ecopath* models, to study management options (Fisheries Centre Report 11(6) 2003).

Sea Around Us Project is active in the Millennium Ecosystem Assessment (MA). The Marine Condition and Trends chapter is led by Daniel Pauly and Jackie Alder, in collaboration with fisheries scientists from around the world and other *Sea Around Us Project* members. Other significant contributions to the MA include linking socio-economic indicators to coastal habitats and assisting with four narrative scenarios on possible futures in the fisheries sector. This work led to a contribution in *Science* (November 2003). We also hosted the MA’s Marine and Coastal Cross-Cutting Workshop in April 2003.

The *Sea Around Us* team has produced numerous data products useful to the world’s scientific and conservation communities. Our global fisheries tools can map fisheries catch composition at any place on the ocean, and show what part of the catch in any country’s waters is likely taken by foreign fleets. Maps documenting this work, and the distribution of all commercial marine species can be straightforwardly downloaded from our website. Over the last three years the project developed databases of fishing access and agreements, estuaries and high seas. They are the first of their kind and generate collaborative studies with several other organizations (e.g. World Wildlife Fund for *Nature* and the World Conservation Monitoring Centre). New methods to integrate, analyze and map this mix of information continue to evolve, making *Sea Around Us Project* a world leader in global analysis of marine ecosystems. The *Sea Around Us Project* was initiated and is funded by the Pew Charitable Trusts of Philadelphia.



Russian trawler fishing for silver hake on the Scotian Shelf in the 1980s.

Photo courtesy Bedford Institute of Oceanography



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Graduate Studies

Graduate students are integral to academic research institutions. The Fisheries Centre aims to focus and promote the multidisciplinary study of fisheries. Analytical tools developed in subjects ranging from biology to policy are employed to assess, appraise and forecast the impacts of both human and natural processes on fishery resources. Fisheries policy and management problems under study include assessment and management of a range of capture fisheries, including recreational, economic valuation studies of marine ecosystems, watershed management, aquaculture, marine protected areas and the conservation of endangered species in marine and freshwater environments.

The Fisheries Centre has strong graduate teaching links to Zoology, Oceanography, Agriculture (Aquaculture), Forestry (Watershed Restoration), Anthropology, Sociology, Education, History and First Nations issues. Students can be enrolled at various departments under the Faculty of Graduate Studies but most students choose Zoology or the Resource Management and Environment Program within the Institute for Resources and Environment. Students interested in graduate studies at the Fisheries Centre should visit the graduate program web page or contact the Fisheries Centre Graduate Secretary.

The Fisheries Centre Academic Plan 2000 aims to consolidate its research profile and further develop its interdisciplinary research to address critical global problems in aquatic ecosystems and fisheries. There are four goals

- retention and renewal of faculty and staff;
- learning environment;
- research excellence; and
- links with the community.

The Centre's graduate teaching is firmly linked to emerging research over a wide range of topics. Graduate students get the benefits of leading edge science, as lectures often describe new findings accepted but not yet published in journals, let alone textbooks. A Fisheries Centre Academic Plan developed in 2000 is being implemented with the appointment of one junior faculty member with expertise in economics in 2002, with two more faculty to follow in 2004, and the introduction of a new course Science and Politics of Aquatic Management. A full list of courses offered by the Fisheries Centre is available at the graduate program web page.

Aqualink is a partnership with the Fisheries Centre (FC) that networks graduate students and early-career researchers interested in the health of aquatic resources and fisheries. The network generates discussion and collaboration in developing and employing a truly interdisciplinary approach to current and emerging problems in aquatic ecosystems.

Aqualink played a significant role in the first Coastal Zone Asia Pacific Conference (Bangkok 2002). Several FC students and graduates were involved as presenters, working group facilitators, steering committee members or in the production of conference proceedings. The conference resulted in a theme issue of Coastal Management (Vol 31(1) 2004) guest-edited by FC director Dr D. Pauly and graduate Dr R. Chuenpagdee.

www.fisheries.ubc.ca/grad



Graduate Students



Cameron Ainsworth (Canada)
PhD RMES (start 2002)
Project: Ecosystem restoration in northern British Columbia.
Supervisor: Dr Tony Pitcher



Jonathan Anticamara (Philippines)
PhD RMES (start 2001)
Project: Recovery of fish assemblages and benthic habitats inside Marine Protected Areas
Supervisor: Dr Amanda Vincent



Natalie Ban (Canada & Germany)
PhD RMES (start 2003)
Project: Selecting ecologically viable marine protected areas in British Columbia
Supervisor: Dr Amanda Vincent



Stephen Ban (Canada)
MSc Zoology (start 2002)
Project: Haulout and rookery selection of Steller sea lions
Supervisor: Dr Andrew Trites



Brajgeet Bhathal (India)
MSc. Zoology (start 2002)
Project: Historical reconstruction of Indian fisheries from 1950 to present.
Supervisor: Dr Daniel Pauly



Emma Bredesen (Canada)
MSc Zoology (start 2000)
Project: Marine mammals in the Antarctic ecosystem
Supervisor: Dr Andrew Trites



Eny Anggraini Buchary (Indonesia)
PhD RMES (start 2001)
Project: Recharting the cognitive map: In search of viable policy options for responsible use of marine resources
Supervisor: Dr Tony J. Pitcher



Rik Buckworth (Australia)
PhD Zoology (start 1995)
Project: Dynamics of tropical line fisheries
Supervisor: Dr Carl Walters



Mary Cashman (USA)
Ph.D. RMES (start 2003)
Project: Ecological impacts of small-scale fishers' decisions on the Danajon Bank, Philippines
Supervisor: Dr Amanda Vincent



Olivier Cheneval (Canada)
MSc Zoology (start 1999)
Project: Steller sea lions and predator-prey relationships
Supervisor: Dr Andrew Trites



Wai Lung Cheung (Hong Kong, China)
PhD RMES (start 2002)
Project: Vulnerabilities of marine fishes in the N South China Sea & implications to fisheries management
Supervisor: Dr Tony J. Pitcher



Andrea Coombs (Canada)
MSc RMES (start 2000)
Project: Impacts on marine mammals and human health in the E Bering Sea
Supervisors: Dr A. Trites and Dr D. Pauly



Janelle Curtis (Canada)
PhD (Start 2000)
Project: Using life history and ecology for conservation and management of *Hippocampus guttulatus*
Supervisor: Dr Amanda Vincent



Raychelle Daniel (USA)
MSc Zoology (start 2000)
Project: Molting of Steller sea lions
Supervisor: Dr Andrew Trites



Ms Robyn Forrest (Australia)
PhD RMES (start 2002)
Project: Spatial ecosystem modelling of New South Wales fisheries
Supervisor: Dr Tony Pitcher



Katia Freire (Brazil)
PhD RMES (start 2000)
Project: Analysis of northeastern Brazilian fisheries
Supervisor: Dr Daniel Pauly



Graduate Students



Ahmed Gelchu (Ethiopia)
PhD RMES (start 2001)
Project: Evolution and distribution of global fishing effort
Supervisor: Dr Daniel Pauly



Heather Keith (Canada)
MSc RMES (start 2003)
Project: Bioeconomic analysis of the purse seine and longline tuna fisheries
Supervisor: Dr Rashid Sumaila



Eulalio Guieb (Philippines)
PhD (start 2002)
Project: Cultural and Institutional Correlates of MPA Effectiveness
Supervisors: Dr C. Scott (McGill), Dr. M. Mulrennan (Concordia) Dr. A. Vincent



Laura Kucey (Canada)
MSc Zoology (start 2002)
Project: Effects of human disturbance on Stellar sea lions
Supervisor: Dr Andrew Trites



Anna Hall (Canada)
MSc Zoology (start 2000)
Project: Harbour porpoise (*Phocoena phocoena*) seasonal abundance, habitat use, diet and interactions with fisheries
Supervisor: Dr Andrew Trites



Saeko Kumagai (Japan)
MSc Zoology (start 2001)
Project: Seasonal differences in energy balance in Steller sea lions.
Supervisors: Dr. Andrew Trites



Andrea Hunter (Canada)
MSc Zoology (start 2000)
Project: Estimating marine mammal energy requirements
Supervisors: Dr D. Pauly & Dr A. Trites



Bob Lessard
Supervisor: Dr Carl Walters



Kerry Irish (Canada)
MSc RMES (start 2001)
Project: Killer whales in Alaska
Supervisor: Dr Andrew Trites



Yajie Liu (China)
PhD RMES 2001
Project: The net benefits from aquaculture
Supervisor: Dr Rashid Sumaila



Vasiliki Karpouzi (Greece)
MSc Zoology (start 2001)
Project: Seabird - Fisheries interactions on a global scale
Supervisor: Dr Daniel Pauly



Sara Lourie (England)
PhD Biology (start McGill University, 1998)
Project: Phylogeography of Southeast Asian seahorses
Supervisor: Dr Amanda Vincent



Kristin Kaschner (Germany)
PhD Zoology (start 1998)
Project: Modelling of global marine mammal food consumption
Supervisors: Dr Daniel Pauly and Dr Andrew Trites



Hector Lozano (Mexico)
PhD Zoology (start 2001)
Project: Historical ecosystem reconstructions in the Gulf of California (Mexico).
Supervisor: Dr Tony Pitcher



Alison Keple (Canada)
MSc Zoology (start 1999)
Project: Marine mammal population surveys in the Strait of Georgia
Supervisors: Dr A. Trites & Dr J. Ford



Dale Marsden (Canada)
PhD RMES (start 2003)
Project: Effects of international trade on fisheries and marine ecosystems
Supervisor: Dr Rashid Sumaila



Graduate Students



Steven Martell (Canada)
PhD Zoology (start 1999)
Project: Shrimp fisheries and ecosystem impacts of benthic trawl fisheries
Supervisor: Dr Carl Walters



David Preikshot (Canada)
PhD Zoology (start 2000)
Project: Fish biodiversity in large marine ecosystems
Supervisor: Dr Daniel Pauly



Michael Melnychuk (Canada)
MSc Zoology (start 2002)
Project: Marine mortality and migration patterns of juvenile Pacific salmonids
Supervisor: Dr Carl Walters



Cynthia Rejwan (Canada)
Visiting Student, University of Calgary



Telmo Morato Gomes (Portugal)
PhD RMES (start 2002)
Project: Ecological modelling of seamounts
Supervisor: Dr Tony Pitcher



Yvette Rizzo (Malta)
PhD RMES (start 2000)
Project: The central Mediterranean: functioning of a large marine ecosystem
Supervisor: Dr Daniel Pauly



Sian Morgan (Canada)
PhD (start McGill University, 1999)
Project: Movement and dispersal in exploited seahorse populations of the central Philippines
Supervisor: Dr Amanda Vincent



Karim Soto (Peru)
MSc Zoology (start 2002)
Project: Pup mortality and maternal behaviour of South American sea lions
Supervisors: Dr Andrew Trites



Lyne Morissette (Canada)
PhD Zoology (start 2001)
Project: Understanding marine ecology through ecosystem modelling
Supervisor: Dr Daniel Pauly



Richard Stanford (UK)
MSc. RMES (start 2000)
Project: Modelling the English Channel ecosystem.
Supervisor: Dr Tony J Pitcher



Thomas Okey (USA)
PhD Zoology (start 2001)
Project: Alternate states in marine communities
Supervisor: Dr Daniel Pauly



Wilf Swartz (Canada)
MSc RMES (start 2002)
Project: Mapping the fish consumption of Japan
Supervisor: Dr Daniel Pauly



Marivic Pajaro (Philippines)
PhD RMES (start 2002)
Project: Biological, social and economic indicator of success in MPAs
Supervisors: Dr Amanda Vincent & Dr Monica Mulrennan (Concordia)



Nathan Taylor (Canada)
MSc Zoology (start 2001)
Project: Pike minnows and rainbow trout
Supervisor: Dr Carl Walters



Amy Poon (Canada)
MSc RMES (start 1999)
Project: Impact of ghost fishing: a tentative global estimate
Supervisor: Dr Daniel Pauly



Louise Teh (Malaysia)
MSc RMES (start 2003)
Project: Effectiveness of Tun Mustapha Marine Park (N Sabah) in conserving coral reef biodiversity & sustaining livelihoods
Supervisor: Dr Rashid Sumaila



Graduate Students



Dawit Tesfamichael (Eritrea)
PhD RMES (start 2002)
Project: Ecosystem based fisheries management for west Indian Ocean
Supervisor: Dr Daniel Pauly



Louisa Wood (UK)
PhD RMES (start 2003)
Project: A global analysis of marine protected areas
Supervisor: Dr Daniel Pauly



Pablo Trujillo (Canada)
PhD RMES (start 2001)
Project: Adding aquaculture to Ecopath models
Supervisor: Dr Tony Pitcher



Harald Yurk (Germany)
PhD Zoology (start 1996)
Project: The evolutionary history of resident killer whale clans in the northeastern Pacific, using vocal dialects
Supervisors: Dr Andrew Trites and Dr John Ford



Colette Wabnitz (France / Germany)
PhD RMES (start 2003)
Project: The ecological role of green sea turtles (*Chelonia mydas*) and the distribution of their foraging grounds
Supervisor: Dr Daniel Pauly

Photograph
Not
Available

Dori Bixler
PhD RMES (start 2000)
Project: Law, water policy
Supervisor: Dr Michael Healey

Luciano Della Rosa (Brazil)
PhD Zoology (start 2003)
Project: Humpback whale population dynamics
Supervisors: Dr A. Trites & Dr J. Ford

Jody Frolek
MSc RMES (start 2000)
Supervisor: Dr M. Healey

Paul Higgins (Canada)
PhD RMES (start 1997)
Project: Experimental management of water releases from BC Hydro dams
Supervisor: Dr Carl Walters

Charlene Lobsinger
MSc Zoology (start 2001)
Supervisor: Dr M. Healey

Camela Matheson
MSc RMES (start 2001)
Supervisor: Dr M. Healey

Ladan Mehranvar
MSc Zoology (start 2000)
Supervisor: Dr M. Healey

Elizabeth Mohammed (Trinidad and Tobago)
PhD RMES (start 1999)
Project: Reconstructing the southeastern Caribbean ecosystem: applications for assessment & management
Supervisor: Dr Daniel Pauly

Nathaniel Newlands (Canada)
PhD RMES (start 1997)
Project: Biomass estimation using a schooling in model for Atlantic bluefin tuna in the Gulf of Maine
Supervisor: Dr Tony Pitcher

David O'Brien
Visiting Student, McGill University
Supervisor: Dr Carl Walters

Jason Quigley
MSc Forest Science (start 200)
Supervisors: Dr M. Healey & Dr S. Hinch

Laurel Rempel
PhD Geography (start 2000)
Supervisors: Dr M. Healey and Dr M. Church

Bernard Walrut (Australia)
PhD RMES (start 1997)
Project: Sea ranching and aspects of the common law: a proposal for a legislative framework
Hosted by: Dr. Daniel Pauly



GRADUATE THESES

COMPLETED

2001 - 03

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2003

Emma Bredesen (Canada)

MSc Zoology

Title: Krill and the Antarctic: finding the balance

Supervisor: Dr Andrew Trites

Raychelle Daniel (United States)

Title: The timing of moulting in wild and captive Steller sea lions (*Eumetopias jubatus*)

Supervisor: Dr Andrew Trites

Melanie Power (Canada)

PhD RMES

Title: Fishing for justice: an ethical framework for fisheries policies in Canada

Supervisor: Dr Tony Pitcher

2002

Cynthia Azana (Canada)

MSc Zoology

Title: Seasonal abundance and distribution of marine mammals in the southern Strait of Georgia, British Columbia

Supervisor: Dr Andrew Trites

Aran Kay (Canada)

MSc Zoology

Title: *Mysis relicta* and kokanee salmon (*Oncorhynchus nerka*) in Okanagan Lake, BC: from 1970 and into the future

Supervisor: Dr Daniel Pauly

Alison Keple (Canada)

MSc Zoology

Title: Variation in pink shrimp populations off the west coast of Vancouver Island: oceanographic and trophic interactions

Supervisor: Dr Carl Walters

Steven Martell (Canada)

PhD Zoology

Title: Variation in pink shrimp populations off the west coast of Vancouver Island: oceanographic and trophic interactions

Supervisor: Dr. Carl Walters

Nathaniel Newlands (Canada)

PhD RMES

Title: Mesoscale spatial dynamics of bluefin tuna

Thunnus thynnus

Supervisor: Dr. Tony Pitcher

Richard Stanford (UK)

MSc RMES

Title: The English Channel: a mixed fishery, but which mix is best?

Supervisor: Dr. Tony Pitcher

Bernard Walrut (Australia)

PhD RMES

Title: Sea ranching and aspects of the common law: a proposal for a legislative framework

2001

Alasdair Beattie (Canada)

MSc RMES

Title: A new model for evaluating the optimal size, placement and configuration of marine protected areas

Supervisor: Dr Daniel Pauly

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MSc Zoology

Supervisor: Dr Michael Healey

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MSc Zoology

Title: Possible effects of pollock and herring on the growth and reproductive success of Steller sea lions: insights from feeding experiments using an alternative animal model, *Rattus norvegicus*

Supervisor: Dr Andrew Trites

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MSc Zoology

Title: Heart rate as a monitor for metabolic rate in captive juvenile Steller sea lions (*Eumetopias jubatus*)

Supervisor: Dr Andrew Trites

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PhD Zoology

Title: A modeling investigation of migratory behaviour in fishes: a case study of sockeye salmon.

Supervisor: Dr Carl Walters

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MSc RMES

Title: Life after death: the importance of salmon carcasses to watershed function

Supervisor: Dr Daniel Pauly



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Dr John Spence
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Publications

ARTICLES IN REFEREED JOURNALS

- Alder, J. and Lugten, G. (2002) Frozen Fish Block: How Committed are North Atlantic States to Accountability, Conservation and Management of Fisheries? *Marine Policy* **26**, 345-357.
- Alder, J. and Ward, T. (2001) Australia's Oceans Policy – Sink or Swim? *Journal of Environment and Development* **10**, 266-289.
- Alder, J., Zeller, D., Pitcher, T.J. and Sumaila, U.R. (2002) A Method for Evaluating Marine Protected Area Management. *Coastal Management* **30**, 121-131.
- Armstrong, C.W and Sumaila, U.R. (2001) Optimal allocation of TAC and the implications of implementing an ITQ management system for the North-East Arctic cod. *Land Economics* **77**, 350-359.
- Baum, J. K., Meeuwig, J. J., Vincent, A. C. J. (2003) Bycatch of lined seahorses (*Hippocampus erectus*) in a Gulf of Mexico shrimp trawl fishery. *Fishery Bulletin* **101**(4), 721-731.
- Beattie, A., Sumaila, U. R., Christensen, V., and Pauly, D. (2002) A model for the bioeconomic evaluation of marine protected area size and placement in the North Sea. *Natural Resource Modeling* **15**(4), 413-437.
- Bell, E. M., Lockyear, J. F., McPherson, J. M., Marsden, A. D., and Vincent, A. C. J. (2003) First field studies of an Endangered South African seahorse, *Hippocampus capensis*. *Environmental Biology of Fishes* **67**, 35-46.
- Benson, A.J. and Trites, A.W. (2002) Ecological effects of regime shifts in the Bering Sea and eastern North Pacific Ocean. *Fish and Fisheries* **3**, 95-113.
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- Chuenpagdee, R., Knetsch, J.L., and Brown, T.C. (2001a) Coastal management using public judgments, importance scales, and predetermined schedule. *Coastal Management* **29** (4), 253-270.
- Chuenpagdee, R., Knetsch, J.L., and Brown, T.C. (2001b) Environmental damage schedules: community judgments of importance and assessment of losses. *Land Economics* **77** (1), 1-11.
- Chuenpagdee, R., Morgan L.E., Maxwell, S.M., Norse, E.A., and Pauly, D. (2003) Shifting gears: assessing collateral impacts of fishing methods in the U.S. waters. *Frontiers in Ecology and the Environment* **10** (1), 517-524.
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- Cox, S.P., Essington, T.E., Kitchell, J.F., Martell, S.J.D., Walters, C.J., Boggs, C. and Kaplan, I. (2002) Reconstructing ecosystem dynamics in the central Pacific Ocean, 1952-1998. II. A preliminary assessment of the trophic impacts of fishing and effects on tuna dynamics. *Canadian Journal of Fisheries and Aquatic Science* **59** (11), 1736-1747.
- Cox, S.P., Martell, S.J.D., Walters, C.J., Essington, T.E., Kitchell, J.F., Boggs, C. and Kaplan, I. (2002) Reconstructing ecosystem dynamics in the central Pacific Ocean, 1952-1998. I. Estimating population biomass and recruitment of tunas and billfishes. *Canadian Journal of Fisheries and Aquatic Science* **59** (11), 1724-1735.
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- Cox, S.P., Walters, C.J., Post, J.R. (2003) A model-based evaluation of active management of recreational fishing effort. *North American Journal of Fisheries Management* **23** (4), 1294-1302.
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- Dill, L.M., Heithaus, M.R., and Walters, C.J. (2003) Behaviorally mediated indirect interactions in marine communities and their conservation implications. *Ecology* **84** (5), 1151-1157.
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- Farrow, S. and Sumaila, U.R. (2002) Conference summary: the new emerging economics of marine protected areas. *Fish and Fisheries* **3** (4), 356-359.
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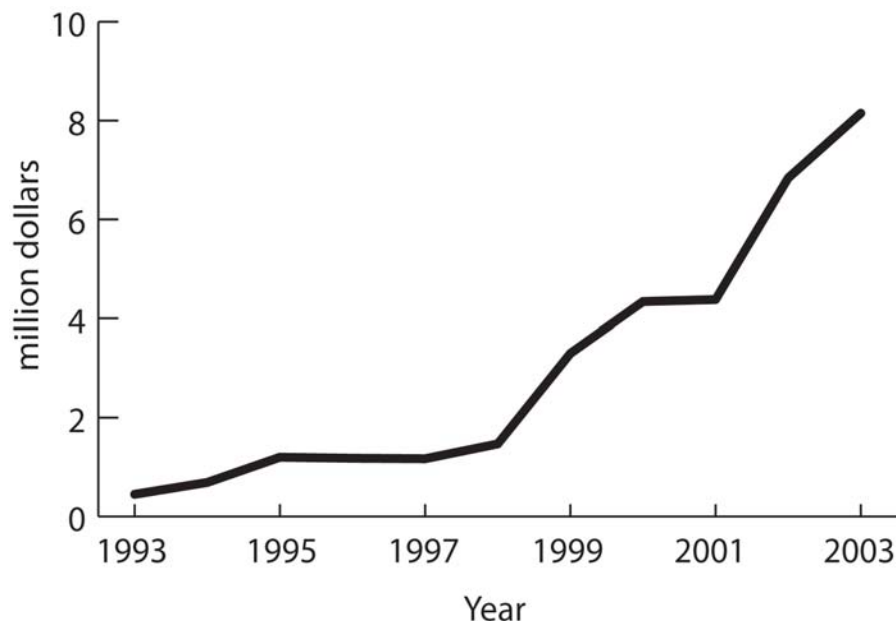
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Research Support Income

Source		2001	2002	2003
UBC Funding	Salaries	382,535	382,535	382,535
	Operating	16,219	16,219	16,219
External Research		4,379,456	6,839,657	8,154,638

External research funding trend:



4th World Fisheries Congress

The World Fisheries Congress is held every four years. The theme of the 2004 congress held in Vancouver is 'Reconciling Fisheries with Conservation: the challenges of fisheries in the 21st Century'. Tony Pitcher chairs the Program Committee for the Congress, and Bruce Ward, from the BC Aquatic Ecosystems Science Section, Ministry of Water, Land and Air Protection, is Co-Chair of the meeting and a member of the Program Committee. The Congress Keynote speaker is Daniel Pauly, the director of the Fisheries Centre. Amanda Vincent and Carl Walters, members of the Centre, are presenting plenary talks while other members are convening theme sessions. The many achievements of members, including students, will be presented in papers and posters throughout the conference.



This report was produced by Jackie Alder, James Hrynishyn, Robert Ahrens, Dale Marsden, Arliss Winship, Ann Tautz, Jordan Beblow, Janice Doyle, Heather Keith and Grace Ong.



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