



Aquatic Ecosystems at the Edge:

Managing for Sustainability

June 17-20, 2013
Victoria, BC, Canada

Co-Chairs
R. Dobell & M. Munawar

Organized by
University of Victoria
Aquatic Ecosystem Health and Management Society



**University
of Victoria**



AQUATIC ECOSYSTEM
HEALTH & MANAGEMENT SOCIETY



CONTENTS

Organization	3
Sponsors and Endorsers	4
Welcome	5
An Introduction to the AEHMS	6-7
General Information and Publication Plans	8
Program-at-a-Glance	9
Program	10-13
<i>Monday, June 17th</i>	10
<i>Tuesday, June 18th</i>	10
<i>Poster Session</i>	11
<i>Wednesday, June 19th</i>	12
<i>Thursday, June 20th</i>	13
<i>Friday, June 21st</i>	13
Abstracts	14-60
<i>Oral presentations</i>	14
<i>Poster presentations</i>	44
List of Presenters	61



Organization

Conference Organizing Committee

Rod Dobell (University of Victoria)
Mohiuddin Munawar (Fisheries and Oceans Canada, President of AEHMS)
Diane Malley (PDK projects, Treasurer of AEHMS)

Secretariat

Lisa Elder (Coordinator)
Jennifer Lorimer

Local Organizing Committee

Jodie Walsh (chair)
Jennifer Thomson
Justin Longo
Jessica Nephin

Editorial support

Sue Blunt
Robin Rozon
Mark Fitzpatrick

Publishers

AEHM Journal



AQUATIC ECOSYSTEM
HEALTH & MANAGEMENT

Taylor and Francis



Taylor & Francis
Taylor & Francis Group



AEHMS 11
An International Conference

Sponsored by:



**University
of Victoria**
Centre for
Co-operative and
Community-Based
Economy



Endorsed by:

- C.S. "Buzz" Holling*
(Eminent Scholar and Professor, University of Florida, USA)
- Kate Moran*
(CEO, Oceans Network Canada, Canada)
- Andrew Price*
(Professor, University of Warwick, UK)
- Linda Sheehan*
(Executive Director, Earth Law Center, USA)
- David Turpin*
(President, University of Victoria, Canada)
- Martin van der Knaap*
(Chief Technical Adviser, FAO, UN, Burundi)



Welcome to scenic Victoria!

The Aquatic Ecosystem Health and Management Society (AEHMS) enters its third decade of promoting the understanding of ecosystem health, management, and conservation of marine and freshwater aquatic resources through its ongoing international series of conferences and publications. Previous biennial conferences were held in Canada, United States, Germany, Portugal, Mexico, France, Netherlands, China, Vietnam and Italy.

This conference has been organized jointly by the University of Victoria and the AEHMS. The Organizing Committee of AEHMS 11 extends a warm welcome to all the participants at this gathering in one of the most beautiful regions of Canada, Vancouver Island and the Capital Regional District of British Columbia. The program has been designed to focus on the state of aquatic ecosystems, sustainability, common threats/risks, and application of ecosystem-based science in management and policy formation.

The program aims to integrate various topics in a coherent fashion in the following themes:

- Climate Change and Lake Dynamics
- Plankton and Invasive Species
- Tools, Toys and Techniques
- Management, Adaptation and Policy

Since its inception the AEHMS has aimed to publish selected papers from the conferences it organizes. Similarly for this meeting, the AEHMS plans to publish papers relevant to the theme of the conference in its journal: *Aquatic Ecosystem Health & Management* (Taylor and Francis, Philadelphia). Presenters are encouraged to submit their papers to the AEHMS for consideration. We also take this opportunity to invite you to participate as a member of the AEHMS and receive the four quarterly issues of its journal each year (see www.aehms.org).

Once again, we are pleased to welcome you to the scenic surroundings of Victoria. We hope that this conference, bringing together experts on various environmental health issues with concerned community participants, will promote more effective ecosystem-based management and more informed, more accountable public policy. The insights, techniques and approaches that may emerge from this conference will join the flow of ideas contributing to the transformation of thinking needed to ensure the conservation and protection of the precious aquatic resources of the world – our common heritage

Rod Dobell
University of Victoria



**University
of Victoria**

Mohiuddin Munawar
*Fisheries & Oceans Canada
President, AEHMS*



**AQUATIC ECOSYSTEM
HEALTH & MANAGEMENT SOCIETY**



An Introduction to the AEHMS

The Aquatic Ecosystem Health & Management Society (AEHMS) was established in 1989 to encourage and promote integrated, eco-systemic and holistic initiatives for the protection and conservation of aquatic resources of the world. The Society has four broad objectives centering on health, management, the convening/sponsoring of conferences/symposia, and publications via its international primary journal, monograph series and its website (www.aehms.org). The objectives of the Society are outlined below:

- Adoption and promotion of ecosystem health concept.
- Application of integrated management from a multi-disciplinary, multi-trophic and sustainable perspective.
- Focusing on integrated approaches for protection, remediation, and restoration.
- Enhancing understanding of marine and freshwater ecosystems: structure, function, ecology, biodiversity, etc.
- Advocating the development of new approaches, tools, techniques and models.
- Encouraging interdisciplinary communication amongst scientists, managers, universities, governments, industry, and public sector.
- Organizing and co-sponsoring international conferences, symposia, workshops, eco-forums and working groups.
- Publication of an international primary journal, special issues and peer reviewed book series.

The Society is actively involved in primary and peer-reviewed publications. It publishes an international journal, *Aquatic Ecosystem Health and Management (AEHM)* on a quarterly basis (in collaboration with the publisher Taylor and Francis, Philadelphia). From 2007 onwards the AEHM was selected by Thomson Scientific for coverage in the Science Citation Index Expanded (SciSearch®); Journal Citation Reports; Current Contents®/Agriculture, Biology, and Environmental Sciences; Zoological Record; Biological Abstracts; and BIOSIS Previews. It has published over **30** special issues on diverse topics from across the world. Currently, plans are under way for publications on: The State of Lake Vänern; Great Lakes of the World (GLOW) VII; Ecosystem Health and remediation of Hamilton Harbour, Lake Ontario Ecosystem: Status and future directions; Ecosystem Health of Lake Naivasha, Kenya. A full list of our special issues is given at the back of this program book.

In addition, the AEHMS also produces a peer reviewed book series under the banner of the *Ecovison World Monograph Series*. It has already published over 20 peer reviewed books on a variety of subjects and aquatic environments (a catalogue of titles is given at the end of this program book). One of its books, *Burning Rivers* by John Hartig, won the 2011 Green Book Festival Award in the scientific category. The newest title we are working on deals with the ecosystem health and fisheries of Major Rivers of India with emphasis on River Ganges.



Upcoming Society events include the following conferences and symposia:

- Marine Invasive Species: Management of ballast water and other vectors. Muscat, Oman, February, 2014
- Great Lakes of the World VIII. Tanzania, June 2014
- Gulf III. Qatar, 2015
- AEHMS 12. India, 2015

The Society welcomes individuals for membership belonging to a wide range of disciplines. AEHMS cordially invites you to join the Society to support global conservation and education. Membership includes 4 quarterly issues of the journal with on-line access, as well as discounts on conference registration fees, purchases of Ecovision books and back issues of our journal. A discounted membership is available for the participants of this conference, students and retired colleagues.

M. Munawar

President:

Aquatic Ecosystem Health & Management Society



AQUATIC ECOSYSTEM
HEALTH & MANAGEMENT SOCIETY





General Information & Publication Plans

Registration Desk

The registration desk will be available from 9:00 am to 10:00 am Monday morning during the workshop. It will reopen at 8:30 am on Tuesday before the program starts and be available throughout the conference.

Badges

You should consider your personal name badge as a valuable entry ticket. Please wear your badge at all times during the conference.

Internet access

In order to not overload the university’s systems UVic participants are encouraged to use their own Netlink ID and password during the conference. For non-UVic participants, the following Netlink Id (aehms11) and password (edge2013) has been set up.

Social Events

Participants will have the opportunity to connect and network at several conference events during the week. These include the fieldtrip portion of the pre-conference workshop, the wine and cheese at the poster session, conference outing Wednesday afternoon and the BBQ that evening, and finally during the post conference whale watching excursion on Friday.

Publication Plans

Aquatic Ecosystem Health and Management is an ISI rated international primary journal published by Taylor & Francis, Philadelphia. Presenters are encouraged to submit manuscripts to the *AEHM* for consideration for publication subject to the AEHMS instructions to authors, guidelines and page charges (www.aehms.org). Due to limited space, AEHMS has set page limit guidelines as follows: Keynote: 10; Oral & Poster: 8 printed pages including tables and figures (Text: Times New Roman 11 pt, Margins: 2.5 cm (1”), Paper: letter size 21.6x28 cm (8.5x11”). For more information please contact Dr. M. Munawar, Chief Editor (mohi.munawar@dfo-mpo.gc.ca). Presenters who are planning to publish in the special issues are requested to complete the publication questionnaire and return it the Registration Desk or by email to lisa.elder@dfo-mpo.gc.ca following the end of the conference.

Liability

Neither the University of Victoria, nor the AEHMS can be held responsible for damage, loss or theft during the conference. Please take precautions to ensure the safety of yourself and your valuables.

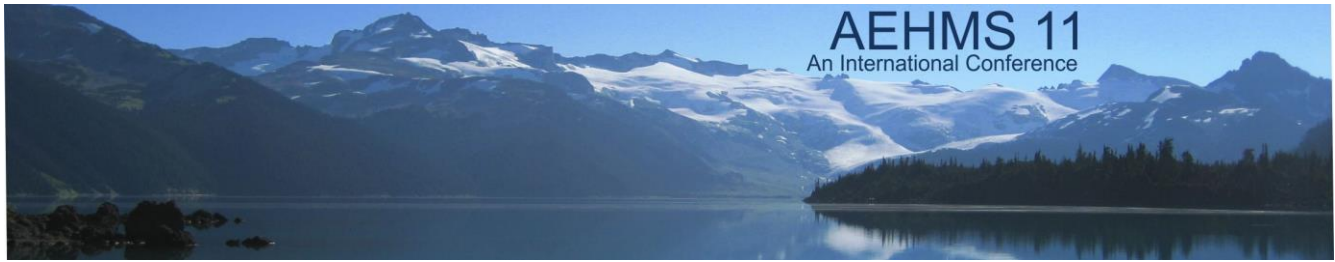
Venue Directions

Other than the daily conference transportation provided there are several other transportation options to get to the David Strong Building on the University of Victoria’s campus.

Bus routes from Downtown	Info on public transportation in Victoria	Victoria Taxi Companies Victoria
4 Uvic/Downtown	can be found at:	Taxi – 250-383-7111 Westwind
11 Tillicum Mall/UVic	http://www.transitbc.com/regions/vic/	Taxi – 250-474-4747
14 Vic General/UVic		Yellow Cab – 250-381-2222
15 UVic Express/Downtown Express		
33 UVic via Richmond		

Transportation

The conference will be providing free transportation from the Delta Ocean Pointe to the University of Victoria’s David Strong Building twice daily.



AEHMS 11
An International Conference

Program-at-a-Glance

Monday, June 17	
9:00-5:30	POLIS freshwater workshop and fieldtrip

Tuesday, June 18		Wednesday, June 19		Friday, June 20	
8:30	Registration	9:00-10:20	Session 2	9:00-9:40	Keynote
9:00-10:10	Opening & welcome	10:20-10:40	Break	9:40-10:20	Session 4
10:10-10:40	Break	10:40-11:40	Session 2	10:20-10:50	Break
10:40-11:20	Keynote	11:40-12:40	Lunch	10:50-12:10	Session 4
11:20-12:20	Session 1	12:40-1:20	Keynote	12:10-1:30	Lunch
12:20-1:30	Lunch	1:20-2:20	Session 3	1:30-3:35	Public session
1:30-2:10	Keynote	2:20-2:40	Break	3:35-4:05	Break
2:10-2:50	Session 1	2:40-3:40	Session 3	4:05-4:50	Panel Discussion
2:50-3:20	Break	6:30	Mixer & BBQ dinner	4:50-5:00	Conference summary
3:20-5:20	Poster session				Adjournment
	Documentary film screening				

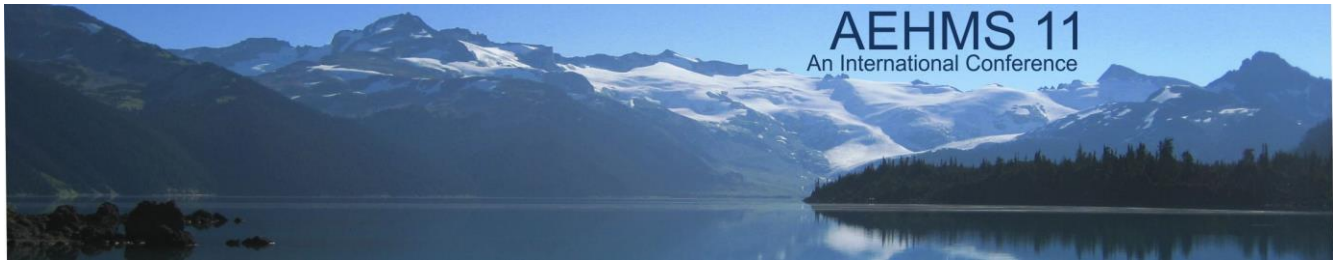
Friday, June 21	
10:00-3:00	Post-conference whale watching excursion

Please note:

All presentations and posters are the property of the presenter. Audio recordings, copying, videotaping or photography of the presentations is prohibited. Media should obtain the permission of the conference chair for use of any conference material.

We request participants to switch off mobile phones in the conference hall.

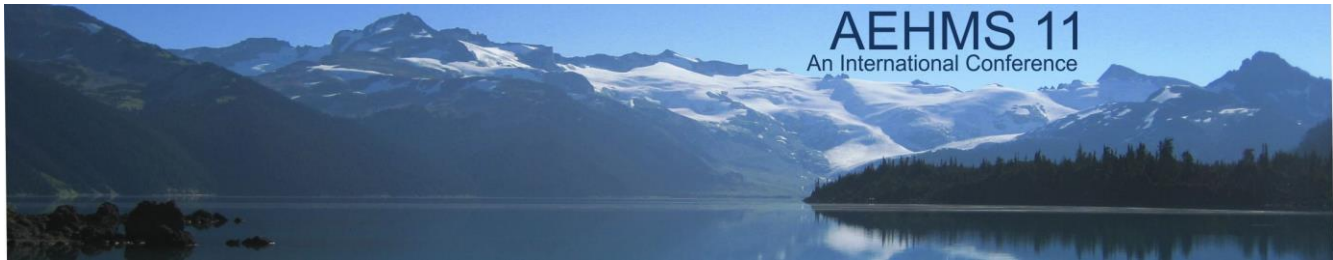
Thank you for your cooperation!



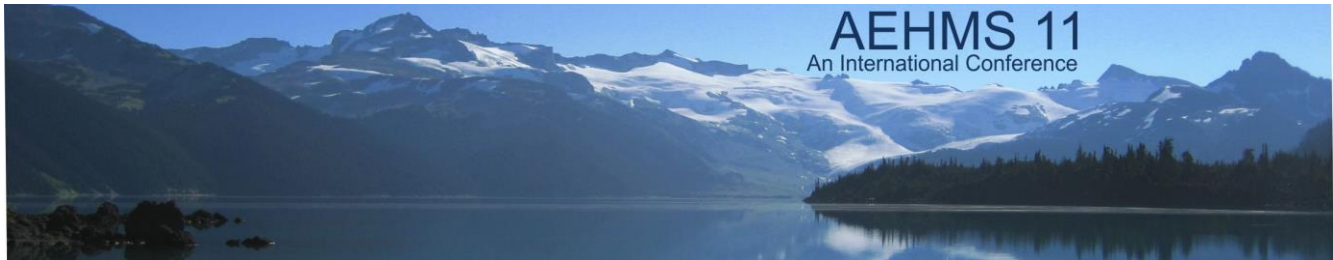
Program

Monday, June 17th	
Pre-Conference Workshop and Fieldtrip	
9:00-3:30	POLIS workshop and fieldtrip (for details see workshop program)
3:30-5:30	Section of the workshop open to the public

Tuesday, June 18th			
8:30	Registration desk opens		
9:00-10:10	Conference opening Welcome to the traditional territory Welcoming reflections on traditional governance: Eli Enns Welcome by the President of the Aquatic Ecosystem Health & Management Society		
10:10-10:40	Break		
Session 1. Climate Change and Lake Dynamics			
10:40-11:20	S1.01	<i>Keynote: Jack Vallentyne memorial lecture – M. Kernan</i>	<i>Managing freshwater ecosystems and freshwater biodiversity under changing climate</i>
11:20-11:40	S1.02	P. Nõges	Lake management in a changing climate
11:40-12:00	S1.03	P. Weidman	Warming and drought stimulate phytoplankton and zooplankton production in a fishless alpine lake: Forecasts using structural equation models and long-term data
12:00-12:20	S1.04	C. Sullivan	Spatial and temporal variation of carbonate chemistry in San Juan Channel, WA
12:20-1:30	Lunch		
1:30-2:10	S1.05	<i>Keynote: M. Munawar</i>	<i>A top down assessment of the state of the Laurentian Great Lakes: Ecology, health and management</i>
2:10-2:30	S1.06	T. Nõges	Recent developments of large lake studies in Estonia
2:30-2:50	S1.07	M. Fitzpatrick	Management capacity building with long term data sets: Lessons from the Bay of Quinte, Lake Ontario
2:50-3:20	Break		
3:20-5:20	Poster session		
	Wine and cheese		
	Screening of documentary films "Voices of the River" and "Troubled Water"		

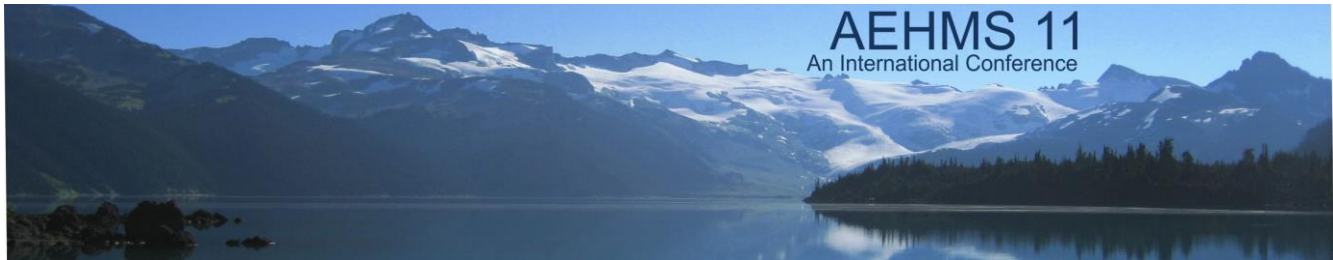


Poster Session		
P.01	S. Bollens	Assessing the role of zooplankton grazing on the development and decline of harmful cyanobacteria blooms in a tidally-influenced floodplain lake (Vancouver Lake, WA, USA)
P.02	M. Bringue	Seasonal variations of dinoflagellate cyst production in the Santa Barbara Basin: records of coastal upwelling and harmful algal blooms
P.03	J. Del Bel Belluz	Spatial and temporal optical characterization of the particulate plume dispersing from the fed components at an Integrated Multi-Trophic Aquaculture (IMTA) system in Kyuquot Sound, British Columbia
P.04	H. El-Serehy	Abundance and diversity of surface microplankton at the Bitter Lake: a hyper saline lake on the Suez Canal, Egypt
P.05	M. Fitzpatrick	Assessing Great Lakes phytoplankton community composition: Comparison of microscopic and fluorometric techniques
P.06	C. Gilpin	Diel temperature and dissolved oxygen patterns inside and outside of sites with planktonic life stage of <i>Thompsodinium intermedium</i> in Comal Springs, Texas Summer 2011
P.07	J. Gross	The Effects of Pulse Pressure from Seismic Water Gun Technology on Northern Pike
P.08	K. Pawluk	Impacts and interaction: the role of two introduced seaweeds in Baynes Sound, British Columbia
P.09	M. A. Rahman	Captive Breeding and Seed Production of the Endangered Giant River Catfish, <i>Sperata seenghala</i> (Skyles) for Species Conservation and Aquaculture Production
P.10	L. Reshitnyk	Remote sensing of nearshore marine habitats using single beam echo sounders - 50 kHz or 200 kHz?
P.11	J. Sherry	Wild fish from the Bay of Quinte Area of Concern contain elevated tissue concentrations of PCBs and exhibit evidence of endocrine-related health effects
P.12	A. Stewart-Malone	The effect of UV-C on larval survival of the quagga mussel
P.13	V. Tunnicliffe	Can we estimate deep-sea benthic biodiversity from ship-based multibeam sonar?
P.14	V. Tunnicliffe	A preliminary study on the effect of earthquakes in abundances of flatfish, ghost shrimps and Squat lobsters on Saanish Inlet
P.15	T. Wagner	Impulsive Sound as an Invasive Aquatic Species Suppression Strategy
P.16	C. Wong	Presenting the facts, inspiring action – Measuring the health of the Salish Sea using transboundary ecosystem indicators



AEHMS 11
An International Conference

Wednesday, June 19th			
Session 2. Plankton and Invasive Species			
9:00-9:20	S2.01	H. El-Serehy	Migration activity of zooplankton between the Red Sea and Mediterranean across the Suez Canal
9:20-9:40	S2.02	S.M.N. Amin	Temporal variation of fish and shrimp assemblages in Merbok River Estuary, Tanjung Dawai, Kedah, Malaysia
9:40-10:00	S2.03	M.A. Rahman	First successful culture of a tropical sea urchin, <i>Salmacis sphaeroides</i> (Linnaeus, 1758) in captivity
10:00-10:20	S2.04	M. Herborg	Aquatic invasive species in BC: Challenges and opportunities
10:20-10:40	Break		
10:40-11:00	S2.05	D. Kreuzweiser	Invasive forest insects pose risks to fisheries habitat: An Emerald Ash Borer case study
11:00-11:20	S2.06	M. Alldred	Impacts of invasive-plant management on nitrogen-removal services in freshwater tidal marshes
11:20-11:40	S2.07	S. Bollens	Invasive copepods and plankton dynamics of the Columbia River Estuary
11:40-12:40	Lunch		
Session 3. Tools, Toys and Techniques			
12:40-1:20	S3.01	<i>Keynote: P. McGillivray</i>	<i>Autonomous technologies for freshwater & marine ecosystem monitoring</i>
1:20-1:40	S3.02	C. Barnes	The health and status of marine ecosystems potentially monitored in real-time through new mini-observatories along repeatered telecommunication cables
1:40-2:00	S3.03	J. Longo	Sandbagging the flood of oceans observation data
2:00-2:20	S3.04	J. Nephin	Data quality in crowdsourced citizen-science: A Digital Fishers case study
2:20-2:40	Break		
2:40-3:00	S3.05	D. Malley	Determination of carbon, nitrogen and phosphorus in sediments and seston of Canadian lakes using near-infrared spectroscopy
3:00-3:20	S3.06	J. Sherry	Differential gene expression in rainbow trout (<i>Oncorhynchus mykiss</i>) exposed to Randle Reef sediment
3:20-3:40	S3.07	S. Tang	Mapping heavy metal zinc in the particulate phase from MERIS in the Pearl River Estuary
3:40-6:30	Conference outing		
6:30-7:00	Mixer		
7:00	Outdoor BBQ Dinner		



AEHMS 11
An International Conference

Thursday, June 20th			
Session 4. Management, Adaptation and Policy			
9:00-9:40	S4.01	Keynote: P. Owens	<i>The health and status of freshwater ecosystems in Canada: The role of science</i>
9:40-10:00	S4.02	R. Nordin	Stewardship and citizen science as a path to water management and protection
10:00-10:20	S4.03	M. Kernan	Adaptive strategies to mitigate the impacts of climate change on European freshwater Ecosystems - case studies from Europe
10:20-10:50	Break		
10:50-11:10	S4.04	J. Blythe	Uncertainty and risk: The case of the White Spot Virus in Mozambique
11:10-11:30	S4.05	D. Malley	Building social process through paraprofessional ecohealth networks in the Philippines, the Canadian Arctic and the Lake Winnipeg Basin
11:30-11:50	S4.06	E. Latham	A forced model of adaptive management in British Columbia's aquaculture sector
11:50-12:10	S4.07	L. Sheehan	Ecosystem-based governance
12:10-1:30	Lunch		
Public Session Sustainability Science and Public Policy Perspectives			
1:30-2:15	Buzz Holling		
2:15-2:35	Kate Moran		
2:35-2:55	Judith Sayers		
2:55-3:35	Public Discussion		
3:35-4:05	Break		
4:05-4:35	Panel Discussion		
4:35-4:50	Conference Overview & Summary		
4:50-5:00	Adjournment		

Friday, June 21st	
Post-Conference Excursion	
10:00-10:30	Travel from Delta Ocean Pointe hotel to Eagle Wing Tours (EWT) dock
10:30-11:00	EWT briefing and safety info
11:00-2:30	Whale watching tour
2:30-3:00	Return to Delta Ocean Pointe hotel



Abstracts

Oral Presentations

Given in order of presentation



S1.01

KERNAN, MARTIN

University College London, UK

m.kernan@ucl.ac.uk

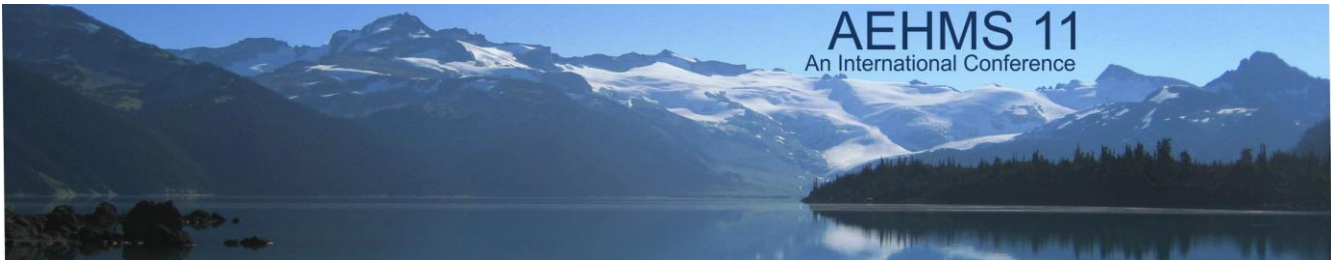
Managing freshwater ecosystems and freshwater biodiversity under changing climate

Climate modelling studies indicate that even if greenhouse gases were stabilised at present levels, change is inevitable as the climate system adjusts to emissions that have already taken place. Although uncertainties remain, the threat is sufficiently real for research now to focus not only on the climate system itself, but also on how changes in the climate system in future might affect the functioning of natural ecosystems.

This presentation focuses on how climate change is affecting, and might in future affect, freshwater ecosystems in Europe, including the threats to freshwater biodiversity. The threats to freshwaters arise from a range of human drivers including agricultural and urban land use, industry and globalisation and, increasingly, climate change. These human drivers cause stressors ranging from a combination of organic and inorganic pollution, flow and morphology alteration, surface and groundwater abstraction, land use change, climate variability and change, invasive species, pathogens, and so on and the synergies between these stresses pose challenges for management. There is a need therefore to assess not only the direct impacts of climate change on freshwaters and their biodiversity (through increasing temperature, shifts in precipitation regimes and altered seasonal patterns) but also its potential indirect impacts through interactions with other drivers (such as land use change, water resource use and atmospheric pollution) and the stresses which result from these, including changes in hydromorphology and nutrient loading.

Understanding how freshwater ecosystems will respond to future climate change is essential for the development of policies and implementation strategies needed to protect aquatic and riparian ecosystems. Policy makers and those that implement policy need to consider the extent to which current policies and practices designed to improve the ecological status of freshwater ecosystems need to be modified in light of projected future climate change. Part of this, and a key challenge, is to safeguard freshwater biodiversity in the face of climate change as, to date, much of the work on conservation implications of predicted climate change has focused on the terrestrial environment. There is a pressing need therefore to generate the scientific understanding that will enable such measures to be implemented successfully.

This presentation will highlight recent research results into the potential implications of climate change on freshwater ecosystems and how these can be applied in management frameworks. The ideas and examples presented stem largely from recent and ongoing research undertaken as part of a series of large scale projects funded by the European Union.

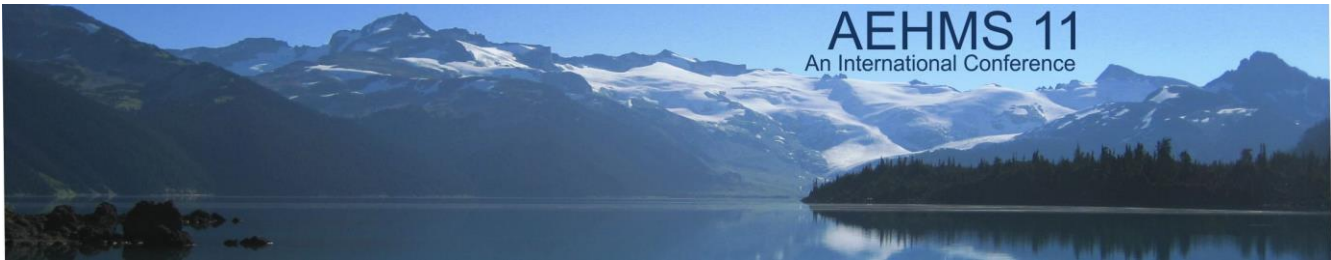


Climate modelling studies indicate that even if greenhouse gases were stabilised at present levels, change is inevitable as the climate system adjusts to emissions that have already taken place. Although uncertainties remain, the threat is sufficiently real for research now to focus not only on the climate system itself but also on how changes in the climate system in future might affect the functioning of natural ecosystems.

This presentation focuses on how climate change is affecting, and might in future affect, freshwater ecosystems in Europe, including the threats to freshwater biodiversity. The threats to freshwaters arise from a range of human drivers including agricultural and urban land use, industry and globalisation and, increasingly, climate change. These human drivers cause stressors ranging from a combination of organic and inorganic pollution, flow and morphology alteration, surface and groundwater abstraction, land use change, climate variability and change, invasive species, pathogens, and so on and the synergies between these stresses pose challenges for management. There is a need therefore to assess not only the direct impacts of climate change on freshwaters and their biodiversity (through increasing temperature, shifts in precipitation regimes and altered seasonal patterns) but also its potential indirect impacts through interactions with other drivers (such as land use change, water resource use and atmospheric pollution) and the stresses which result from these, including changes in hydromorphology and nutrient loading.

Understanding how freshwater ecosystems will respond to future climate change is essential for the development of policies and implementation strategies needed to protect aquatic and riparian ecosystems. Policy makers and those that implement policy need to consider the extent to which current policies and practices designed to improve the ecological status of freshwater ecosystems need to be modified in light of projected future climate change. Part of this, and a key challenge, is to safeguard freshwater biodiversity in the face of climate change as, to date, much of the work on conservation implications of predicted climate change has focused on the terrestrial environment. There is a pressing need therefore to generate the scientific understanding that will enable such measures to be implemented successfully.

This presentation will highlight recent research results into the potential implications of climate change on freshwater ecosystems and how these can be applied in management frameworks. The ideas and examples presented stem largely from recent and ongoing research undertaken as part of a series of large scale projects funded by the European Union.



S1.02

NÖGES, PEETER

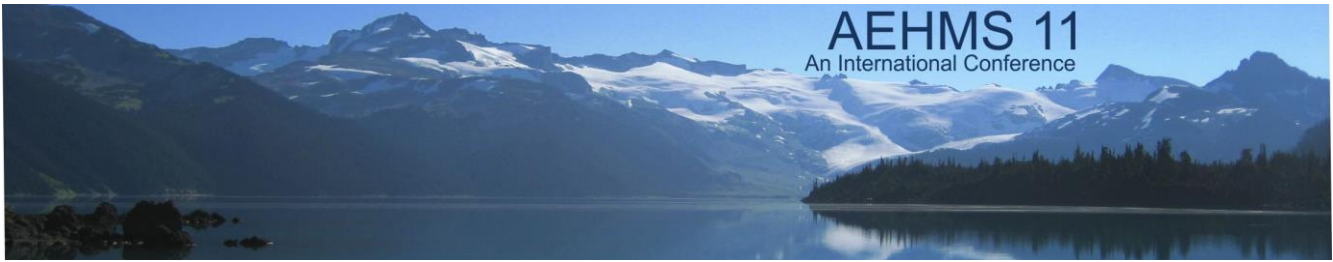
Centre for Limnology, Estonian University of Life Sciences, Estonia
peeter.noges@emu.ee

Lake management in a changing climate

Anticipated effects of climate change (CC) will add to the already existing anthropogenic pressures on water bodies and may multiply the stress by synergistic effects. Most physical, chemical and biological parameters of water bodies used for ecological quality assessment are likely affected, although it may be often hard to disentangle the CC effects on surface waters from the local direct human impact. As disregarding of CC effects potentially endangered the achievement of the targets set by the European Water Framework Directive WFD, in 2009 the European Commission produced a guidance document “River basin management in a changing climate” which described the policy framework around climate-water issues giving advice on handling scientific knowledge and uncertainties about CC.

The recently published Blueprint to Safeguard Europe's Water Resources (2012) puts a strong emphasis on water quantity issues. The document recognises the negative impacts of CC on water status; however, does not specifically address lakes. Eutrophication of lakes, which still remains the main risk of failure to meet the WFD requirements for ecological status, is largely ignored by the Blueprint. Such ignorance may mislead or perplex water managers, giving a wrong signal as if eutrophication problems in the EU were almost solved. In 2010 the European Environment Agency found no clear improvement in nutrient water quality in most agricultural catchments across Europe.

The EU FP7 Project REFRESH aims at developing adaptive strategies to mitigate CC impacts on freshwater ecosystems in Europe. It has formulated some robust guiding principles for lake management to recall some of the basic rules of limnology regarding nutrient limitation, cascading effects in foodwebs, and type-specific differences of lakes. These guiding principles put a clear emphasis on needs to combat eutrophication as the dominating pressure on lakes in Europe.



S1.03

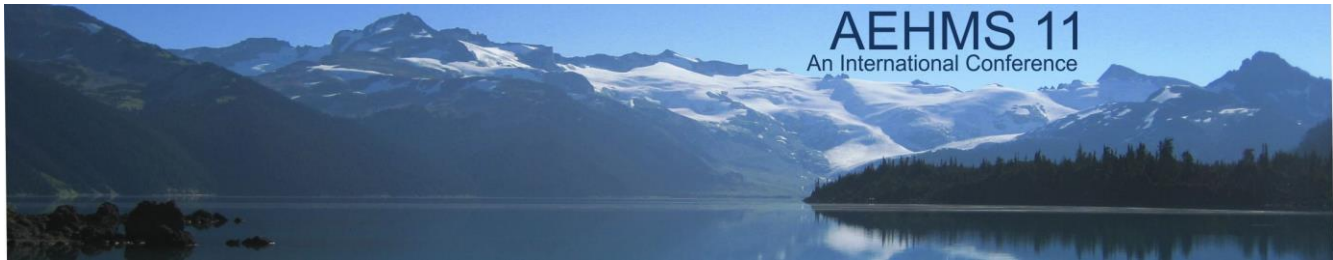
WEIDMAN, PAUL*, VINEBROOKE, ROLF, SCHINDLER, DAVID

University of Alberta, Department of Biological Sciences, Canada

*pweidman@ualberta.ca

Warming and drought stimulate phytoplankton and zooplankton production in a fishless alpine lake: Forecasts using structural equation models and long-term data

Effects of climate change on lake foodwebs involve large-scale multiple factors, such as long-term warming, decreased precipitation, and advanced ice-off. We determined the effects of long-term (1991-2006) variation in temperature and precipitation on a fishless alpine lake foodweb in Banff National Park (Alberta, Canada) using structural equation modeling. We hypothesized that decreased precipitation would decrease inputs of C-rich allochthonous matter, thereby decreasing dissolved C relative to P and increasing production of P-limited autotrophs relative to mixotrophs. We also hypothesized that warming would promote faster-growing P-limited herbivorous cladocerans and rotifers relative to omnivorous copepods. We found that decreased summer precipitation significantly reduced concentrations of dissolved organic C and reduced dilution increased concentrations of total dissolved P, which coincided with an increase in diatoms relative to phytoflagellates. Despite increases in dissolved P, however, there was a net increase in particulate C:P primarily due to warming-related increases in *Daphnia*, which retained P and grazed on P-rich phytoflagellates. Calanoid copepods were not suppressed by warming, but instead increased with reduced winter snow pack and advanced ice-off, which subsequently increased copepod grazing on diatoms. Our findings suggest that warmer and drier conditions due to climate change will enrich alpine lakes in dissolved P relative to C, stimulating autotrophic production and secondary production by daphnids and copepods. However, comparison with other studies suggested that more extreme warming conditions outside the range in variation in our dataset may produce different effects on phytoplankton and zooplankton taxa in alpine lakes.



S1.04

SULLIVAN, CONSTANCE^{1*}, **NEWTON, JAN**², **KLINGER, TERRIE**³, **O'DONNELL, MICHAEL**⁴,
APPLE, JUDE⁵

¹ WA Sea Grant/ Puget Sound Partnership, United States

² Applied Physics Laboratory, University of Washington, United States

³ School of Marine and Environmental Affairs, University of Washington, United States

⁴ Friday Harbor Laboratories, University of Washington, United States

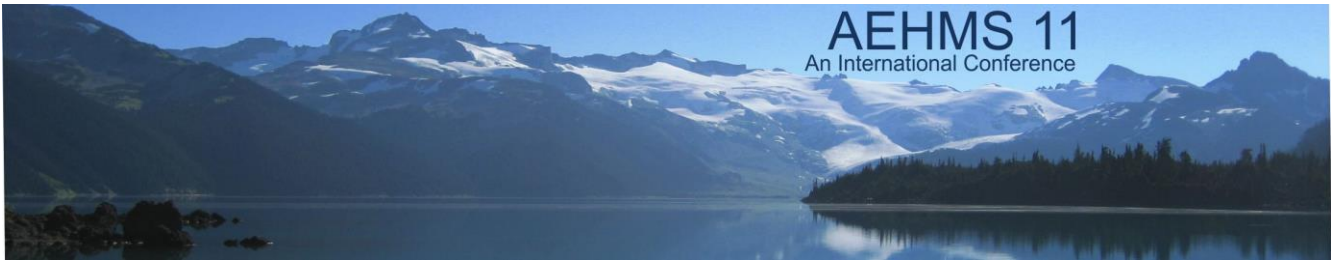
⁵ Shannon Point Marine Center, Western Washington University, United States

*constance.sullivan@psp.wa.gov

Spatial and temporal variation of carbonate chemistry in San Juan Channel, WA

Recent attention has been given to the potential vulnerability of coastal zones to ocean acidification. Estuaries in close proximity to urban areas, such as the Salish Sea, are strongly influenced by human activities and could be particularly vulnerable to the added stress of ocean acidification. However, very little is known about existing carbonate chemistry in these estuaries. To begin to address this need, we sampled seawater and measured carbonate chemistry at two stations in San Juan Channel, near the center of the Salish Sea, at four depths over 13 sampling time points during 2011 and 2012.

While pH was variable, in all samples it was substantially lower than contemporary values in open ocean settings. $p\text{CO}_2$ levels were correspondingly high. Aragonite saturation state – a measure of the kinetics of calcium carbonate precipitation – was under-saturated at most time points. Compared to values from open ocean environments, the relatively wide range in variation of carbonate variables observed at these stations could be due to a combination of factors, including the intrusion of upwelled waters from the outer coast, local upwelling within the Salish Sea, discharge from rivers, local respiration, and inputs from human activities other than fossil fuel combustion. Understanding the dynamics of seawater carbonate chemistry in the Salish Sea is necessary for the development of appropriate strategies for resource management and human adaptation.



S1.05

MUNAWAR, MOHIUDDIN^{1*}, MUNAWAR, IFTEKHAR F.², FITZPATRICK, MARK¹, NIBLOCK, HEATHER¹

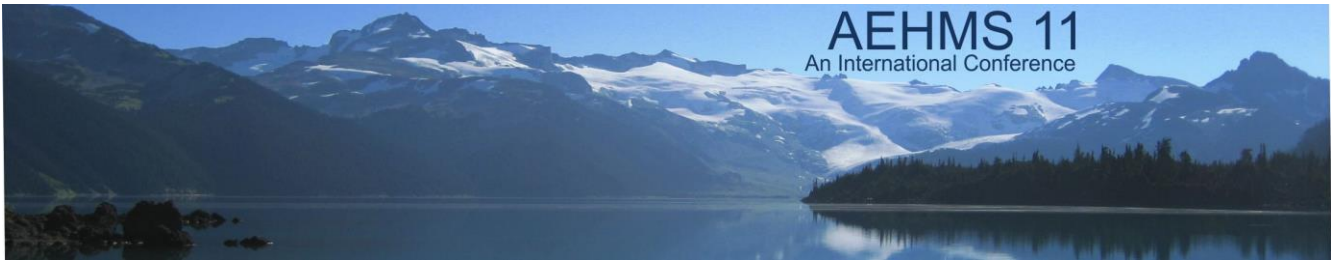
¹ Fisheries & Oceans Canada, Canada

² Plankton Canada, Canada

*mohi.munawar@dfo-mpo.gc.ca

A top down assessment of the state of the Laurentian Great Lakes: ecology, health and management

The Great Lakes have seen considerable changes over the past 40 years including eutrophication, phosphorous abatement, invasive species, oligotrophication, the re-emergence of algal blooms and global warming. The first comprehensive biological surveys of the Great Lakes were organized by Dr. Richard Vollenweider in the early 1970s and followed the classical ecological paradigms relating nutrient loadings to trophic state. In this period, the lakes were classified according to phytoplankton community composition and primary production. Experimental bioassays were also developed and undertaken to assess the impact of various contaminants. A growing recognition of human behaviour in influencing ecosystem health led to the adoption of Dr. Jack Vallentyne's "Ecosystem Approach" for managing the Great Lakes. Beginning in the late 1980s, comprehensive foodweb surveys were organized which included the microbial loop in addition to phytoplankton, zooplankton benthos and fish. At about the same time, the establishment of Dreissenid Mussels in the Great Lakes provided a new focus for research on the impact of invasive species on the foodweb dynamics and potential disruption. Currently, new technologies are emerging (e.g. multi spectra fluorometers, optical sensors and sondes) that allow for more expansive spatial surveys and presumably greater precision in assessing the impact of multiple anthropogenic stressors. However these data need to be verified and interpreted against more traditional measurements from index stations. The Great Lakes are at the threshold of integrating classical ecology with new digital technologies. This integration will empower scientists and students to explore further the intricacies of large lake dynamics with improved precision.



S1.06

NÖGES, TIINA*, AGASILD, HELEN, LAAS, ALO, TOMING, KAIRE, ZINGEL, PRIIT, NOGES, PEETER

Centre for Limnology, Estonian University of Life Sciences, Estonia

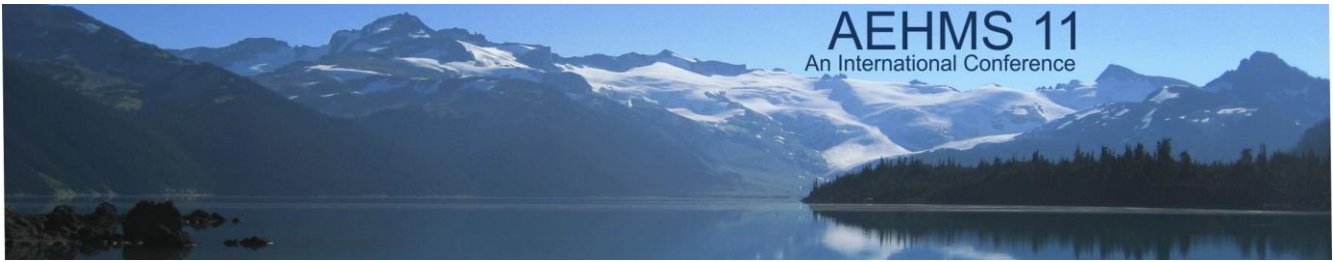
tiina.noges@emu.ee

Recent developments of large lake studies in Estonia

During the last 5 years we have begun several new studies in large shallow Lake Võrtsjärv (270 km², mean depth 2.8 m) in Estonia. We have assessed the origin of organic matter in lake water and sediments, as well as the structure of the foodwebs by using stable isotopes ($\delta^{13}\text{C}$, $\delta^{15}\text{N}$) and other complementary methods. We started measurements of methane, CO₂ and other greenhouse gas emissions from the lake by using the floating chamber method. We have applied bio-optical modelling to determine annual primary production and its long-term changes. Mesocosm experiments and nutritional analysis of fish larvae have clarified the aspects of food chain functioning. High frequency measurements with monitoring platforms and buoys were used for whole-lake metabolism estimations. Lake Võrtsjärv revealed seasonal switching between net autotrophy and net heterotrophy, the first prevailing from early spring until August/September and the latter during the rest of the year.

On an annual basis Võrtsjärv is rather CO₂ neutral. The stable isotope analyses of foodweb structures and carbon sources revealed different foodweb functioning in the shallower macrophyte-covered lake as compared to northern and central plankton dominated areas. The depleted carbon signatures of chironomid larvae and crustacean zooplankton in the period of oxygen depletion in the macrophyte-covered area suggest that methane-derived carbon can seasonally contribute to both the benthic and pelagic foodwebs. Labelling experiments with natural planktonic ciliates revealed that microciliates are ingested by all dominant crustacean species, but their predation impact is relatively weak.

Enclosure experiments with removal and addition of crustaceans demonstrated the indirect effect of small-sized crustaceans on ciliate community structure, which is mainly controlled by the interactions within the ciliate assemblage. Our studies showed that without ciliates the daily food requirement of fish larvae are not met, which is also probably the case in many other freshwater lakes.



S1.07

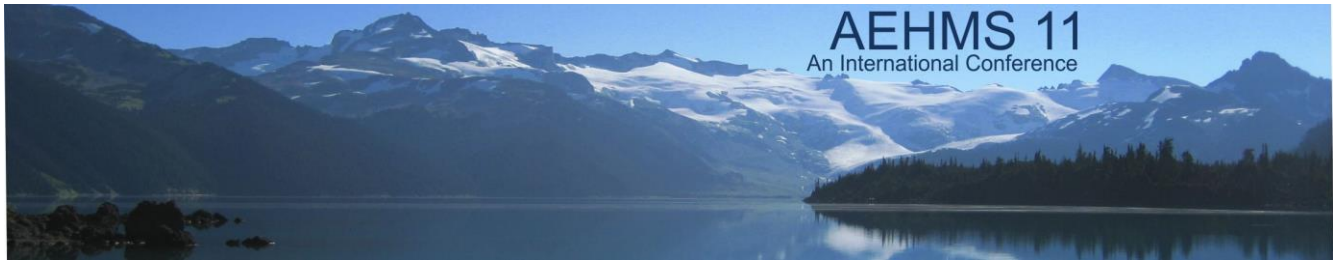
MUNAWAR, MOHIUDDIN, FITZPATRICK, MARK*, NIBLOCK, HEATHER

Fisheries & Oceans Canada, Canada

*mark.fitzpatrick@dfo-mpo.gc.ca

Management capacity building with long term data sets: Lessons from the Bay of Quinte, Lake Ontario

The Bay of Quinte is a degraded hyper-eutrophic ecosystem located on the northeastern shore of Lake Ontario. In 1972, a biological/limnological monitoring program was established as a first step toward remediation. The monitoring program included regular measurements of nutrients, chlorophyll *a*, phytoplankton and zooplankton and was used to establish a phosphorous abatement strategy and evaluate its effectiveness. In the intervening years, researchers and managers have also been able to use this reference data set to assess the impact of stressors that occurred later or have become evident over time such as the establishment of Dreissenid Mussels or the impacts of climate change. Beginning in 2000, the scope of the program was expanded to include the microbial foodweb with additional measurements of bacteria, autotrophic picoplankton, heterotrophic nanoflagellates and ciliates as well as size fractionated primary productivity and bacterial growth rates. The expanded program has resulted in a growing understanding of the relative roles heterotrophic and autotrophic communities play in foodweb dynamics. For example our Bay of Quinte data indicated the heterotrophs could contribute more than 60% of the organic carbon resources, even under eutrophic conditions. In this paper, we discuss the scientific insights gained from such a long term monitoring program and the implications for holistic, ecosystem-science based management. These insights may also be useful to other parts of the world.



S2.01

EL-SEREHY, HAMED^{1*}, ABDEL RAHMAN, NASER², BAHGAT, MAGDY³, ABOU ELA, HAMDY⁴, AL-QURAI SHY, SALEH⁵, AL-FARRAJ, SALEH⁵, AL-MISNED, FAHAD⁵, AL-RASHEID, KHALED⁵

¹ King Saud University, Saudi Arabia

² National Institute of Oceanography and Fisheries, Alexandria, Egypt

³ Port Said University, Egypt

⁴ Suez Canal University, Egypt

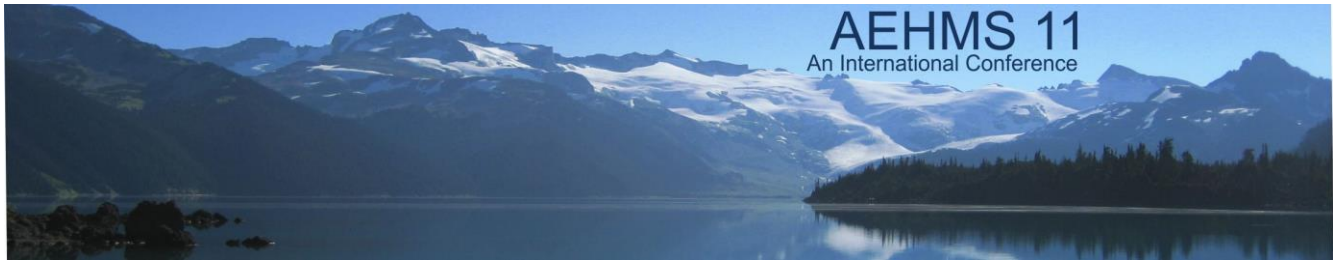
⁵ King Saud University, Saudi Arabia

*helserehy@ksu.edu.sa

Migration activity of zooplankton between the Red Sea and the Mediterranean Sea across the Suez Canal

The Suez Canal is the main connecting link between the Red Sea in the south and the Mediterranean Sea in the north. It crosses many lakes, which represent many different habitats. 87 zooplankton taxa and species were collected for a complete year from 10 selected stations on the canal. Most zooplankton species seem to be immigrant plankters to the Suez Canal, and much interest was focused on determining from which end of the canal these organisms were invading the opposite sea. However, the canal itself, along with its lakes, should also be considered as a substantial permanent habitat in its own right; it cannot be considered only as a funnel or corridor through which animals pass like ships from one sea to the other.

Plankton appears to enter the Suez Canal from the south via water currents; to do so it needs to be carried over a distance of 20 km along the canal from the Gulf of Suez into the Bitter Lakes, then pass across the Bitter Lakes before being carried a further 12 km along the canal into Lake Timsah. Transport of zooplankton southward along the canal from the Mediterranean is unlikely to take place during most seasons of the year because it would require transport against the dominant-water flow; it is possible only during a brief period (July–September) of reversed flow. Because the main part of the 80 km from the Red Sea is canalized, passive transport of zooplankton by water currents from the north could occur within a week during the brief period of reversed flow even at the low speed of 0.5 km hour⁻¹. Moreover, conditions (barriers, obstacles and/or links) along the migratory route of the Suez Canal, in either direction, are likely to determine the success of passive transport of zooplankton species.



S2.02

AMIN, S.M.N.*, ARSHAD, AZIZ

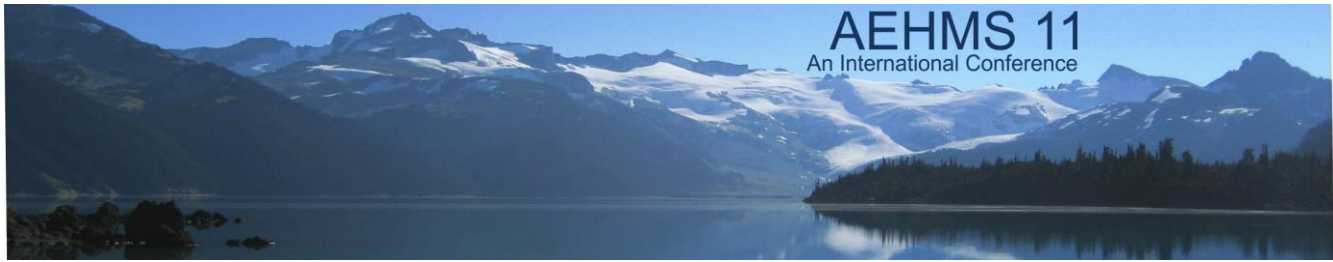
Universiti Putra Malaysia, Malaysia

*sm_nurul@putra.upm.edu.my

Temporal variation of fish and shrimp assemblages in Merbok River Estuary, Tanjung Dawai, Kedah, Malaysia

The temporal variation and assemblage composition of fish and shrimp species caught by estuarine set bag nets (ESBN) in Tanjung Dawai estuarine, Tanjung Dawai, Kedah, Malaysia were investigated based on data collected from May to September 2012.

Stolephorus tri was the most abundant fish caught by ESBN in Tanjung Dawai (1.1%), while *Acetes* sp. was the most abundant shrimp (92.18%). The highest percentage of species occurrence caught by ESBN in Tanjung Dawai estuary was found in August (70.0%), and the lowest was in May (50%). The percentage of numerical abundance of all fish and shrimp species caught by ESBN was the highest in July (51.17%) and the lowest in August (7.04%). Length-weight relationship analysis displayed that four species had a positive allometric growth while seven of them had a negative allometric growth. The average monthly catch per unit effort (CPUE) of the ESBN observed was 2.914 kg net⁻¹ hour⁻¹. Since the abundance percentage of juvenile fish caught by ESBN was low (2.42%), the use of ESBN in Tanjung Dawai estuarine, Merbok River, Kedah was concluded to be a non-destructive fishing gear.



S2.03

RAHMAN, M. AMINUR^{1*}, ARSHAD, A.², YUSOFF, FATIMAH MD.²

¹ Laboratory of Marine Biotechnology, Institute of Bioscience, Universiti Putra Malaysia, 43400 UPM Serdang, Selangor, Malaysia

² Department of Aquaculture, Faculty of Agriculture, Universiti Putra Malaysia, 43400 UPM Serdang, Selangor, Malaysia

*aminur1963@gmail.com

First successful culture of a tropical Sea Urchin, *Salmacis sphaeroides* (Linnaeus, 1758) in captivity

Salmacis sphaeroides (Linnaeus, 1758), also known as ball-like or White Sea Urchin, is one of the regular echinoids distributed in the warm Indo-West Pacific ocean including coastal waters in Johor State between Malaysia and Singapore. It has significant biological, ecological, nutritional and pharmaceutical values, yet to be explored.

To study this high-valued marine resource, an experiment was conducted to develop appropriate techniques for aquaculture of *S. sphaeroides* under captive aqua-rearing conditions. Three-month-old juveniles produced through induced breeding, larval rearing and metamorphic induction were stocked in each of nine well-aerated glass aquaria (46 x 30 x 30 cm). Stocking density was maintained at 20 juveniles aquarium⁻¹. Juveniles fed with Red Alga (*Amphiroa fragilissima*) were designated as Treatment-1 (T1), Brown Alga (*Sargassum polysystem*) as Treatment-2 (T2) and Sea Grass (*Enhalus acoroides*) as Treatment-3 (T3), respectively. At stocking, all juveniles were of the same age group batch-rearing, with mean length and weight of 9.63±0.31 mm and 0.39±0.05 g, respectively.

All the juveniles were fed ad libitum and water in each cultured aquarium was completely changed at monthly intervals. The culture was maintained for one year during which time the juveniles attained sexual maturity. Growth performances (final weight, final length, weight gain, length gain and specific growth rate) and survival of adults were significantly higher (P<0.05) in T1 than in T2 and T3. Gonad production in terms of wet gonad weight and gonad index also followed the same trend as that for growth.

Therefore of the three algal feeds evaluated, Red Alga appeared to be the most suitable for rearing *S. sphaeroides* under captive conditions. This study is the first demonstration of the successful culturing of *S. sphaeroides* in a static aquarium system, the findings of which could be helpful towards the commercial aquaculture of Sea Urchins.



S2.04

HERBORG, M.L^{1*}, BECK, M.²

¹ British Columbia Ministry of Environment, Victoria, BC

² School of Environmental Studies, Victoria, BC

*Matthias.Herborg@gov.bc.ca

Aquatic invasive species in British Columbia: Challenges and opportunities

Aquatic invasive species are one of the leading causes of biodiversity loss in the freshwater environment. A recently developed Aquatic Invasive Species database developed for British Columbia (BC) is the first snapshot of the number and range of species that have already been introduced to BC.

An overview of the species present in BC will be provided and a couple of high risk species, either already present or getting closer, will be highlighted. The latest results on the impact of some of these introduced species will be presented as well as the prevention or eradication approaches that are ongoing.

New provincial legislation focussing on Aquatic Invasive Species is currently being implemented to greatly enhance BC's biosecurity.



S2.05

KREUTZWEISER, DAVID^{1*}, CAPELL, SCOTT¹, NISBET, DAVID², SIBLEY, PAUL², SCARR, TAYLOR³

¹ Canadian Forest Service, Natural Resources Canada, Canada

² University of Guelph, Canada

³ Ontario Ministry of Natural Resources, Canada

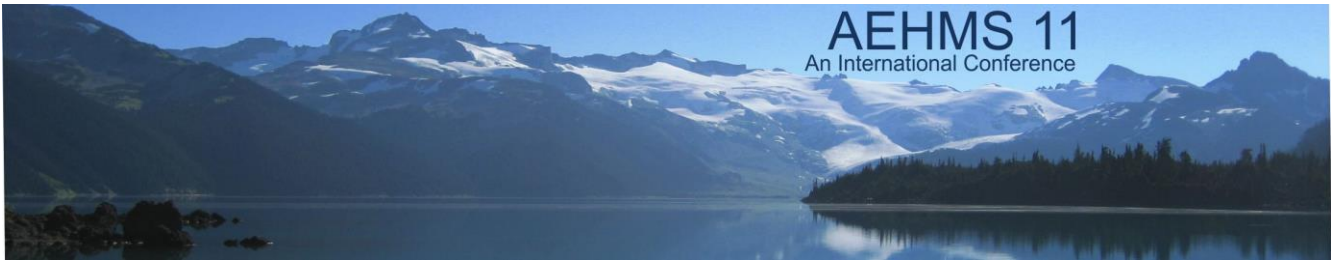
*dave.kreutzweiser@nrcan.gc.ca

Invasive forest insects pose risks to fisheries habitat: An Emerald Ash Borer case study

The exotic, invasive forest insect, Emerald Ash Borer (EAB), is rapidly spreading through eastern North America and causing extensive mortality of ash trees. Many of these trees are in residual forests of riparian buffers that provide critical ecological services including the protection of water quality and aquatic ecosystem health. A field study in south-western Ontario that is assessing the ecological consequences of ash mortality from EAB in riparian forests of agricultural landscapes is described.

Early results show how the loss of ash influences stream canopy cover and leaf litter deposition, and how these affect organic matter dynamics in adjacent streams. Across our riparian forest study plots, ash trees contributed 10-90% tree basal area, with an average of 35%. EAB infestations caused 100% ash mortality. When ash trees compose about 30% or more of riparian forests, this mortality causes large and sudden canopy openings. Light penetration to forest floors is measurably increased, riparian vegetation proliferates, incursions by invasive plants are about doubled, and nitrogen cycling in riparian soils is increased by about 4 times above baseline rates.

In our riparian plots, ash is always among the top 4 tree species contributing leaf litter to adjacent water bodies, with an average contribution of 20% and ranging to 45%. Ash litter inputs to streams have a distinct seasonal trend: always among the earliest inputs. Among litter from the 6 most common riparian trees, ash is preferred (decomposed) by aquatic invertebrates as first or second choice in selection microcosms. Further endpoints, including invertebrate communities on in situ leaf packs with or without ash, are being assessed and will be reported. We discuss how the loss of important tree species in riparian forests can affect riparian and aquatic ecosystems and their services, and how these effects could be mitigated or managed.



S2.06

ALLDRED, MARY^{1*}, BAINES, STEPHEN¹, FINDLAY, STUART²

¹Stony Brook University, United States

²Cary Institute of Ecosystem Studies, United States

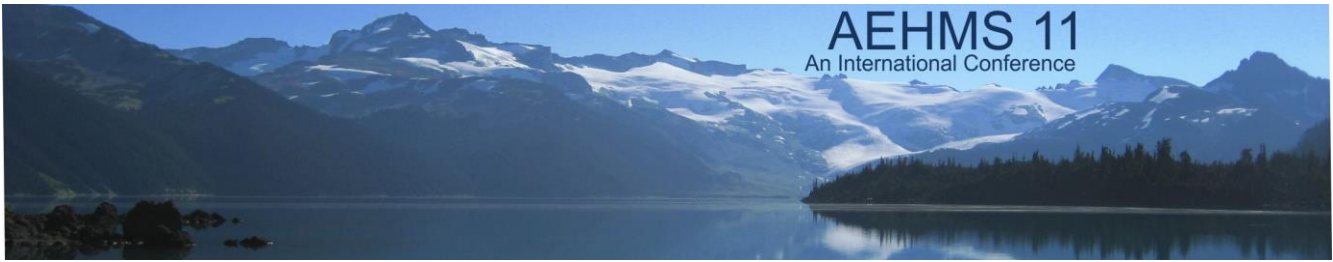
*maldred1@gmail.com

Impacts of invasive plant management on nitrogen-removal services in freshwater tidal marshes

Management of invasive plant species such as *Phragmites australis* in order to conserve native plant diversity is a major management goal in the Hudson River Estuary. Substantial changes in plant community composition resulting from species invasions and the removal of invasive species may drastically alter sediment characteristics and processes, including permanent removal of nitrogen from these systems via microbial denitrification.

The Nature Conservancy conducted small-scale removals of *Phragmites* from Ramshorn (also Catskill) Marsh of the Hudson River in September 2010 using glyphosate herbicide. Here we present results from a four-year monitoring project, including two years of pre-treatment monitoring, of sediment characteristics and potential denitrification rates for three herbicide-treated *Phragmites* patches, three untreated *Phragmites* sites, and adjacent sites dominated by native *Typha angustifolia*.

Sediment ammonium increased following the removal of vegetation from treated sites, likely as a result of decreased plant uptake and nitrification. Denitrification potentials were lower in removal sites, relative to untreated *Phragmites* sites, a trend that persisted two years following removal as native plant species began to re-colonize treated sites. With the exception of measurements conducted following Hurricane Irene in September 2011, denitrification measurements were consistently highest in *Phragmites*-dominated sites. This result suggested the potential for a trade-off between invasive-plant management and nitrogen-removal services. However, our results also revealed considerable interannual and interseasonal variation in denitrification, highlighting a need for more frequent intra- and interannual monitoring efforts in order to fully understand the dynamics of plant-sediment interactions, and their impacts on nitrogen cycling, in tidal marshes of the Hudson River.



S2.07

BOLLENS, STEPHEN^{1*}, BRECKENRIDGE, JOANNE¹, ROLLWAGEN-BOLLENS, GRETCHEN¹, CORDELL, JEFFERY², KALATA, OLGA¹

¹ School of the Environment, Washington State University, USA

² School of Aquatic and Fishery Sciences, University of Washington, USA

*sbollens@vancouver.wsu.edu

Invasive copepods and plankton dynamics of the Columbia River Estuary

As part of a multi-year field study to investigate plankton dynamics in the lower Columbia River estuary, monthly sampling of chlorophyll, nanoplankton, microplankton, and mesozooplankton was conducted. In addition to the description of seasonal variations in the plankton community and relationships to environmental predictors, we sought to better understand the linkages between different taxonomic groups and the role of native vs. non-indigenous copepods.

Group-specific ordinations and cluster analyses that related community composition to both environmental and biological variables were performed. While all plankton communities displayed strong seasonal cycles and were correlated to freshwater discharge and salinity, analyses also suggested large inter-group differences. Unlike heterotrophic communities, the diatom community was not strongly associated with a temperature gradient. Both diatom and microzooplankton communities were related to predator forcings. Conversely, the mesozooplankton community lacked strong relationships with potential prey groups, with the exception of total nanoplankton. The copepod community was numerically dominated by *Eurytemora affinis*, *Coullana canadensis*, and *Pseudodiaptomus forbesi*. During autumn, the non-indigenous *P. forbesi* dominated and peak abundances of *Limnoithona tetraspina*, another non-indigenous copepod, were also observed.

These results indicate that plankton communities in the lower Columbia River estuary are strongly influenced by both biological and physical processes, with the relative importance of these processes varying between different groups of plankton. On-going analyses will include examination of potential relationships between specific size classes of nano- and microplankton and mesozooplankton communities, particularly with respect to native vs. non-indigenous copepods.



S3.01

McGILLIVARY, PHILIP

US Coast Guard Pacific Area, USA

philip.a.mcgillivary@uscg.mil

Autonomous technologies for freshwater and marine ecosystem monitoring

Autonomous underwater vehicles (AUVs), autonomous surface vehicles (ASVs), and autonomous unmanned aircraft systems (UAS) are coming into use for monitoring marine ecosystems. These systems extend the spatial and temporal ranges of ocean observing systems, and track important but time-space variable features including pollution events, oceanographic fronts, eddies and upwellings, or river plumes.

By combining these autonomous systems, air-sea fluxes of CO₂ and methane, as well as heat, moisture and salinity can synoptically be measured. Such data are now difficult and costly to collect routinely, although critical for improving climate models. This is particularly true in the arctic where the availability of manned platforms is limited, and logistics costs are high.

A critical open source communication software protocol, and delay and disruption tolerant wireless networking (DTN), which allows autonomous systems to remain in communication both with operators and each other, are described. DTN allows reliable control by remote operators, while at the same time allowing autonomous systems to interact independently to make use of adaptive sampling (also called anomaly mapping) control software. For example, video from an unmanned aircraft can direct AUVs and/or ASVs to an oceanic front or to schools of fish for further in situ sampling and study. An ASV is described that was specifically developed for measuring ocean acidification, along with energy systems which harvest wave and solar power to permit long-term operation of the platform and associated sensors. How UAS can be used to improve monitoring of rivers and streams is also described. This is particularly critical in the arctic, where changes due to permafrost melting as well as rainfall seasonality and intensity, are causing erosion and destruction of critical fish spawning habitat.

Finally, data systems for ingesting, geo-referencing, archiving and searching/analyzing large volumes of video and other data collected by networks of autonomous systems are also discussed.



S3.02

BARNES, CHRISTOPHER^{1*}, BUETI, CRISTINA², MELDRUM, DAVID³

¹ SEOS, University of Victoria, Canada

² International Telecommunications Union, Switzerland

³ Scottish Marine Institute, Scotland

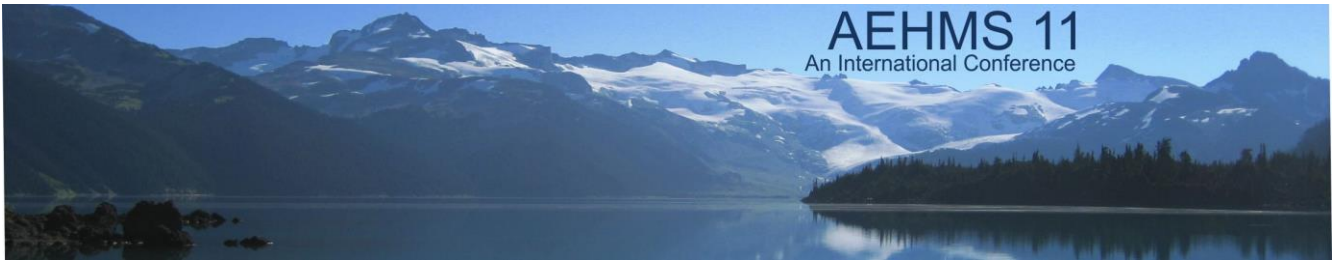
*crbarnes@uvic.ca

The health and status of marine ecosystems potentially monitored in real-time through new mini-observatories along repeatered telecommunication cables

Aspects of the health and status of marine ecosystems could be monitored in real-time or near-real time on a global basis through a new generation of ocean mini-observatory systems. Ocean temperature is a key factor for marine life, particularly as related to future changes with global warming. A lesser issue is the extent and impact of periodic seabed destruction and community modification by tsunamis and associated slope failures.

A recent joint initiative between three UN agencies is proposing to develop trans-ocean mini-observatories to measure changing seafloor temperatures over several decades. A Joint Task Force (JTF), established in 2012 by the International Telecommunication Union (ITU), the World Meteorological Organization (WMO) and the Intergovernmental Oceanographic Commission (IOC) of UNESCO, is examining novel uses for submarine telecommunication cables. With ITU secretariat support, the JTF is developing a strategy and roadmap that could lead to enabling the availability of modified submarine repeaters equipped with scientific sensors (such as temperature, pressure and acceleration) for climate monitoring and disaster risk reduction (particularly tsunamis). Repeaters are deployed along submarine telecommunication cables about every 50-70 km to amplify the pulsed optical signal and so, if successful and needing support from industry and regulatory bodies, a wide network of mini-observatories could be established at many places across the world's ocean floors to measure these important parameters accurately over several decades.

The initiative addresses two main issues: a) the need for sustained climate-quality data from the sparsely observed deep oceans and continental slopes but extending into coastal waters; and b) the desire to increase the reliability and integrity of the global tsunami warning networks. Presently, plans are being developed to launch a pilot project with the active involvement of cable industry players and existing ocean observatory researchers. More information is available at: <http://www.itu.int/en/ITU-T/climatechange/task-force-sc/Pages/default.aspx>.



S3.03

LONGO, JUSTIN*, DOBELL, ROD, NEPHIN, JESSICA, WALSH, JODIE

University of Victoria, Canada

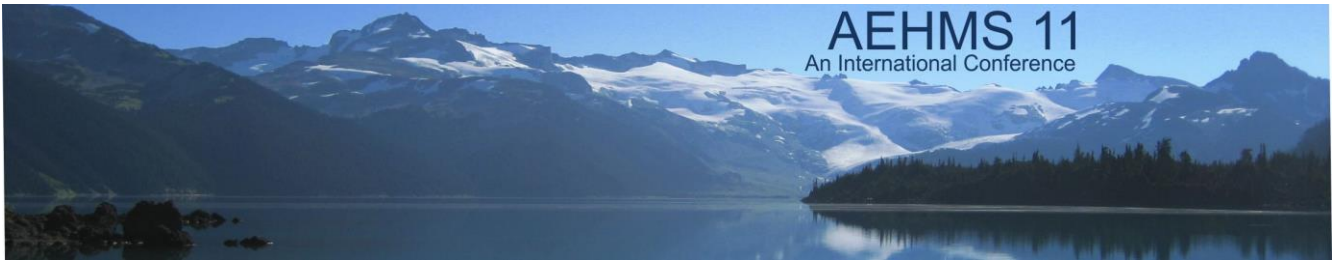
*justin.longo.phd@gmail.com

Sandbagging the flood of oceans observation data

A growing flood of data from oceans observation platforms - e.g. smart buoys, moored instrumentation, drifting platforms, benthic landers, remotely piloted and autonomous aircraft and underwater vehicles - represents a dilemma of riches that challenges our organizational and analytical capacity to understand ocean systems. For data that is not easily deciphered by computers - e.g. video and audio data captured from cameras and hydrophones - the problem is particularly acute, as given resources can easily become overwhelmed or the data can go under-analyzed.

Digital Fishers is an Internet platform that engages volunteer citizen scientists to filter and tag the large volume of video data being captured through the NEPTUNE Canada cabled seafloor observatory, and does so without diverting scientific resources to low-expertise video analysis tasks or adversely affecting data quality. We call this approach "science-oriented crowdsourcing" focussed on the engagement of public participants in low-intensity pattern recognition tasks carried out over the Internet. Since its deployment, 1 400 individuals have used the Digital Fishers web platform to view short video clips and provide over 100 000 annotations.

The framework and principles for modifying the Digital Fishers approach and applying it to similar settings so that oceans observation systems with large volumes of visual or audio data might benefit from the pattern-recognition and interpretation strengths of volunteer citizen scientists are presented.



S3.04

NEPHIN, JESSICA^{1*}, DOBELL, ROD²

¹ School of Earth and Ocean Sciences, University of Victoria, Canada

² Centre for Global Studies, University of Victoria, Canada

*jessica.nephin@gmail.com

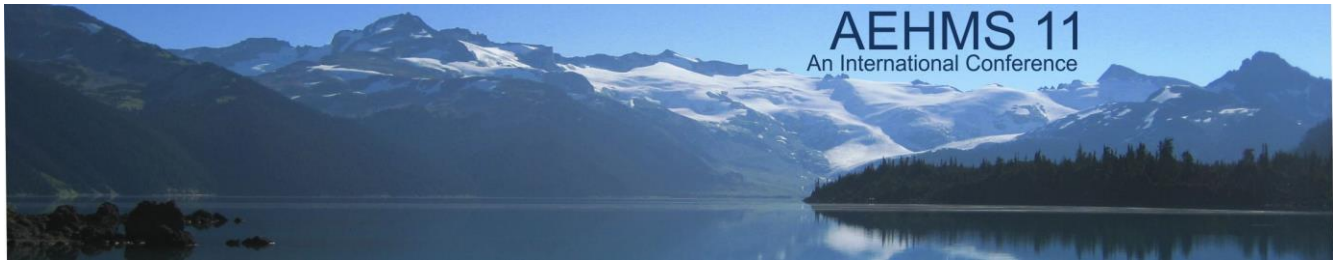
Data quality in crowdsourced citizen-science: a Digital Fishers case study

Web 2.0 citizen science, fuelled by the massive inflow and widespread availability of data from emerging scientific instruments, is increasing the scope of citizen science projects and the accessibility of science. These citizen science projects provide a rare platform to facilitate 2-way communication between scientists and the general public. Through the examination of the citizen science project Digital Fishers, we investigate barriers that limit the extent to which citizen science can be an effective tool for the scientific community.

Digital Fishers is a web 2.0 crowdsourcing citizen science initiative which creates a massive database on species abundances and their associated habitat through volunteer annotations of video data sourced from the Ocean Networks Canada arrays. Born of the need to filter increasing volumes of video data, Digital Fishers taps into the human ability to recognize objects and patterns far better than a computer software agent, at present.

In large scale collaborative taxonomic ventures, like Digital Fishers, the lack of training and expertise, and the diversity in data collectors represent a potential barrier to high data quality. Crowdsourcing tackles this data quality problem through the potential for multiple user annotations to converge toward consensus. Due to the nature of this large database, post-processing is necessary to determine where consensus emerged, prior to which the data cannot be easily interpreted by scientists.

Data quality issues inherent in Digital Fishers and a data analysis tool used to generate meaningful data are presented. This methodology has the potential to improve data quality in crowdsourced citizen-science.



S3.05

MALLEY, DIANE

PDK Projects, Inc., Canada

dmalley@pdkprojects.com

Determination of carbon, nitrogen and phosphorus in sediments and seston of Canadian lakes using near-infrared spectroscopy

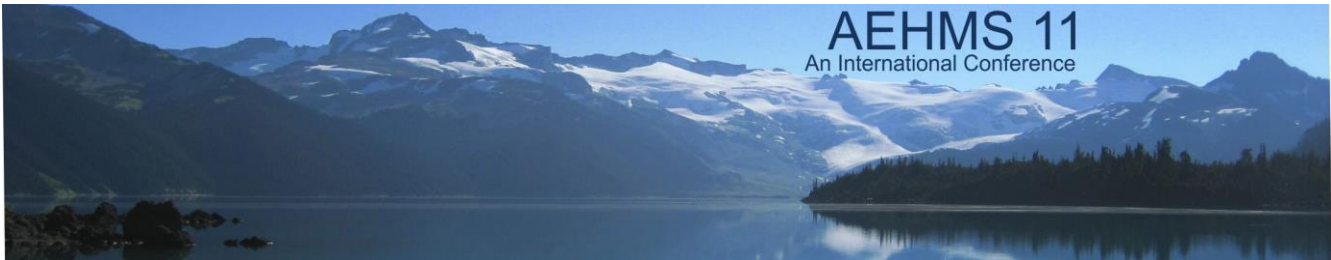
Carbon, nitrogen and phosphorus are determined in sediments and seston in lakes for a number of purposes including sediment quality assessment, identifying the trophic level of lakes, and in nutrient and contaminant studies. Analytical time and cost can be limiting factors in these studies. The use of near-infrared spectroscopy provides a rapid and cost-effective alternative following routine sample preparation.

Near-infrared spectroscopy (NIRS) combines applied spectroscopy and statistics. Calibration equations developed from spectral data and the results of conventional chemical analysis on an initial set of representative samples are used to predict constituents in future unknown samples of the same type.

Sediment cores were obtained from four lakes in Canada ranging in 190 degrees of latitude and 2000 times in area. Seston was sampled from two small oligotrophic lakes. Samples from sections of sediment cores were freeze-dried and homogenized. Seston was collected by filtering lake water through Whatman GF/C filters. Filters were then dried and samples were scanned on a Model 6500 visible/NIR spectrophotometer.

Trial calibrations were developed by modelling spectral data with and without transformation to first or second derivative. For the most successful calibrations for sediments from the four lakes combined, predicted and measured values had a linear regression relationship with r^2 of 0.99 for total C, 0.98 for inorganic C, 0.98 for organic C, 0.97 for N, and 0.70 for P. For seston, results were 0.98 for C, 0.99 for N, and 0.97 for P.

In summary, NIRS is a rapid, low-cost, non-chemical, non-destructive method for the analysis of C, N and P in freshwater sediment cores or seston.



S3.06

SHERRY, JAMES^{1*}, NEHELI, TANNIS¹, CRUMP, DOUG², KENNEDY, SEAN³

¹ Environment Canada, Water Science & Technology Directorate, Canada

² Environment Canada, National Wildlife Research Centre, Canada

³ Environment Canada, Canada

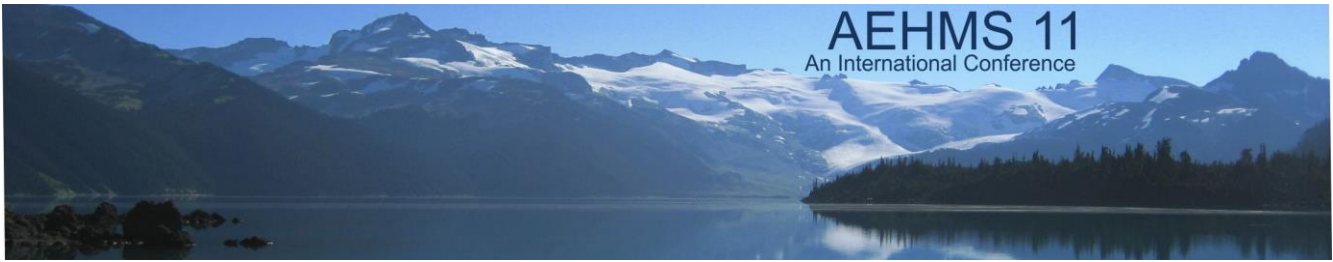
*jim.sherry@ec.gc.ca

Differential gene expression in Rainbow Trout (*Oncorhynchus mykiss*) exposed to Randle Reef sediment

Hamilton Harbour was designated an Area of Concern (AOC) by the International Joint Commission in 1985. For that reason, there is an ongoing Remedial Action Plan (RAP) to restore the harbour's beneficial uses.

Sediment in the Randle Reef (RR) area of Hamilton Harbour is highly contaminated with polycyclic aromatic hydrocarbons (PAHs) and heavy metals. The use of Fluorescent RNA Arbitrarily Primed Polymerase Chain Reaction (FRAP-PCR) to develop a molecular fingerprint in juvenile Rainbow Trout that were exposed to RR sediment was reported. FRAP-PCR enabled us to identify 42 unique genes that were differentially expressed in livers of fish exposed in the laboratory to RR sediment compared to fish exposed to Lake Ontario water.

A 20-gene subset, all of which were confirmed by qPCR, was selected as a fingerprint for use in the diagnosis of exposure to RR contaminants. CYP1A and Vtg, both of which are known to change expression upon exposure to PAHs, were up-regulated by exposure to RR sediment. Pathways analysis showed that exposure to RR sediment altered the expression of genes within multiple categories including cell adhesion, cell morphogenesis, DNA synthesis, and immune response. Pathways analysis also enabled us to explore links between the modulated transcripts and potential health effects. In the next phase we propose to use the diagnostic fingerprint to track the efficacy and progress of the proposed remediation of RR from the perspective of fish in the adjacent waters.



S3.07

LIU, FENFEN, TANG, SHILIN*, CHEN, CHUQUN

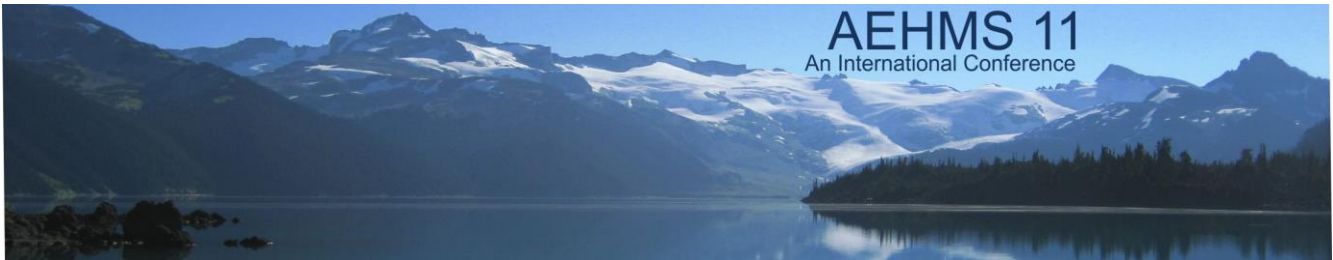
South China Sea Institute of Oceanology, Chinese Academy Of Sciences, P. R. China

*sltang@scsio.ac.cn

Mapping heavy metal zinc in the particulate phase from MERIS in the Pearl River Estuary

Marine heavy metals in the particulate phase are considered to be undetectable by remote sensing since their minor spectral signal is masked by marine optical constituents. However, over 80% of heavy metals adsorb to and complex with the suspended sediment and the quantity of adsorbed heavy metals strongly depends on suspended sediment load and size. Thus, the suspended sediment load and size could be useful information for estimating heavy metal levels through remote sensing techniques.

We investigated the potential to derive heavy metal concentration, using zinc as an example. Eight cruises in the Pearl River Estuary were carried out to measure zinc concentrations in the particulate phase (C_{zn}) and remote sensing reflectance (R_{rs}) data from 2009 to 2010. The relationship of R_{rs} ratio in the near infrared bands and the scattering spectral slope (which indicates particle size distribution (PSD)) was firstly proposed. According to a previously established suspended sediment algorithm for the study area and the newly proposed relationship of remote sensing reflectance and suspended sediment size, a piecewise algorithm was developed to retrieve C_{zn} . The algorithm was applied to MERIS full resolution data to obtain C_{zn} distribution in the Pearl River Estuary and was found mainly in the range from 10 to 63 $\mu\text{g l}^{-1}$, which is consistent with the in situ data ranges (5.67–86.62 $\mu\text{g l}^{-1}$).



S4.01

OWENS, PHILIP N.

University of Northern British Columbia, Canada

owensp@unbc.ca

The health and status of freshwater ecosystems in Canada: The role of science

Few would argue that freshwater resources and freshwater ecosystems are under increasing pressure from a range of threats, including climate change and the development of watersheds by society. We all have a role to play in trying to protect freshwaters.

Scientists – whether university academics and students, government researchers or engaged citizens – have a particularly important role through the provision of knowledge about the health and status of freshwater ecosystems. This talk will provide examples of existing initiatives, with particular emphasis on: (i) measurement and monitoring programs; and (ii) new tools and approaches. It will be demonstrated that such knowledge is crucial to our understanding of the systems that we are trying to protect. However, such knowledge is only part of the process; multi-level knowledge exchange is just as important. Examples that illustrate some of the exciting opportunities underway that are enabling scientific understanding to become meaningful and relevant to user groups who typically have been unaware of, or unable to access such knowledge, will be provided.



S4.02

NORDIN, RICK

University of Victoria, Canada

nordin@uofvic.ca

Stewardship and citizen science as a path to water management and protection

At a time when freshwater ecosystems are undergoing significant changes because of development pressures and climate change, government science presence is becoming less available. With less ability of government agencies to provide water quality and ecological monitoring, other options for protection and management of freshwater need to be considered.

Involvement by citizens in both the science and data gathering and in government policy direction and setting is becoming an option for many NGOs and local environmental groups. Case studies of successful initiation and implementation of watershed planning, water monitoring programs and policy changes are provided from case studies from British Columbia.



S4.03

KERNAN, MARTIN^{1*}, WHITEHEAD, PAUL²

¹ University College London, UK

² University of Oxford, UK

*m.kernan@ucl.ac.uk

Adaptive strategies to mitigate the impacts of climate change on European freshwater ecosystems - case studies from Europe

Development of a management tool-kit that will help water managers design cost-effective restoration and management programmes for freshwater ecosystems that will account for the projected future impacts of these changes is discussed. The main purpose of this is to support efforts to achieve and maintain compliance with the Water Framework Directive and Habitats Directive. It is being developed by the EU project REFRESH which considers how freshwater ecosystems in Europe will change over the next fifty years. REFRESH is generating the understanding and tools needed to implement an adaptive management approach and highlighting specific adaptive measures to minimise the deleterious impacts of global change.

Within REFRESH, gaps in understanding of how freshwater ecosystems respond to changes in the environment brought about by global change (e.g. temperature, flow regime, nutrient loading) are being addressed by bringing together results from field, laboratory and mesocosm experiments and analysis of existing databases.

The information generated by this work will feed into the development of the REFRESH modelling tool-kit, initially being developed in a number of case study catchments in the UK, Finland, Norway, Czech Republic and Greece. In each catchment REFRESH is;

- (i) generating scenarios of change over the next 50-60 years;
- (ii) assessing how projected change will affect the physical and chemical status of surface waters;
- (iii) identifying the ecological response driven by these changes;
- (iv) identifying where this is likely to cause problems reaching prescribed ecological targets (e.g. compliance with the WFD and HD);
- (v) modelling the response to management measures (in discussion with local stakeholders), adapted to accommodate future global change; and
- (vi) examining the cost effectiveness of the management response

Here results from the case study catchments and focus in more detail on one in particular, The Thames, to exemplify the approach are highlighted.



S4.04

BLYTHE, JESSICA^{1*}, FLAHERTY, MARK¹, MURRAY, GRANT²

¹ University of Victoria, Canada

² Vancouver Island University, Canada

*jessicalblythe@gmail.com

Uncertainty and risk: the case of the white spot virus in Mozambique

The emergence of the resilience perspective has focused attention on understanding the dynamics of social-ecological systems. Resilience thinking recognizes that periods of growth, stability and equilibrium only characterize a portion of systems' behaviour. Systems are also characterized by phases of surprise, novelty and collapse. Rather than trying to prevent these phases, resilience thinkers emphasize the importance of understanding and preparing for uncertainty and risk. The vulnerability of coupled human-environment systems was a central element of this dialogue.

In this paper, Turner et al.'s (2003) framework for vulnerability analysis in sustainability science to analyze the elements of vulnerability (exposure, sensitivity and adaptive capacity) of rural households in Mozambique was employed. Specifically, vulnerability of export-oriented shrimp farm employees and non-farm employees before and after the onset of the white spot virus in 2011 was analyzed. Findings indicated that employment at the shrimp farm facilitated higher adaptive capacity and lower vulnerability in rural households. However, the onset of the virus demonstrated that farm employees were highly vulnerable to surprise and collapse in the ecological components of their system.

This paper therefore argued that employment at the shrimp farm both increased and decreased household vulnerability and that future vulnerability research will need to account for these complexities.



S4.05

WATTS, PAUL¹, PAJARO, MARIVIC², MOAR, LARRY³, MALLEY, DIANE^{4*}

¹ Daluhay, Philippines & Canada

² Haribon, Philippines

³ Crane River Band, Canada

⁴ PDK Projects, Inc., Canada

*dmalley@pdkprojects.com

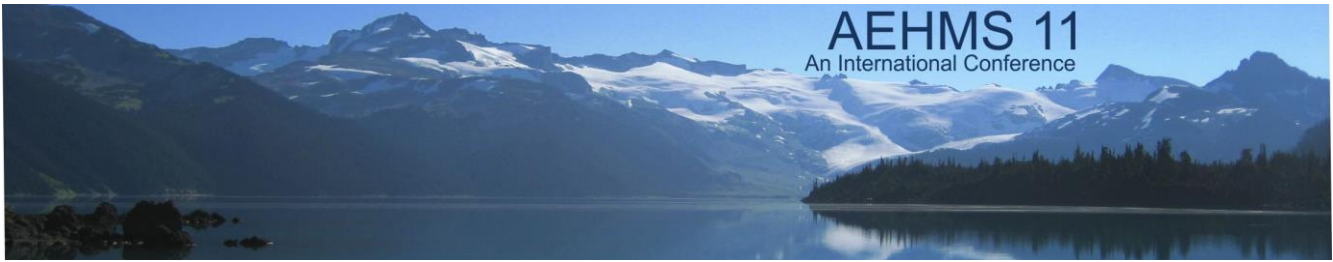
Building social process through paraprofessional ecohealth networks in the Philippines, the Canadian Arctic and the Lake Winnipeg Basin

Scientists are considered key role players in supporting the development of policy, both in Canada and globally. Governments utilize consulting scientists or their publications as a basis for developing laws/programs responsive to specific knowledge sets. However, the ongoing electronic revolution has significantly narrowed or eliminated the knowledge gap between societies and their governments.

Democratic action through voting is increasingly better informed on issues, while the process for specific changes often remains somewhat problematic. As well, scientific results are often shared through television or other traditional mass media and even more quickly through the internet. Although in general, academe remains globally focused on publications, there is an ever increasing need for the actions of experts to include action as a catalyst or facilitator through social-process.

Ecohealth is one example of a transdisciplinary lens, in this case professionals working with society, drawing upon any discipline, focused on the linkage between human health and environmental wellness. Ecohealth generally considers people as part of the environment or an ethnoecology approach. Transdisciplinarity and the concept's predecessor, Action Research, break with mainstream science in that the investigator is not seen as separate from the research or as an observer, but instead as a facilitator for collaborative goals. PAMANA, a Philippine group of fisherfolk Marine Protected Area Managers has been identified as a prototypical group of Paraprofessional Ecohealth Practitioners – networked nationally. The Philippine coastal situation and related development is compared to a process for the use of traditional ecological knowledge piloted in the Lake Winnipeg Basin and as well to aspects of Inuit indigenous rights related to an analysis of their dependence upon the marine environment in Canada.

Possible development barriers within the Canadian academic sector are examined as opportunities for change and professional leadership mitigation for aquatic systems on the edge.



S4.06

LATHAM, ERIN*, CROSS, STEVE

University of Victoria, Canada

*els.latham@gmail.com

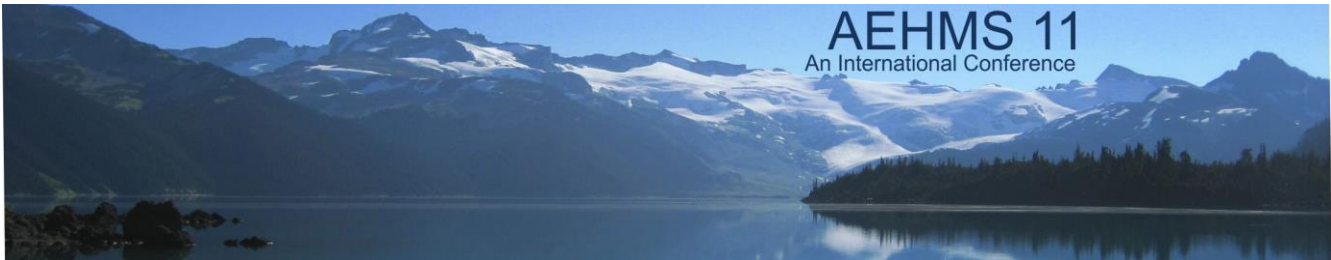
A forced model of adaptive management in British Columbia's aquaculture sector

Aquaculture now contributes over 50% of global seafood production. Canada's aquaculture industry has been its fastest growing industry in the last two decades. British Columbia (BC) is a significant contributor to Canada's overall production, but BC's past development and potential can only be understood through the Crown's relationship with First Nations. This research is preliminary and seeks to explore aquaculture development in a geographic context.

In the last decade, First Nations have been consulted on a site-by-site basis, and development of new finfish sites have occurred in areas where the local First Nation has allowed for them. Growth in the industry has resulted in efficiencies in production rather than expansion into new areas. Since the industry began in the 1980s, management and the industry have been forced to respond to opposition from local communities and environmental organizations, as well as recognition of Aboriginal rights and title.

Therefore, opposition has forced the industry towards an adaptive management approach, and currently the federal government is focusing on more effective governance.

First Nations is a significant actor in effectively forcing a sustainable model of operations in the industry that is unique to the top finfish producers in the global context. Long-term persistence of these industries in BC may be aided by policies that create space for First Nations self-determination in resource development.



S4.07

SHEENAN, LINDA

Earth Law Center, Fremont, California, USA

lsheehan@earthlaw.org

Ecosystem-Based governance

Our current suite of environmental protection laws are grounded in the assumption that economic growth can and must continue, and that the elements of the natural world are “resources” to be used to fuel that growth. Accordingly, while our environmental laws may slow the rate of environmental degradation, they cannot ultimately reverse it. Monetizing the environment to fit it within the contours of our economic system has recently been recommended as a new, more effective conservation strategy. Yet this approach also ignores the fact that we, and our human economic constructs, are part of an integrated whole with the natural world. We are neither separate from nor masters of the Earth, and our governance structures must reflect that fact to ensure environmental integrity.

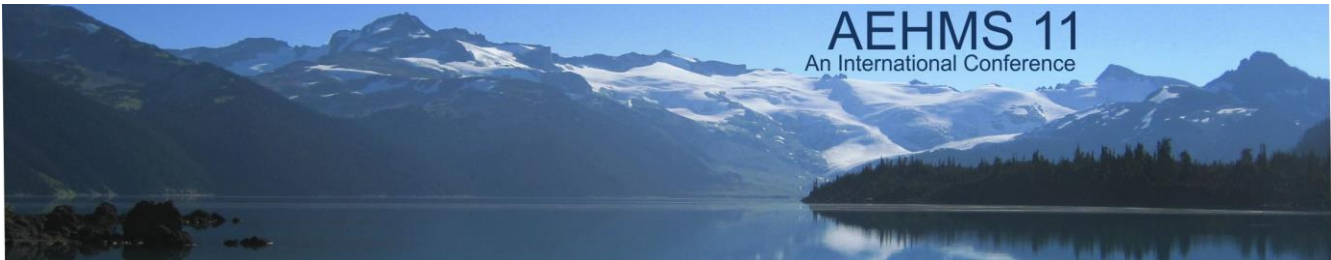
This presentation touches on the science of our interconnectedness with the natural world, illustrates the ways in which our current legal and economic systems act contrary to science, and posits alternative legal and economic structures that would govern human behavior in a manner consistent with modern ecological science and systems theory. It will particularly address recognition in law of the rights of nature to exist, flourish and evolve as an essential tool to ensure thriving, interconnected communities of humans and nature.



Abstracts

Poster Presentations

Given in order of presentation



P.01

ROLLWAGEN-BOLLENS, GRETCHEN, BOLLENS, STEPHEN*, BOYER, JENNIFER, LEE, TAMMY, ZIMMERMAN, JULIE, EMERSON, JOSH

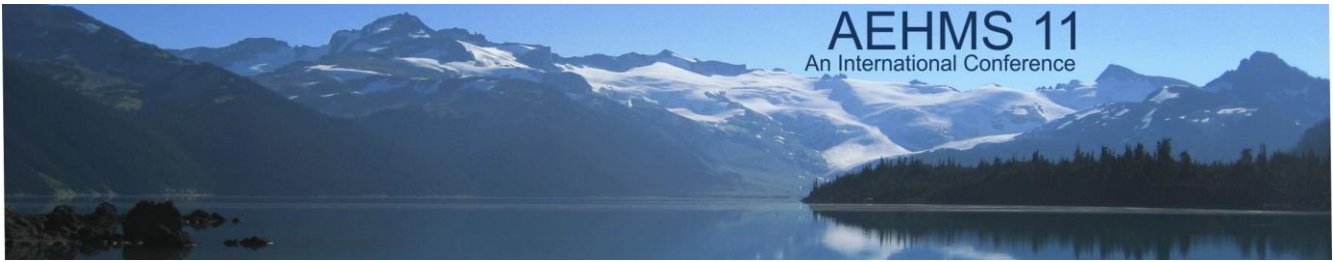
School of the Environment, Washington State University, USA

*sbollens@vancouver.wsu.edu

Assessing the role of zooplankton grazing on the development and decline of harmful cyanobacteria blooms in a tidally-influenced floodplain lake (Vancouver Lake, WA, USA)

Since 2007, the factors that influence the development of intense seasonal cyanobacteria blooms in Vancouver Lake – a large, tidally-influenced shallow lake in the lower Columbia River flood plain in Washington State, USA have been investigated.

Over two complete bloom cycles (May – October) in 2008 and 2009, bi-weekly dilution experiments and grazer incubation experiments to concurrently measure cyanobacteria/algal growth rates, microzooplankton (ciliates, dinoflagellates) community grazing rates, and mesozooplankton (copepod and cladoceran) clearance and ingestion rates were conducted. From April to June of both years, algal/cyanobacterial growth rates were maximal and microzooplankton grazing rates were relatively low. By contrast, from mid-June to mid-July (immediately preceding each year’s cyanobacteria bloom), both algal growth rates and microzooplankton grazing rates were often negative, suggesting a “trophic cascading” effect may have led to conditions which promoted rapid cyanobacteria growth. Algal growth rates rapidly increased back to maximal rates after the cyanobacteria bloom began, and remained high during the bloom from late July to early September. However grazing rates of both microzooplankton and copepods also increased markedly as the bloom progressed, such that by September/October of 2008 and 2009 grazing rates were approximately equal to algal growth rates. This suggests grazers may have contributed to the rapid decline in cyanobacteria abundance, and demonstrates that zooplankton grazing may play an important role in the overall development and decline of cyanobacteria blooms.



P.02

BRINGUE, MANUEL^{1*}, POSPELOVA, VERA¹, PAK, DOROTHY²

¹ School of Earth and Ocean Sciences, University of Victoria, Canada

² Marine Science Institute, University of California at Santa Barbara, USA

*mbringue@uvic.ca

Seasonal variations of dinoflagellate cyst production in the Santa Barbara Basin: records of coastal upwelling and harmful algal blooms

Seasonal variations in dinoflagellate cyst fluxes and assemblage composition were investigated for the first time on the west coast of the United States of America. The palynological content of a ~ two year-long (May 1995 to March 1997) fortnightly sediment trap time series from the Santa Barbara Basin (SBB, off Southern California), a region characterized by seasonal upwelling and high levels of primary productivity, was analyzed.

A total of 47 dinoflagellate cyst taxa were identified in the trap samples, with assemblages dominated by cysts produced by heterotrophic taxa. Multivariate analyses supported that dinoflagellate cyst fluxes and assemblages were reliable indicators of primary productivity, and reflected sea surface temperature (SST) variations associated with upwelling in the SBB. In particular, *Brigantedinium* spp. were associated with active upwelling intervals (fluxes up to 127,430 cysts m⁻² day⁻¹ and up to 86.6% of the assemblage); when SST is lower, stratification was weaker and diatom production was maximal. Conversely, *Lingulodinium machaerophorum* indicated relaxed upwelling conditions (up to 9,640 cysts m⁻² day⁻¹ and 29.9% of the assemblage) characterized by higher SST, stronger stratification and reduced primary productivity. *Selenopemphix undulata* was associated with colder SST in the region, whereas cyst type A abundances increased with higher SST. Thecae of potentially toxic dinoflagellates were also documented, such as *Lingulodinium polyedrum* and *Prorocentrum micans*, which were mainly recorded under conditions of higher SST and strong stratification, and *Dinophysis* spp. with higher fluxes between June and September of both 1995 and 1996.



P.03

DEL BEL BELLUZ, JUSTIN^{1*}, COSTA, MAYCIRA¹, CROSS, STEPHEN¹, REID, GREGOR²

¹ University of Victoria, Canada

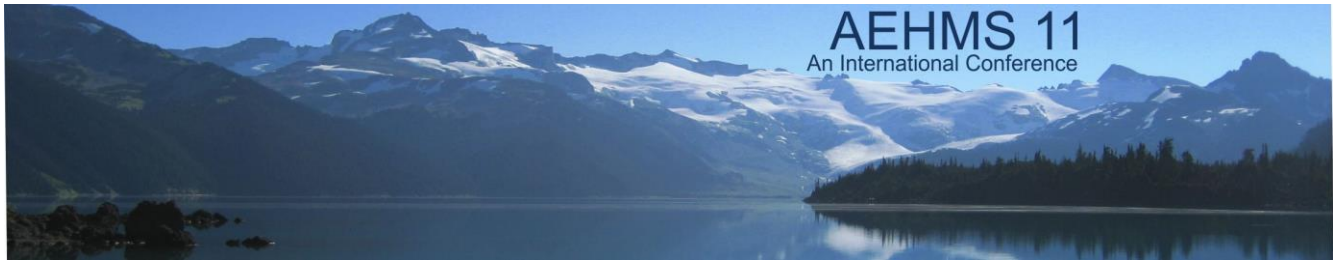
² St. Andrews Biological Station, Fisheries and Oceans Canada, Canada

*jdelbel@uvic.ca

Spatial and temporal optical characterization of the particulate plume dispersing from the fed components at an Integrated Multi-Trophic Aquaculture system in Kyuquot Sound, British Columbia

Integrated Multi-Trophic Aquaculture (IMTA) systems work to mitigate many negative environmental effects caused by traditional finfish aquaculture through the use of unfed species (bivalves and macrophytes) for waste extraction from fed components (fish) of the system. In order for these secondary species to effectively assimilate the fish derived particulate wastes, a great deal of knowledge is needed about their properties and dispersion through the water column. Optical oceanographic parameters may be useful tools for gaining a greater understanding of these particulate wastes. Thus, the objective of this research is to use in situ optical oceanographic methods to characterize the particulate wastes dispersing from the fish cages at an operational IMTA site.

Four data collections were conducted at the SEALabs Inc. IMTA site in Kyuquot Sound, British Columbia. Optical data were collected with a WETLabs ac-s meter and ECO backscatter sensor, and a Satlantic ISUS V4 Nitrate sensor. Analysis of these data showed increases of 0.30 m^{-1} in bp (660 nm) (particulate scattering, a proxy for particulate concentrations) within the fish cages between pre and post feeding casts. Data collected directly outside of the cages showed no similar increases, indicating little or no outward movement by the wasted feed particulates. Additionally, slight increases (0.06 m^{-1}) in bp (660 nm) were observed within the cages between 5-10 m depth at 3, 4, and 5 hours post feeding. Similar increases were seen below and directly down-current of the cages at 4 and 5 hours post feeding. These increases were likely due to the release of feces by the fish and its precipitation downwards and out of the cages. Further analysis of these data will provide more detailed information on the particulates being released from the fish at the studied IMTA site which will be extremely useful for future management decisions.



P.04

EL-SEREHY, HAMED^{1*}, AL-MISNED, FAHAD¹, AL-RASHEID, KHALED¹, SHAFIK, HESHAM², QURAIISHI, SALEH¹, BAHGAT, MAGDY³, AL-FARRAJ, SALEH¹

¹ King Saud University, Saudi Arabia

² Suez Canal University, Egypt

³ Port Said University, Egypt

*helserehy@ksu.edu.sa

Abundance and diversity of surface microplankton at the Bitter Lake: a hyper saline lake on the Suez Canal, Egypt

This study reports the microplankters found occurring in the surface water of the lake at monthly intervals from November 2005 until November 2006. A total of 130 taxa and species were identified, among which 67 taxa were of Bacillariophyceae, 15 Dinophyceae, 11 Chlorophyceae, 11 Cyanophyceae, 1 Euglenophyceae, 18 Tintinnidae, 4 Foraminiferidae, as well as 3 taxa of Rotifera. Species diversity, numerical abundances and dynamics were analysed for each taxon at three sites inside the Bitter Lake.

At each of these sites Bacillariophyceae were predominant in the standing crop, forming some 67.2 % of the total microplankton community with an average of 11594 ind. l⁻¹. The Dinophyceae occupied the second rank constituting about 16.5 % of the total microplankton. Seasonally, the main peak of microplankton abundance started in spring with maximum values being attained in late summer and early autumn (August), with an average of 37498 ind. l⁻¹, while January was characterized by the lowest density (9251 ind. l⁻¹).

Relatively higher diversity values were recorded at the northern part of the lake and a progressive decline in diversity was observed southward. Nutrient concentrations in the lake waters were very low, with silicate varying between 0.52-1.34 $\mu\text{mol l}^{-1}$, phosphate between 0.14 and 0.55 $\mu\text{mol l}^{-1}$ and nitrate between 0.82-3.16 $\mu\text{mol l}^{-1}$. Moreover, chlorophyll *a* fluctuated between 0.4 and 0.89 $\mu\text{g l}^{-1}$. This data from microplankton analyses, nutrient and chlorophyll *a* measurements was used to assess the ecosystem health of the "Bitter Lake", and it was concluded from this data, that the northern part of the lake (i.e. the "Great Bitter Lake") can be classified as oligotrophic, while the southern part (the "Little Bitter Lake") is ultraoligotrophic.



P.05

MUNAWAR, MOHIUDDIN, FITZPATRICK, MARK*, NIBLOCK, HEATHER, ROZON, ROBIN, LORIMER, JENNIFER

Fisheries & Oceans Canada, Canada

*mark.fitzpatrick@dfo-mpo.gc.ca

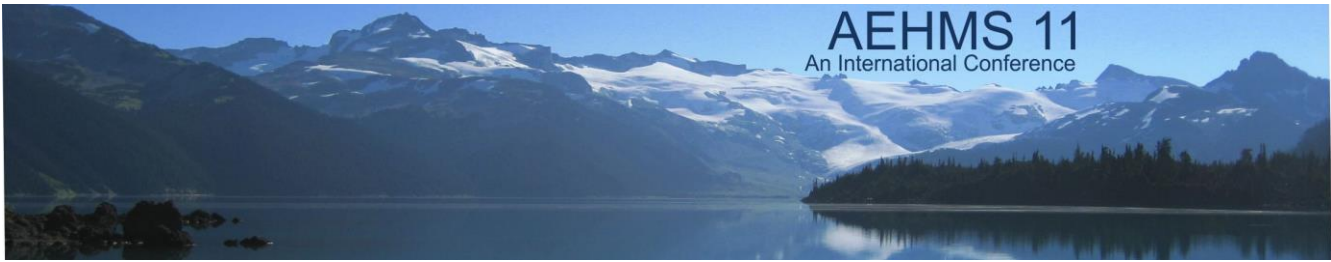
Assessing Great Lakes phytoplankton community composition: Comparison of microscopic and fluorometric techniques

Phytoplankton form the base of aquatic foodwebs and are the most important parameter generating energy for transfer to higher trophic levels. Understanding the structure of the phytoplankton community and in particular its species composition is an essential step towards understanding biodiversity, foodweb linkages and dynamics.

Traditionally, species and size composition of phytoplankton have been obtained through standard inverted microscopy which is time consuming and requires qualified taxonomists with long term experience. Consequently, the trend has been to rely on pigment analysis (especially chlorophyll *a*), as a proxy for the algal standing crop which is measured quickly. Recently, a variety of multi-spectra fluorometers have been developed to classify phytoplankton according to pigment groups which have the advantage of offering nearly instantaneous data. The question is, how reliable are fluorometric-based pigment class assessments when compared to standard microscopic identification and enumeration data?

In the North American Great Lakes, Fisheries & Oceans Canada began comprehensive assessments of phytoplankton species composition and biomass over 35 years ago and has consistently followed the standard Utermöhl inverted microscope technique. Recently, we have begun deploying an in situ multi-spectra fluorometer in our research and monitoring efforts.

In this paper, we consider examples from both a highly stressed eutrophic ecosystem (Hamilton Harbour, Lake Ontario) and a largely pristine, ultra oligotrophic environment (Lake Superior) and directly compare the pigment classes assigned by the fluorometer to the comprehensive species assessments performed by a highly skilled taxonomist. Our results suggest that extreme caution is required when interpreting fluorometric algal class data and that further comparisons with standard microscopy are warranted.



P.06

GILPIN, CHERYL^{1*}, VON ZHAREN, WYNDLYN¹, WORMUTH, JOHN¹, THORNTON, DAN¹, GULLEN, GEORGE², CARTY, SUSAN³

¹Oceanography Texas A&M,

²Environmental Science University of Houston Clear Lake

³Biology Heidelberg University

*seacheyl@gmail.com

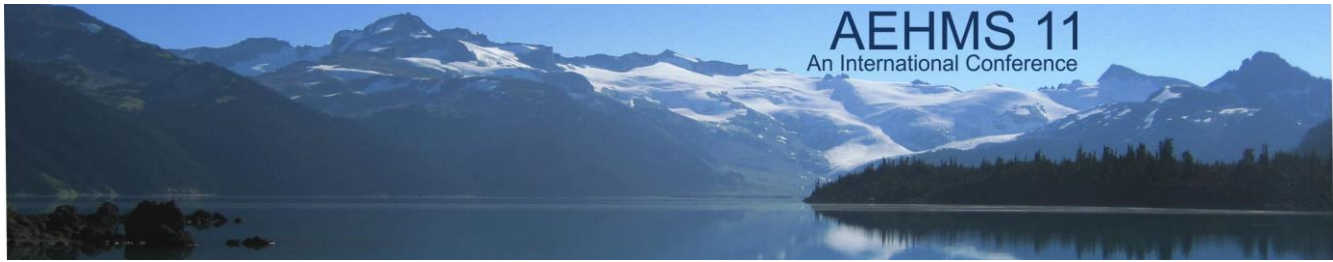
Diel temperature and dissolved oxygen patterns inside and outside of sites with planktonic life stage of *Thompsodinium intermedium* in Comal Springs, Texas, summer 2011

During a period of low springflow in summer 2011, late afternoon and early morning measurements of dissolved oxygen and temperature and presence of dinoflagellate blooms were monitored to determine if increases in frequency and intensity of hypoxia and hyperthermia occurred inside sites with afternoon bloom events in Comal Springs, Texas. Significant differences in diel fluctuations were found in all of these parameters between sites, with and without the blooms.

In karst springruns, spatial and temporal patterns of freshwater dinoflagellates and their interactions with physical, chemical and biological parameters had not been previously investigated. This new karst spring location, Comal Springs, which is also a critical habitat of endangered species, was discovered for a rare freshwater dinoflagellate species *T. intermedium*. Its planktonic form recurred during periods of low springflows and extreme temperature between July 2009 and October of 2011. Late-afternoon blooms changed from benthic to planktonic for 2-3 hours over a period of several weeks to months. Arrays of in situ continuous monitoring temperature/light probes were used inside and outside of blooms which revealed that daily vertical stratification events in the shallow springrun were occurring simultaneously with the planktonic bloom events. Within the blooms, temperature and dissolved oxygen exceeded the tolerance ranges for endangered species more often and severely than outside the bloom.

Bloom presence should be considered a stressor for endangered species. Stratification occurring in daily cycles could be avoided with temperature buffering from adequate flow of colder deeper groundwater. The springflows that occurred in summer would make managing the water quality in the spring run difficult for avoiding harmful conditions for endangered species. A higher rate of colder springflow must therefore be the goal of regional pumping management and modeling to buffer against short term fluctuations in temperature which cause daily stratification events and trigger daily planktonic dinoflagellate lifestage transitions in the Comal Springs habitat.

Prediction and modeling of dinoflagellate blooms in the ocean on large scales has been difficult; however patterns and relationships established at smaller scales may be helpful in determining bloom dynamics in coastal waters. Hypoxia and hyperthermia are known to promote harmful microbes. Improved monitoring and modeling is needed for better management of anthropogenic practices in order to minimize the occurrence of dinoflagellate blooms from springs to coastal bays in order to best protect wildlife and human health.



P.07

GROSS, JACKSON^{1*}, WAGNER, TRISTANY¹, WILMOTH, SIRI², SHIELDS, PATRICK³, FOX, JEFFREY³

¹ Smith-Root, United States

² Wilmoth Statistical Consulting, United States

³ Alaska Department of Fish & Game, United States

*jgross@smith-root.com

The effects of pulse pressure from seismic water gun technology on Northern Pike

We examined the efficacy of sound pressure pulses generated from a water gun for controlling invasive Northern Pike (*Esox lucius*) populations in south central Alaska. Two pulse pressures from two sizes of water guns were evaluated on individual fish placed at a predetermined distance. Fish mortality from a 5620.8cm³ water gun (source level: 252 dB ref 1uP @ 1 m) was assessed every 24 hours for 168 hours, and damage to the gas bladder, kidney, and liver was recorded. The experiment was replicated using a 1,966.4 cm³ chamber water gun (source level: 244 dB ref 1uP @ 1 m, but fish were euthanized immediately following exposure). The sound pressure levels, peak and peak-to-peak (SPL_{peak}, SPL_{p-p}) were recorded during each experiment, and cumulative sound exposure level (SEL_{cum}) was subsequently calculated. SPL_{peak}, SPL_{p-p}, and SEL_{cum} were correlated and values varied significantly by treatment group for both guns.

Mortality increased and organ damage was greater with decreasing distance to the water gun. Mortality (31%) by 168 h was only observed for Northern Pike exhibiting the highest organ damage. Mortality was associated with increasing SEL_{cum} above 195 dB at 72 h and 168 h. The minimum SEL_{cum} calculated for gas bladder rupture from the 5620.8 cm³ water gun was 198.8 dB recorded at 9 m, and the minimum calculated SEL_{cum} for gas bladder rupture from the 1966.4 cm³ water gun was 193.7 dB recorded at 6 m.

One hundred percent of gas bladders exposed to the large water gun were ruptured at 3 and 6 m, and 86% of gas bladders were ruptured at 9 m. Seventy-eight percent of all gas bladders were ruptured when exposed to pulse pressures from the smaller gun.

Results from these initial controlled experiments underscore the potential of water guns as a potential tool for controlling Northern Pike.



P.08

PAWLUK, KYLEE*, CROSS, STEPHEN

University of Victoria, Canada

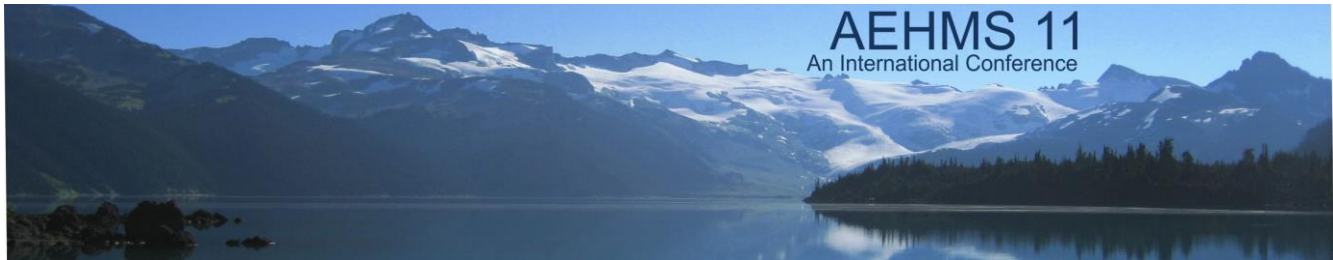
*kpawluk@uvic.ca

Impacts and interaction: the role of two introduced seaweeds in Baynes Sound, British Columbia

Marine invasive species are thought to be one of the leading causes of native species loss. While invasive predators are thought to have the greatest impact on extinction of native species, introduced foundation species, such as seaweeds, can both decrease abundance of native species and increase associated epifauna.

Assessing the impacts of introduced foundation species can be difficult due to their bi-directional impacts and the fact that they are relatively understudied. One of the few methods to determine the impacts of introduced foundation species is long term removal experiments and observation of the restructuring of the community. However, to this point only one foundation species has been observed at a time. With increasing connectivity, habitats are being invaded by multiple species increasing the potential for one invasive species to facilitate the invasion of a second. In Baynes Sound two introduced seaweeds, *Sargassum muticum* and *Mazzaella japonica*, overlap in their growing range in some areas and not in others. This provided the opportunity to assess: 1) the impact of these two species on native communities individually and in tandem and 2) whether there is evidence for facilitation of multiple introduced species.

Preliminary results from a long term removal experiment comparing: introduced and native plant densities, motile invertebrate densities, and abiotic factors such as temperature and light conductance will be discussed, as will implications for native seaweed communities and changes in basal members of the food chains.



P.09

RAHMAN, M. AMINUR

Laboratory of Marine Biotechnology, Institute of Bioscience, Universiti Putra Malaysia, 43400 UPM Serdang, Selangor, Malaysia

aminur1963@gmail.com

Captive breeding and seed production of the endangered Giant River Catfish, *Sperata seenghala* (Skyles) for species conservation and aquaculture production

The Giant River Catfish *Sperata seenghala*, locally known as “Guizza Air” has significant aquacultural and conservational values. However, this fish is considered to be critically endangered. To conserve the species from extinction, an experiment was undertaken to develop a suitable technique for breeding and seed production of Guizza in a controlled rearing system.

Nine ponds, each covering an area of 0.012 ha and with a depth of 0.8 m were used for the experiment. Three different treatments were evaluated at varying stocking densities with three replications per each. Fry produced from natural propagation of Guizza stocked at 100,000 ha⁻¹ was defined as treatment-1 (T1), 150,000 ha⁻¹ as treatment-2 (T2) and 200,000 ha⁻¹ as treatment-3 (T3). At stocking, all fry were of the same age, with mean length and weight of 1.74±0.27 cm and 0.20±0.03 g, respectively. Fry in the experimental ponds were reared with SABINCO nursery feed for the first 14 days and starter-I for days 15 to 56. The physico-chemical parameters and plankton population of ponds were within suitable range for fish culture.

Growth (final weight, final length, weight gain, length gain and specific growth rate) and survival of fingerlings were significantly higher ($P<0.05$) in T1 than that in T2 and T3, respectively. Feed conversion rate was significantly lower in T1 and increased from T2 to T3. A significantly higher number of fingerlings were produced in T3 followed by T2 and T1. Despite this, consistently higher net benefits were obtained from T1 than from T2 and T3. Therefore, of the three stocking densities, 100,000 fry ha⁻¹ appeared to be the most suitable for rearing of *S. seenghala* fingerlings for 8 weeks in nursery ponds.

These results represent the first successful attempt to produce quality seeds from a highly endangered catfish under captive rearing conditions.



P.10

RESHITNYK, LUBA*, ROBINSON, CLIFF, DEARDEN, PHIL

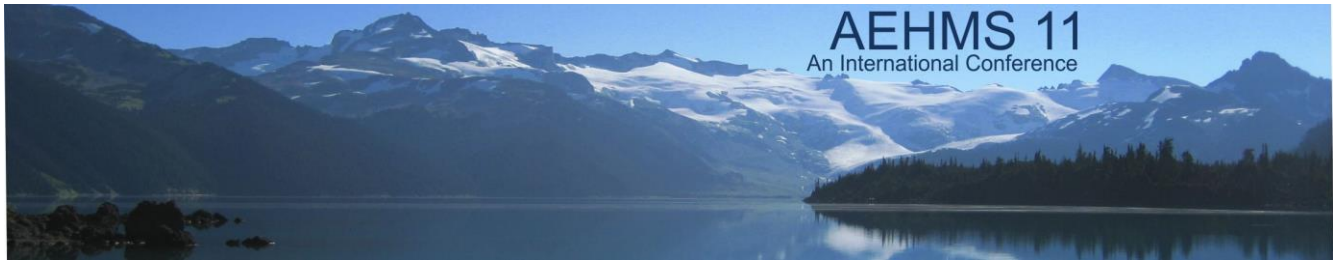
University of Victoria, Canada

*lresh016@uvic.ca

Remote sensing of nearshore marine habitats using single beam echo sounders - 50 kHz or 200 kHz?

The QTC VIEW 5 acoustic seabed classification system was used in the Gwaii Haanas National Marine Conservation Area Reserve and Haida Heritage Site to map benthic habitats. With 1700 km of coastline and a mandate to produce a zoning management plan for its coastal waters, nearshore mapping of marine habitats is currently a top science priority for informing park policy makers. In light of this need, remote sensing has been identified as a potential mapping tool for efficient data collection.

Acoustic data were obtained through two successive surveys, each conducted with one of the following echo sounder frequencies: 50 kHz or 200 kHz. Ground truth data consisted of towed underwater video recordings. The performance of each survey frequency for the identification of marine vegetated habitats was analyzed. The surveys were conducted in depths from 1-20m. The acoustic data obtained at two different frequencies were, individually, submitted to manual clustering and 6 and 10 classes were obtained for the 50 kHz and 200 kHz, respectively. Acoustic classes were then assigned to a habitat class using a subset of ground truth data. Accuracy assessment of the habitat maps was performed using a confusion matrix. Overall, the 200 kHz dataset was better at discerning vegetated habitat (eelgrass and red algae) with an overall accuracy of 60% compared to 40% for 50 kHz data. Neither dataset was able to discern intertidal vegetated habitats (*Ulva* sp. and *Fucus* sp.).



P.11

SIMMONS, DENINA¹, MCMASTER, MARK¹, REINER, ERIC², HEWITT, MARK¹, PARROTT, JOANNE¹, PART, BRAD³, BROWN, SCOTT⁴, SHERRY, JAMES^{1*}

¹ Environment Canada, Water Science & Technology Directorate, Canada

² Laboratory Services Branch, Ontario Ministry of the Environment, Canada

³ Freshwater Institute, Fisheries and Oceans Canada, Canada

⁴ Posthumous

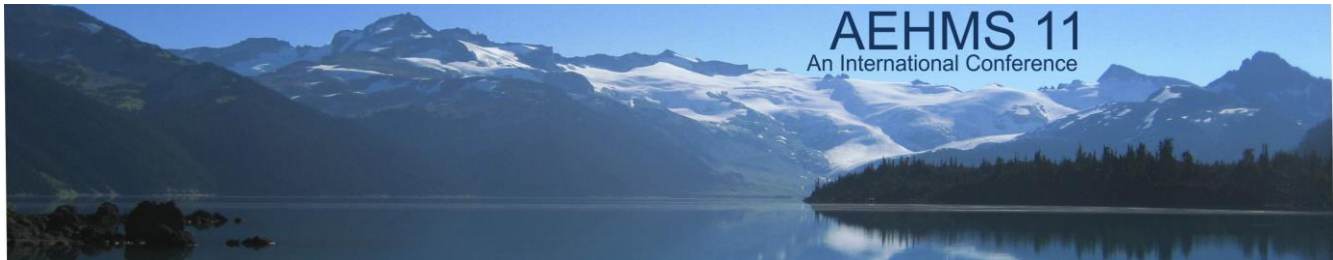
*jim.sherry@ec.gc.ca

Wild fish from the Bay of Quinte Area of Concern contain elevated tissue concentrations of PCBs and exhibit evidence of endocrine-related health effects

The Bay of Quinte (BOQ) is designated an Area of Concern by the International Joint Commission under the Great Lakes Water Quality Agreement. Adult Yellow Perch (*Perca flavescens*) and Brown Bullhead (*Ameiurus nebulosus*) were sampled from Trenton, Belleville, and Deseronto (reference site) in the BOQ.

A suite of hormone assays and various measures of exposure and/or sublethal health effects were used to assess the health status of fish of both species and sex. Condition factor, hepatosomatic index, ethoxyresorufin-O-deethylase activity, circulating levels of steroid and thyroid hormones, thyroid activation, oocyte size distribution, spermatogenic cell stages, and plasma vitellogenin were among the endpoints that were significantly affected by sampling location. Many of those effects corresponded with significantly greater tissue concentrations of polychlorinated biphenyls (PCBs) at Belleville and Trenton. The PCB concentrations at Belleville and Trenton were also above Canadian tissue residue guidelines for consumption by wildlife. Hepatic extracts from Brown Bullhead sampled from Trenton had significantly greater binding activity to the androgen receptor and sex steroid binding protein.

Taken together, these data and preliminary data from a concomitant study suggest that PCBs are likely being hydroxylated in vivo, resulting in enhanced bioactivity at endocrine receptors and measurable health responses. We recommend the continued monitoring of tissue PCB concentrations and of the endocrine health status of fish in the BOQ Area of Concern.



P.12

STEWART-MALONE, ALECIA^{1*}, MISAMORE, MIKE², WONG, DAVID³, GROSS, JACKSON¹, WILMOTH, SIRI⁴

¹ Smith-Root, Inc., United States

² Texas Christian University, United States

³ University of Nevada-Las Vegas, United States

⁴ United States

*amalone@smith-root.com

The effect of UV-C on larval survival of the Quagga Mussel

First introduced to the Great Lakes from Ukraine, Quagga Mussels (*Dreissena rostriformis bugensis*) have thrived and spread throughout North America. Since their first introduction into the Midwest, Quagga Mussels have begun to overtake the equally invasive Zebra Mussel and have since spread west of the Rocky Mountains. The Pacific Northwest is at risk for subsequent invasion from either the Great Lakes region or the lower Colorado River.

The presence of mussels has caused costly damage to hydropower and a dramatic shift in foodweb dynamics. At such a high filtration rate, mussels can consume high amounts of phytoplankton, limiting the amount available for organisms such as zooplankton and predator fish. Current strategies for mitigating the growth and spread of Quagga Mussels include physical and chemical means of removing adults, but they negate other stages within the life history and are oftentimes costly and labor intensive.

In the present study, germicidal ultraviolet light (UV-C) was used to target the free swimming larval stage of mussel development and its effectiveness in causing mortality was evaluated at four different fluence levels, 0, 13.1, 26.2, and 79.6 mJ cm⁻². This, to our knowledge was the first dose response study on Quagga Mussels exposed to UV radiation and it was demonstrated that with a fluence as low as 13.1 mJ/cm², survival of pre-settlement stage larvae could be reduced by 50% after 7 d post exposure.



P.13

DU PREEZ, CHERISSE, TUNNICLIFFE, VERENA*

University of Victoria, Canada

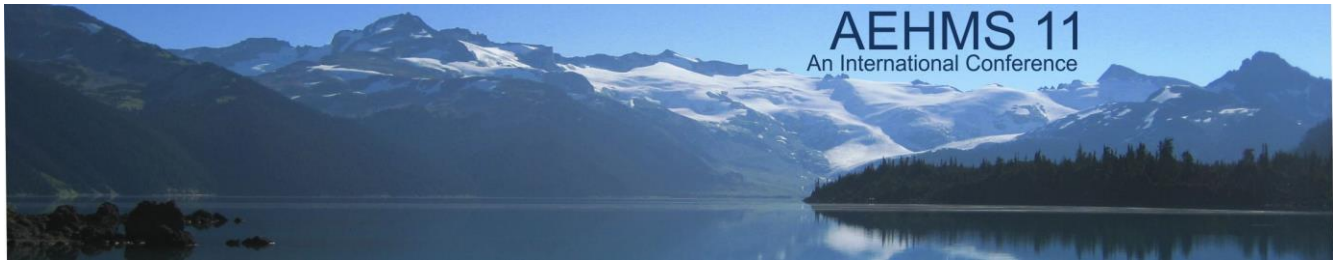
*verenat@uvic.ca

Can we estimate deep-sea benthic biodiversity from ship-based multibeam sonar?

Marine biodiversity is an index of ocean health and stability of ecosystem services, and is a parameter often considered in conservation decisions for marine ecosystems. Marine biodiversity studies usually occur in easily accessible ecosystems (e.g. the intertidal, coral reefs, mangroves) and, owing to sampling limitations and cost, there is a general lack of comprehensive biodiversity data for deeper ecosystems.

Anthropogenic impacts continue to extend into the ocean depths and so baseline information, such as the locations of biodiversity hotspots, is increasingly important. Extensive biological sampling to collect such data for deep ecosystems is logistically problematic but predicting biodiversity through habitat mapping by large-scale remote sensing is an emerging methodology. Ship-based multibeam sonar is one such potential approach and previous studies have successfully used multibeam data to relate various biological and physical seafloor parameters. At its most basic, multibeam sonar returns bathymetry (depth) data, which can be analysed in GIS programs to derive various multi-scale terrain parameters (e.g. slope, aspect, roughness indices).

In this study, the relation between multi-scale terrain parameters and biodiversity of seafloor megafauna (>5 cm) in a continental shelf environment in northern British Columbia, Canada was assessed. Our study site, Learmonth Bank, is a submarine glacial feature and a variety of deep-sea ecosystems were examined, ranging 500-50 m depth, and included: submarine banks of exposed bedrock, rocky aggregations, and sandy basins. A 5 m² grid bathymetric map of the study area and annotated our biological data from seafloor imagery collected by remotely operated vehicles (ROVs) was processed. The study examined the extent to which remote sensing can predict biodiversity and examines which measurable parameters are most relevant. Furthermore, we developed a new method of calculating the terrain parameter rugosity (roughness) and explained why previous, popular methods are unintentionally confounded by slope, a separate terrain parameter.



P.14

DOYA LE BESNERAIS, CAROLINA¹, AGUZZI, JACOPO¹, COMPANY, JOAN BAPTISTA¹, TUNNICLIFFE, VERENA^{2*}

¹Institute of Marine Sciences-Spanish National Research Council, Spain

²University of Victoria, Canada

*verenat@uvic.ca

A preliminary study on the effect of earthquakes in abundances of Flatfish, Ghost Shrimps and Squat Lobsters on Saanish Inlet

Seismic activity may alter the behaviour of benthic species in a-to-date still not yet described manner. In this study, the behaviour of different benthic species by video-imaging at the VENUS cabled subsea network (Saanich Inlet, on the west coast of Canada) located at 96 m depth prior and after two major seismic events was monitored. These occurred in the Gulf of Alaska (12 and 28 of October of the 2012 with a magnitude of 6.4 and 7.7, respectively) were detected in the VENUS area.

The aim of this study was to examine the interplay between day-night and internal tidal cycles and two earthquakes occurring in this period in regulating the abundances of Flatfish, the range of emergence of the Ghost Shrimp (*Callianassidae* sp.) and the abundances of Squat Lobsters (*Munida quadrispina*) situated both in the mud and on a big sponge. Photographs of the same two adjacent seabed areas (approx. 5 m²) were taken with a remotely-controlled HD camera every 30 minutes during two month (from 29th October 2012 to 29th December 2012). Instruments located on a near-by platform provided high-resolution measurements of environmental variables. Fluctuations in visual counts for the different species were firstly plotted, and then screened in one-week length sub-segments by Chi-square periodogram analysis, in order to assess the behavioural response of species to day-night and internal tidal cycles or the stochastic seismic events.

Preliminary results showed that species presented different abundances in a period of constantly low oxygen concentration, which is known to modulate the ecology of Saanich Inlet. Taxa presented day-night and internal tidal periodicities of different strength. In some cases, a drop in the abundances after the seismic event was reported (i.e. the Ghost Shrimp, *Callianassidae* sp. and the Squat Lobster, *Munida quadrispina*).



P.15

WAGNER, TRISTANY^{1*}, GROSS, JACKSON¹, CARLSON, TOM²

¹Smith-Root, United States

²United States

*twagner@smith-root.com

Impulsive sound as an invasive aquatic species suppression strategy

Control of aquatic nuisance or invasive species has high economic and ecological value. The use of continuous and impulsive sounds to cost effectively manage nuisance fish species to the benefit of indigenous species or to solve a condition impacting an industrial activity is being developed.

Sound is an attractive alternative to the use of chemicals and similar approaches that can be difficult to control and can persistent in the environment. Studies have been conducted to determine the effects of sound energy technologies on both invasive and native fishes. Initial studies of the exposure of species including Cutthroat Trout, Northern Pike, Asian Carp and Pallid Sturgeon to various sounds have provided valuable information aiding design of invasive species control measures. The investigative approach focuses on: identification of lethal exposure levels or behavioral response thresholds, the design of sound production devices that can produce the required sound at levels with characteristics found to be effective, and the development of control treatment strategies that optimize effectiveness.

This research differs from the traditional goals to identify exposure thresholds that are safe for identified species, to inform regulatory measures, and with the design of mitigation to protect exposed animals. Recently completed management actions have resulted in the successful clearing of Asian Carp with water guns operated effectively in the Chicago Sanitary and Shipping Canal. Extensions of sound based measures found effective to modify the behavior of alosids are being investigated both alone and integrated with other technologies to affect the behavior of additional fish species.



P.16

WONG, CECILIA^{1*}, RYLKO, MICHAEL²

¹ Environment Canada, Canada

² National Estuary Program Coordinator for the Puget Sound / Georgia Basin, Environmental Protection Agency, United States

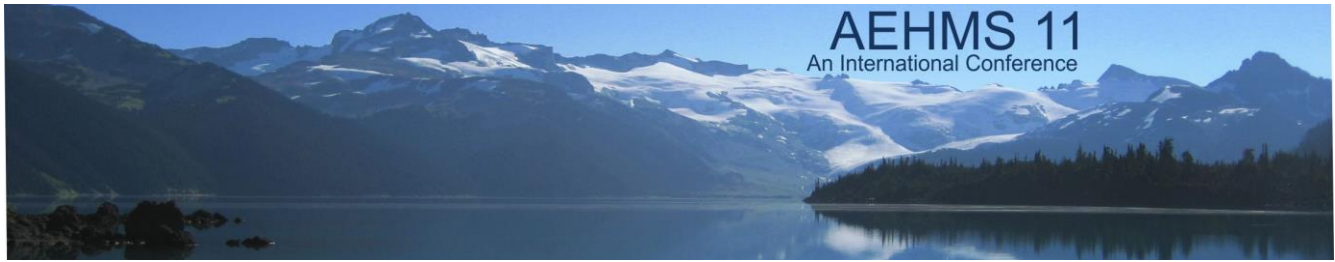
*Cecilia.Wong@ec.gc.ca

Presenting the facts, inspiring action – Measuring the health of the Salish Sea using transboundary ecosystem indicators

The Salish Sea extends from the north end of the Strait of Georgia and Desolation Sound in British Columbia, Canada, to the south end of Puget Sound in Washington, and west to the mouth of the Strait of Juan de Fuca where it meets the Pacific Ocean. These bodies of water form a single inland marine ecosystem known as the Salish Sea which transcends U.S. and Canadian boundaries.

In 2000, a Joint Statement of Cooperation (SOC) on the Salish Sea was signed between Environment Canada (EC) and US Environmental Protection Agency (EPA) Region 10. Under the auspices of the SOC, the Transboundary Ecosystem Indicators project was created to establish a common understanding of transboundary ecosystem priorities for action. Since its inception, two transboundary indicator reports were published in 2002 and 2005 to share knowledge on the health of the Salish Sea ecosystem. The current update expands the suite of indicators and increases its relevance to ecosystem health including sustainability perspectives on traditional and local ecological knowledge where possible. Ten ecosystem indicators are being reported to describe the state of air, water, species and human wellbeing.

This paper describes distinctions from concurrent state of environment reports and previous transboundary indicator reports, the approach for updating the indicators, and results of the Transboundary Ecosystem Indicators update.



List of Presenters

Surname	First name	E-mail
Alldred	Mary	malldred1@gmail.com
Amin	S.M.N.	sm_nurul@putra.upm.edu.my
Barnes	Christopher	crbarnes@uvic.ca
Blythe	Jessica	jessicalblythe@gmail.com
Bollens	Stephen	sbollens@vancouver.wsu.edu
Bringue	Manuel	mbringue@uvic.ca
Del Bel Belluz	Justin	jdelbel@uvic.ca
El-Serehy	Hamed	helserehy@ksu.edu.sa
Fitzpatrick	Mark	mark.fitzpatrick@dfo-mpo.gc.ca
Gilpin	Cheryl	seacheyl@gmail.com
Gross	Jackson	kgross@smith-root.com
Herborg	M.L.	Matthias.Herborg@gov.bc.ca
Kernan	Martin	m.kernan@ucl.ac.uk
Kreutzweiser	David	dave.kreutzweiser@nrcan.gc.ca
Latham	Erin	els.latham@gmail.com
Longo	Justin	justin.longo.phd@gmail.com
Malley	Diane	dmalley@pdkprojects.com
McGillivary	Philip	philip.a.mcgillivary@uscg.mil
Munawar	Mohiuddin	mohi.munawar@dfo-mpo.gc.ca
Nepkin	Jessica	jessica.nepkin@gmail.com
Nõges	Tiina	tiina.noges@emu.ee
Nõges	Peeter	peeter.noges@emu.ee
Nordic	Rick	nordin@uofvic.ca
Owens	Philip N.	owensp@unbc.ca
Pawluk	Kylee	kpawluk@uvic.ca
Rahman	M. Aminur	aminur1963@gmail.com
Reshitnyk	Luba	lresh016@uvic.ca
Sheehan	Linda	lsheehan@earthlaw.org
Sherry	James	jim.sherry@ec.gc.ca
Stewart-Malone	Alecia	amalone@smith-root.com
Sullivan	Constance	constance.sullivan@psp.wa.gov
Tang	Shilin	sltang@scsio.ac.cn
Tunncliffe	Verena	verenat@uvic.ca
Wagner	Tristany	twagner@smith-root.com
Weidman	Paul	pweidman@ualberta.ca
Wong	Cecilia	Cecilia.Wong@ec.gc.ca

AQUATIC ECOSYSTEM HEALTH & MANAGEMENT

The official Journal of the Aquatic Ecosystem Health & Management Society

A peer reviewed international journal published quarterly which is devoted to understanding ecosystem performance, function and management from integrated, multi-disciplinary and sustainable perspectives.

Objectives:

The major objective of the Journal is to promote an understanding of the structure, function and performance of healthy and damaged ecosystems (freshwater, marine, estuarine) from integrated, multi-disciplinary and sustainable perspectives. The Journal focuses on the development and application of management practices that will protect, maintain or restore the health of ecosystems.

The AEHMS recognizes the need to explore the complex interactions between human society, ecology, economy/development, politics and the environment. It also encourages a watershed approach, acknowledging that aquatic ecosystems are influenced by atmospheric and terrestrial processes, both natural and anthropogenic.

The Journal provides a forum for the assessment and discussion of ecosystemic, integrated approaches to aquatic ecosystem research and management. This includes concepts and approaches that address health, integrity, performance, efficiency, remediation, restoration recovery, conservation, sustainable human use and development. This Journal seeks to foster international and cross-sectorial exchange of information among scientists, academicians, managers, engineers, doctors, lawyers, citizens, business, industry, politicians and governments on the health and sustainability of global aquatic resources.

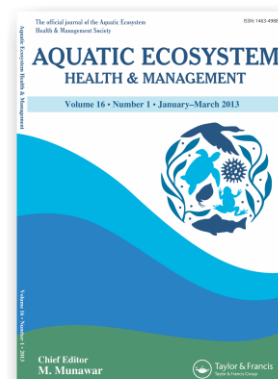
Scope:

Aquatic Ecosystem Health & Management (AEHM) will publish:

- peer-reviewed original papers
- state of the art reviews and critiques on current issues
- invited perspective essays
- short, communications dealing with concepts, techniques and ideas warranting rapid publication
- special issues devoted to selected themes, approaches, ecosystem types and ecotechnologies

Representative Topics:

- Integrated and ecosystemic approaches to management
- Assessment of the effects of the onset and cessation of anthropogenic perturbations on the health and integrity of food webs
- Bioassessment/biomonitoring techniques, protocols and other diagnostic tools that enhance the understanding of the ecosystem performance, resilience, response and recovery processes
- Development and modification of early warning indicators and diagnostic methods for a better understanding of ecosystem health, resilience, functioning and evaluation of management practices
- Development of environmental and habitat guidelines, aquatic quality guidelines, remedial actions, innovative management strategies, and monitoring protocols for the restoration of impacted ecosystems and the maintenance of healthy systems
- Evaluation of the cumulative effects of large scale perturbations and activities such as damming, dredging, river diversions and water transport
- Technologies for the reclamation of highly-damaged or poorly-utilized areas including war-affected regions
- Application and integration of various disciplines such as ecology, toxicology, limnology, fisheries, statistics, modeling and environmental risk assessment towards the assessment of ecosystem health.



“The Instructions for the Preparation of the Manuscript” can be found at www.aehms.org. Manuscripts should be submitted to:

Dr. M. Munawar, Chief Editor

Fisheries and Oceans, Canada Centre for Inland Waters, 867 Lakeshore Rd., P. O. Box 5050
Burlington, Ontario, Canada. L7R 4A6
mohi.munawar@dfo-mpo.gc.ca

Special Issues of the AEHM	Volume	Year
Celebrating the 20th Anniversary of the AEHMS: The Aquatic Ecosystem Puzzle	16(2)	2013
Ecosystem Health and Recovery of the Bay of Quinte, Lake Ontario: Part II	15(4)	2012
Tropical Coastal Seas: Health and Management	15(3)	2012
Linkages of lakes, rivers, estuaries and oceans: Asia-Pacific focus	15(2)	2012
Changing Gulf Ecosystem: Ecology, Health and Management	15(S1)	2012
Marine Environmental Change of the South China Sea	15(1)	2012
Ecology of Lake Superior	14(4)	2011
J.R. Vallentyne & R.A. Vollenweider Memorial Issue	14(2)	2011
Ecosystem Health and Recovery of the Bay of Quinte, Lake Ontario	14(1)	2011
Ecosystem Health of the Majestic River Ganges	13(4)	2010
Assessing Great and Large Lakes of the World (GLOW V, Part II)	13(2)	2010
Changing Great Lakes of the World and Rift Valley Lakes: Sustainability, Integrity & Management (GLOW V, Part I)	13(1)	2010
Ecosystem sustainability & health of threatened marine environments (ESHTME)	12(4)	2009
The State of Lake Huron: Ecosystem Change, Habitat and Management, Part II	12(1)	2009
Checking the Pulse of Lake Ontario	11(4)	2008
State of Lake Huron: Ecosystem Change, Habitat, and Management, Part I	11(2)	2008
Changing Great Lakes of the World (GLOW IV)	11(1)	2008
Great Lake Victoria Fisheries: Changes, Sustainability, and Building Blocks for Management	10(4)	2007
The State of the Gulf Ecosystem: Future and Threats	10(3)	2007
Freshwater fishes of South America: Their biodiversity, fisheries and habitat	10(2)	2007
Sediment Quality Assessment: Watershed-Sediment Management from Source to Sink	10(1)	2007
Aquatic Ecosystems of Malaysia: Health, Sustainability and Management	9(2)	2006
Aquatic Ecosystems of China: Concerns, Technologies and Management	9(1)	2006
Aquatic Ecosystem Health: Scaling from Local to Global Perspectives	8(4)	2005
The Great Himalayas: Ecology, Health and Management	8(3)	2005
Assessing Risks and Impacts of Contaminants in Sediments (Continuation of papers from SQA5, Issue 7:3, 2004)	8(1)	2005
Emerging Issues in Lake Superior Research	7(4)	2004
Assessing Risk and Impacts of Contaminants in Sediments	7(3)	2004
Coastal Wetlands of the Laurentian Great Lakes: Health, Integrity & Management	7(2)	2004
Comparing Great Lakes of the World	6(3)	2003
Barometers of Aquatic Ecosystem Health and Integrity	6(2)	2003
Freshwater Biodiversity in Australia	6(1)	2003
Great Lakes of the World: Food Web, Fisheries, and Management	5(3)	2002
Resilience and Integrity of Aquatic Ecosystems	5(1)	2002
Freshwater Fish Habitat, Science and Management: A Global Perspective	4(4)	2001
Aquatic Ecosystems of Tropical and Temperate Regions: Health and Management	4(3)	2001
State of Brazilian Aquatic Ecosystems	3(4)	2000
Ecosystem Health of Lake Baikal, Russia	3(2)	2000
Large Lakes of the World: Comparative Ecology	3(1)	2000
Sediment Quality Assessment: Tools, Criteria and Strategies	2(4)	1999
Jack Christie Memorial Essays	2(3)	1999
Integrated Toxicology	2(1)	1999
Mexican Waters: Ecology Health and Management	1(3-4)	1998
Managing Aquatic Ecosystems in Southern Africa	1(2)	1998



Ecovision World Monograph Series

Dr. M. Munawar, Series Editor

An International, integrated, peer reviewed and scientific publication

Exploring the linkages between society, ecology, ecosystems and the environment

Objectives:

The Ecovision World Monograph Series has been launched to focus on the paradigm of life on our ever-changing planet and its sustainability under the impact of physical, chemical, biological, and human influences. It covers detailed and comprehensive treatments of various topics, subjects and ecosystems. The Ecovision Series is dedicated to integrated and ecosystemic research merging the high quality of a journal with the comprehensive approach of a book.

Scope:

- Ecovision Series will publish peer-reviewed groups of original papers in a book form on specific topics, themes, issues, subjects, concepts, or ecosystems.
- It promotes an ecosystemic, multi-disciplinary, multi-trophic, and integrated approach.
- The Series focuses on the integrity, health, restoration, remediation, and management of stressed ecosystems.
- It encourages publications dealing with the effects of environmental perturbations on ecosystem health at the structural, functional, and ultra-structural levels.
- It publishes material dealing with the integrated assessment of environmental issues, involving interactions between air, water, land and human health.
- The Series fosters trans-disciplinary and cross-sectoral linkages between the environment and ecological, socio-economic, political, ethical, legal, cultural, and management considerations.

Themes and topics:

- “State of the environment” publications focusing on countries, habitats and emerging problems and their management
- Comparison and management of large ecosystems, such as Great Lakes of the World (GLOW) and marine ecosystems with emphasis on food web dynamics
- Ecosystem health of stressed habitats such as harbours and embayments
- Effects of pollutants of global interest, such as metals, organic contaminants, and petroleum hydrocarbons
- Effects of large-scale practices, such as the damming and diversion of rivers, and deforestation
- Sampling, monitoring, analytical, bioassay, and other assessment techniques, including statistical and modelling approaches
- Ecotechnologies designed for the recovery, restoration, rehabilitation, and integrated management of perturbed ecosystems. Also those designed for the “reclamation” of poorly-utilized areas such as deserts
- Integrated toxicology
- Risk assessment and ecosystem modelling
- Sedimentary Quality Assessment
- Invasion of exotic species and management

Sponsored by the Aquatic Ecosystem Health and Management Society, Canada
www.aehms.org



List of Books Published by Ecovision

1. Aquatic Ecosystems of China: Environmental and toxicological assessment, 1995.
2. The Contaminants in the Nordic Ecosystem: Dynamics, Processes, and Fate, 1995.
3. Bioindicators of Environmental Health, 1995
4. The Lake Huron Ecosystem: Ecology, Fisheries and the Management, 1995
5. Phytoplankton Dynamics in the North American Great Lakes, Vol. 1: Lakes Ontario, Erie and St. Clair, 1996
6. Developments and Progress in Sediment Quality Assessment: Rationale, Challenges, Techniques and Strategies, 1996
7. The Top of the World Environmental Research: Mount Everest - Himalayan Ecosystem, 1998
8. The State of Lake Erie Ecosystem (SOLE): Past Present and Future, 1999
9. Aquatic Restoration in Canada, 1999.
10. Aquatic Ecosystems of Mexico: Scope & Status, 2000.
11. Phytoplankton Dynamics in the North American Great Lakes, Vol. 2.: Lakes Superior, Michigan, North Channel, Georgian Bay and Lake Huron, 2000.
12. The Great Lakes of the World (GLOW): Food-web, Health & Integrity, 2001.
13. Ecology, culture and conservation of a protected area: Fathom Five National Marine Park, Canada, 2001.
14. The Gulf Ecosystem: Health and Sustainability, 2002.
15. Sediment Quality Assessment and Management: Insight and Progress, 2003
16. State of Lake Ontario(SOLO): Past, Present and Future, 2003
17. State of Lake Michigan (SOLM): Ecology, Health and Management, 2005.
18. Ecotoxicological Testing of Marine and Freshwater Ecosystems: Emerging Techniques, Trends, and Strategies, 2005.
19. Checking the Pulse of Lake Erie, 2008.
20. State of Lake Superior, 2009.
21. Burning Rivers, 2010.

Dr. M. Munawar, Series Editor

Ecovision World Monograph Series
685 Inverary Rd., Burlington, Ontario
Canada L7R 2L8

Email: mohi.munawar@dfo-mpo.gc.ca
www.aehms.org