

Western Fisheries Research Center - Summary of International Activities					
Activity	Type	Sponsor	Cooperators	Dates	Description of Research
Phylogeography of rhabdoviruses from Japan	T	USGS	WFRC, Hokkaido University, Japan	2004-2009	Phylogenetic analyses of IHN virus field isolates from Japanese salmonids. Manuscript submitted to peer reviewed scientific journal 2007.
Phylogeography of rhabdoviruses from Korea	T	USGS	WFRC, Hokkaido University, Japan; Ulsan University, Korea; Chonnam National University, Korea	2004-2009	Phylogenetic analyses of IHN virus field isolates from Korean salmonids. Manuscript in preparation for peer reviewed scientific journal 2007.
Molecular biology of fish rhabdoviruses	E	USGS, Ulsan University, Korea	Ulsan University, Korea	2007	WFRC is hosting Dr. J.W. Park for a one year sabbatical research visit in the Molecular Biology Laboratory working on gene function in fish rhabdoviruses.
Fish pathology research	R,E	USGS	WFRC, Ministry of Agriculture and Fisheries, United Kingdom	1986-Present	International visits, exchange information and scientific materials.
Molecular biology of spring viremia virus	R	USGS	WFRC, übo Akademi University, Finland	2002	Complete genome sequence of SVC virus submitted to Genbank and published in a peer-reviewed review article.
Analysis of algal pigments in estuarine sediments	R	USGS	WFRC, University of Regina, Canada	2003-2004	Pilot project: measurement of algal pigments, metals, diatoms and contaminants in sediment cores of the lower Columbia River
Fish Histopathology Workshop	T	European Association of Fish Pathologists (EAFP)	WFRC, FRS Marine Laboratory, Scotland, University of Tasmania	2001-Present	Cooperators are co-chairs of fish histopathology workshop held every two years in conjunction with the EAFP International Conference.
Broodfish testing for bacterial kidney disease (workshop, technical report)	T	European Commission	Various agencies in EU member nations and Norway	2004	WFRC provided technical advice on broodfish testing for bacterial kidney disease to prevent international transfer of infected eggs.
Phylogeography of IHN virus in western Europe	T, E	USGS	WFRC, Federal Research Institute for Animal Health,	2004-2005	WFRC hosted a one week training visit of Dr. P.J. Enzmann and collaborated on

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			Germany		phylogenetic analyses of field isolates of IHN virus from Western Europe. Peer-reviewed paper published in 2005.
Emergence and phylogeography of IHN virus in western Europe	R, E	USGS, KamchatNIRO	WFRC, KamchatNIRO, Russia	2003-Present	In 2003 WFRC hosted a one month visit from Dr. S L. Rudakova for training and collaborative research in the Kurath laboratory. Continuing collaborative research is on epidemiology, emergence, and phylogenetic analyses of IHN virus newly discovered in Kamchatka salmonids. Paper published in peer-reviewed journal 2007.
Epidemiology and control of IHNV in salmonids of British Columbia	R	USGS, Dept. of Fisheries and Oceans, Canada	WFRC, Pacific Biological Station, Nanaimo, DFO, Canada	1995-2010	Ongoing collaboration on genetic typing, epidemiology, and DNA vaccine studies of IHN virus in salmonids of British Columbia, including seapen-reared Atlantic salmon.
Virulence of IHN virus	R	USGS, INRA	WFRC, INRA Jouy-en-Josas, France	2005-Present	Investigations of the genetic basis of virulence and host specificity of IHN virus using infectious clones.
Host specificity of IHN virus	R, E	USGS, Fulbright International Program, Univ. of Washington	WFRC, Phillipine Fulbright Agricultural Scholarship Program, UW Department of Pathobiology	2004-2007	Phillipine Fulbright scholar M.M.D.Penaranda is conducting research for her Ph.D. (estimated 2004-2009) in the Kurath laboratory at WFRC investigating the basis of host specificity of genogroups of IHN virus genogroups in different salmonid species.
Phylogeography of IHN virus in Europe	T	USGS, Danish Veterinary Institute	WFRC, Danish Veterinary Institute	2000-Present	WFRC hosted a research visit for Dr. K. Einer-Jensen in 2000. Continuing interaction involves occasional consultation on viral phylogenetic analyses.

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Ballast water treatment research	TA and R	USGS	WFRC, International Maritime Organization (IMO)	Varies	Occasional consultation on ballast water research questions to address international ballast management issues and research to address IMO issues.
External thesis/dissertation reviewer	T	USGS	WFRC, University of Madras, India	1994	One-time collaboration requested because of general ecological expertise.
External thesis/dissertation reviewer	T	USGS	WFRC, University of Agriculture, Faisalabad, Pakistan	2003	One-time collaboration requested because of contaminant expertise.
External thesis/dissertation reviewer	T	USGS	WFRC, University of Agriculture, Faisalabad, Pakistan	2007	One-time collaboration requested because of contaminant expertise.
Susceptibility of larval and juvenile herring to VHSV	R	EVOS TC, Science Council of BC, USGS	USGS – Marrowstone Marine Field Station, D.F.O.	2005-Present	DFO researchers visit the Marrowstone facility annually to conduct experiments using colonies of specific pathogen-free (SPF) herring that were developed at USGS (the only colonies of SPF marine fish known to exist in the world). These particular studies demonstrated the susceptibility of larval herring to VHSV and demonstrated that survivors of the larval epidemics are protected against future exposure, even after their metamorphosis to juveniles.
Susceptibility of herring to IHNV	R	EVOS TC, Science Council of BC, USGS	USGS – Marrowstone Marine Field Station, D.F.O	2006-Present	These ongoing studies are investigating the susceptibility of Pacific herring to IHNV and determining whether herring may be involved as carriers in epizootics that occur in Atlantic salmon net pens in BC.
Attended PICES Invasive Species Working Group	E		WFRC, North Pacific Marine Science Organization (PICES)	10/2006	Technology exchange on design of distributed information systems for

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					invasive species.
Per Capita Invasion Probabilities	R	WFRC	WFRC,EPA	2009/ 2010	White paper on ballast water standards development and management options, in review by the national Research Council
Spatial variation in fish growth	R	USGS, BPA	WFRC, Netherlands Institute of Ecology	2005- Present	A manuscript was written "Application of theory and methods for modeling fish growth and detecting spatial differences in populations"
Use of PIT-tag technology for individual-based modeling of fish growth and movement	T	USGS	WFRC, University of Waikato, Hamilton, New Zealand	2006- Present	Information exchange and development of collaboration potentials
PCBs and Arctic Charr	R	Norwegian Research Council; USGS	WFRC, University of Waterloo, Canada , University of Tromso, Norway	1999- 2005	Field study of charr with either high or low PCB contamination
Artic charr, feeding and immune responses	R	Norwegian Research Council; USGS	WFRC, University of Waterloo, Canada , University of Tromso, Norway	2010- Present	Charr fast for 10 months/year. How does this influence immune-endocrine cross-talk?
Rainbow/Charr Genetics	R	USGS	WFRC, Russian Academy of Sciences, Dr. Dmitrij S. Pavlov Wild Salmon Center	2001- Present	Kamchatka studies of genetic and morphological relationships in Dolly varden; rapid assessment sample for presence/absence of riverine fishes; genetic markers for rainbow and steelhead trout
Behavioral ecology of fishes	T	USGS	WFRC, Russian Academy of Sciences, Dr. Dmitrij S. Pavlov	2001	Provided information (in the form of reports, manuscripts, and standard operating procedures) and hands-on training regarding all aspects of radio-telemetry techniques.
Behavioral ecology of fishes	T	USGS	WFRC, Africa, Laboratory of Hydrobiology, University of Cocody, Dr. Kone Tidiani, Fulbright Fellow	2007	Provided information, in the form of reports, manuscripts, and standard operating procedures regarding all aspects of radio-telemetry techniques; providing in-the-

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					field experience and training in telemetry
Behavioral ecology of fishes	T	USGS	WFRC, Australia, Natural Resources and Environment, John Koehn	1998	Provided information (in the form of reports, manuscripts, and standard operating procedures) and hands-on training regarding all aspects of radio-telemetry techniques
Behavioral ecology of fishes	T	USGS	WFRC, United Kingdom, University of Hull, Dr. Jonathan D. Bolland	2002	Provided information, in the form of reports, manuscripts, and standard operating procedures) regarding all aspects of radio-telemetry techniques
Behavioral ecology of fishes	T	USGS	WFRC, Argentina, University of Argentina, Dr. Miguel Pascual.	2001	Provided information (in the form of reports, manuscripts, and standard operating procedures) and hands-on training regarding all aspects of radio-telemetry techniques
Behavioral ecology of fishes	T	USGS	WFRC, Argentina, University of Argentina, Drs. Norberto Oldani and Claudio	2003	Provided information (in the form of reports, manuscripts, and standard operating procedures) and hands-on training regarding all aspects of radio-telemetry techniques
Columbia River White Sturgeon Restoration	T	Upper Columbia White Sturgeon Recovery Initiative	WFRC, Province of British Columbia, BC Hydro, Fisheries and Oceans Canada, HCTF, CBT, Spokane Tribe of Indians, CCRIFC, BPA, USFWS, CPC, WDFW, Colville Confederated Tribes, Columbia Basin FWCP, Celgar Pulp Company, Teck Cominco (Trail Operations), Golder Associates	2000 – Present	USGS provides technical expertise on sturgeon ecology and biology, technical reviews of USWSRI documents related to scientific studies
Bioenergetics modeling of fishes	T	USGS, Fulbright Foundation,	WFRC, University of the West Indies	2005	Provided a workshop and training in modeling techniques to students from

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		University of the West Indies			Caribbean universities, the Nature Conservancy, and University of Miami
Serve as International Reference Laboratory for IHNV and BKD	T	USGS	WFRC, World Organization for Animal Health (OIE) Paris, France	1990-Present	Provide reference laboratory services and technical assistance to national laboratories relevant to diagnosis of two of the internationally listed diseases of fish.
Invasive plants	E	USGS	International Symbiosis Society	8/4/06-8/10/06	Presentation of data.
Genomic aspects of the fish immune response— BIOINFORMATICS	R	USGS	WFRC, Institut National de la Recherche Agronomique, France	2004-Present	Continual collaboration dealing with immune molecules controlling T and B cell response in fish. Writing & publishing manuscripts.
Cellular (T-cells) immune responses in fish	R	USGS	WFRC, Scottish Fish Immunology Research Centre	2004-Present	Collaborations dealing with key sentinels of the fish immune response. Writing and publishing manuscripts.
Characterization of immunity in fish: bioinformatics and gene mapping	R	USGS	Institute for Comprehensive Medical Science, Fujita Health University-Japan	2004-Present	Collaborative effort defining genes (MHC) that govern the recognition of pathogens in fish. Writing manuscripts.
Molecular biology of the host-pathogen interactions:role of temperature	R	USGS	Dept of Biology, University of Waterloo-Canada	2004-Present	Cloning genes involved in fish immunity
Identification of receptors for the innate immune response in fish	R	USGS	Biological Sciences, University of Edmonton-Canada	2006-Present	Innate immune response genes in trout. Initial collaboration.
Salmon life history-otolith chemical analysis	T,R	Fisheries & Oceans Canada-PBS	USGS/BRD/WFRC, Pacific Salmon Commission, Stanford University, UCLA, BLM	2008-Present	Collaborative effort validating migratory history of selected salmonid populations. Technical assistance in otolith sample preparation for microchemical analysis, editing of manuscript.
Chemical composition of symbiotic fungi	R	University of Saskatoon;	Dept of Biology, University of Saskatoon-Canada;	2006-Present	Utilizing the Canadian Light Source synchrotron to assess nutritional composition of

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		USGS	Department of Chemistry, University of Manitoba-Canada		symbiotic and saprophytic fungi
Mitigating impacts of climate change on rice production	R	USGS; South Korean Government	South Korean Dept. Agriculture	2008-Present	Utilize symbiotic fungi to confer drought and salt tolerance to rice plants.
Mitigating impacts of climate change on plant communities	R	USGS	University of Alicante, Spain; Kenyatta University, Kenya	2008-Present	Identify native fungal endophytes to enhance growth and confer stress tolerance to native and crop plants.
Deciphering symbiotic communication between fungi and plants	R	USGS	Volcani Institute, Isreal	2000-Present	Determining the genes responsible for pathogenic and mutualistic symbiotic lifestyles
Developing a Wiki site for symbiosis	E	USGS; European Union	Department of Agriculture-Switzerland	2010	Presentation at a workshop about the future of symbiosis research
Mitigating impacts of climate change on crop production	R	USGS	Krishidhan Seeds-India	2010	Identify native fungal endophytes to enhance growth and confer stress tolerance to crop plants.
Development of immunological tools for salmonid health	R	USGS; European Union	Federal Research Institute for Animal Health Greifswald-Insel Riems, Germany	2007-Present	Collaborative effort for defining monoclonal antibodies for fish leukocytes: writing and publishing manuscripts.
T = Technical Assistance R = Research E = Exchange					