



Science Atlantic Student Conference:

Celebrating Aquaculture and Fisheries (23 yrs), Biology (43 yrs) & Environment (11 yrs)

Conference  Program

WELCOME!



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Welcoming Remarks



Dear Delegates:

Welcome to the annual Science Atlantic Biology Conference, Science Atlantic Aquaculture & Fisheries Conference, and Science Atlantic Environment Conference!

Science Atlantic conferences provide important opportunities for bright young scientists like you. If you're presenting, you'll gain valuable feedback from the judges reviewing your oral or poster presentation. If you're observing, perhaps it will spark a desire in you to come back next year and present your own research. No matter your role, you will learn from your peers and from expert speakers. Perhaps you'll even meet your future graduate school supervisor.

Acadia conference organizers have worked hard to make this weekend successful. Please enjoy and take part in all aspects of the conference!

Sincerely,

Lois Whitehead
Executive Director
Science Atlantic



Conference Delegates:

Welcome to the annual Science Atlantic conference for Aquaculture & Fisheries, Biology, and Environment! For the 3rd consecutive year, the three conferences have been combined and we feel that this will again result in an enhanced experience for all attendees. Once again, many excellent undergraduate and graduate student oral presentations and posters have been assembled, spanning a plethora of topics. Two outstanding, not-to-be-missed keynote lectures will accompany student presentations to address overarching concepts in our world and provide 'big picture' views. While you are in Wolfville, we hope you will get a taste of the many things that make Acadia University and the surrounding area such a dynamic place to be.

The Acadia Centre for Estuarine Research, Acadia Tidal Power Institute, and various research groups within the Biology Department study many aspects related to **Aquaculture and Fisheries**. Our broad approach and regional collaborations provide hands-on experience in topical research areas including commercial and recreational fishing, local and small-scale harvesting operations, conservation, and citizen science.

The recently opened Department of **Biology** building houses specialized research labs and five state-of-the-art teaching labs used by all levels of undergraduate and graduate students in one of Acadia's largest and most established programs.

In our beautiful KC Irving Centre is found the Center for Analytical Research on the Environment (CARE), which "provide(s) research and analytical services aimed at the quantification of contaminant fate and understanding processes that support healthy ecosystems". In addition to just **Environment**, CARE is also composed of multiple disciplines and collaborations within Acadia and among other institutions as well.

We hope you enjoy the oral and poster presentations, keynote speakers, and the social activities. Thanks to you for helping to make this conference a success!

Your Local Organizing Committee:

Trevor Avery, *Aquaculture & Fisheries Committee Chair*
Mike Stokesbury, *Biology (AUBC) Representative*
Nelson O'Driscoll, *Environment Representative*
William Roberts, *Conference Coordinator*

Schedule of Events

Friday, March 15th, 2013

5:00 – 8:00pm Registration (Old Orchard Inn Lobby)

Students

5:00 – 7:00pm Poster Setup (Acadia - Fountain Commons) (*optional*)

6:30 – 8:00pm Mixer with cash bar (Old Orchard Inn Bar Room)

Faculty

6:30 – 7:00pm Mixer with cash bar (Old Orchard Inn Bar Room)

7:00 – 8:00pm Faculty Banquet (Old Orchard Inn Salon D)

8:00 – 9:00pm Faculty Committee Meetings (Old Orchard Inn Meeting Rooms)
 Aquaculture & Fisheries – Salon C
 Biology – Salon A
 Environment – Salon B

Saturday, March 16th, 2013

8:00 – 9:00am Breakfast/Poster Setup (Acadia - Fountain Commons)
 Registration for Latecomers

9:00 – 9:15am Joint Welcoming Remarks (Fountain Commons)
 Dr. Peter Williams, Dean of Science, Acadia University
 Dr. Trevor Avery, Chair of Science Atlantic Aquaculture & Fisheries Committee
 William Roberts, Conference Organizer

9:15 – 10:15am *Keynote Presentation* (Fountain Commons)
 Speaker: Dr. Mark Mallory
 Presentation: Biological transport of chemicals on the Arctic conveyor belt

10:15 – 10:30am Joint Break & Dispersal to Presentation Sessions

10:30am – 12:00pm Oral Presentations (15 minutes each) (6)
 Aquaculture & Fisheries – Patterson Hall, Room 224
 Biology – KC Irving Centre Auditorium
 Environment – KC Irving Centre Classroom

12:00 – 2:00pm Joint Lunch & Poster Presentations (Fountain Commons)

2:00 – 3:00pm *Keynote Presentation* (Fountain Commons)
 Speaker: Dr. Fred Whoriskey
 Topic: Big Ocean Science: Canada's Ocean Tracking Network and its contribution to
 Aquaculture, Fisheries and the Environment

3:00 – 3:15pm Joint Snack (Student Union Building)

3:30 – 5:45pm	Oral Presentations (15 minutes each) (9) Aquaculture & Fisheries – Patterson Hall, Room 224 Biology – KC Irving Centre Auditorium Environment – KC Irving Centre Classroom
6:00 – 8:30pm	Joint Dinner & Poster Presentations (Fountain Commons) <i>Dinner will be served at 6:15pm</i>
9:00pm - 1:00am	Evening at the Axe (<i>optional</i>)

Sunday, March 17th, 2013

8:30am - 9:45am	Saint Patrick's Day Breakfast (The Axe Lounge) (<i>optional</i>)
10:00 – 12:00am	Oral Presentations (15 minutes each) (8) Aquaculture & Fisheries – Patterson Hall, Room 224 Biology – KC Irving Centre Auditorium Environment – KC Irving Centre Classroom
12:30 – 2:00pm	Joint Lunch and Awards Ceremony (Fountain Commons)

Notes on our Keynote Speakers

Dr. Mark Mallory

Associate Professor, Acadia University

Canada Research Chair in Coastal Wetland Ecosystems

Dr. Mark Mallory received his BSc (Hon.) from Queen's University, Kingston, and both his MSc and PhD from Carleton University, Ottawa. He started his career as a biologist in Ontario, Canada, where he worked first as an undergraduate student field assistant, then as a contractor, and finally moved into the federal government as a biologist, studying the effects of acid rain on aquatic ecosystems. In 1999, he moved to Iqaluit, Nunavut, with his wife (Carolyn) and three children (Conor, Jessamyn and Olivia), where he started the Nunavut-based field program for the Canadian Wildlife Service, principally studying the effects of climate change and pollution on Arctic biota. In 2011, Mark left the government to take up the CRC position at Acadia, but he continues to work in Canada's North. In fact, most of Mark's northern work takes him to the High Arctic, but he and his students have initiated studies around Nova Scotia and New Brunswick, collaborating with organizations like Ducks Unlimited Canada and the Nova Scotia Department of Natural Resources. He has written over 140 scientific papers and book chapters, is an Associate Editor at two scientific journals, and his research has led to the creation of two new National Wildlife Areas on eastern Baffin Island, Nunavut, as well as the uplisting of Ivory Gulls (*Pagophila eburnea*) to Endangered.



Conference Keynote Topic:

Biological transport of chemicals on the Arctic conveyor belt

Dr. Fred Whoriskey

Executive Director, Ocean Tracking Network



Dr. Fred Whoriskey was born and raised in Massachusetts. He graduated from Brown University in Rhode Island, and worked for five years at Woods Hole Oceanographic Institution before beginning Ph.D. studies at l'Université Laval in Quebec City. He was a Professor at McGill University from 1986 to 1995, then joined the Atlantic Salmon Federation in 1995, where he served as Vice President, Research and Environment, and was responsible for directing the Federation's science activities until 2010. While at ASF, he developed the organizations sonic tracking programs, which have included work on Atlantic salmon juveniles and adults, American eel, Atlantic cod, and alewives. Fred's research interests are in fish biology and ecology, and the impacts of exotic species on native ecosystems. He has been heavily involved in public policy issues, especially with regards to environmental impact assessments, and has worked extensively in public education. He received a Gulf of Maine Visionary Award in

2008, and is a frequent public speaker. Fred served on the Board of AquaNet (Canada's National Centre of Excellence in Aquaculture) and Chairs the Board of the Huntsman Marine Science Centre. Fred became the OTN Executive Director in June, 2010.

Conference Keynote Topic:

Big Ocean Science: Canada's Ocean Tracking Network and its contribution to Aquaculture, Fisheries and the Environment

Schedule of Oral Presentations

Saturday, March 16 th ~ Morning Sessions			
Timeslot	~ Aquaculture & Fisheries ~ Patterson Hall Room 224	~ Biology ~ KC Irving Centre Auditorium	~ Environment~ KC Irving Centre Classroom
10:30 – 10:42am	Freya Keyser, ACA Riding the tide is no bore: Movement patterns of striped bass in the Minas Passage	Amy Powell, ACA Sequencing the Male Control Region of <i>Modiolus modiolus</i>	Erin Mann, ACA Determining rate constants for photochemical reduction of mercury in Arctic snow
10:45 – 10:57am	Xujie Li, DALAGRI Determination of nutrient digestibility in different fish meals used as high protein feedstuffs in rainbow trout (<i>Oncorhynchus mykiss</i>) diets	Amanda Thomas, UPEI Cranberry (<i>Vaccinium macrocarpon</i>) extract inhibits matrix metalloproteinase expression in aortic smooth muscle cells by affecting key cell signaling pathways	Jacqueline Carverhill, MTA Unearthing the Secret to Lower Agricultural Greenhouse Gas Emissions: Quantifying Nitrogen and Carbon Emissions from Crop Residue Degradation
11:00 – 11:12am	Cassandra Mellish, UPEI Population monitoring, nutrient analysis and the management of European green crabs in Prince Edward Island	Kristen MacLeod, CBU Applying the Reference Condition Approach to Remediated Streams in Cape Breton Island, Nova Scotia, Canada	Christian Hart, STFX A new field portable instrument for in-situ gas diffusivity, porosity, and tortuosity measurements
11:15 – 11:27am	Laurie Baker, DALU Reproductive ecology of the female pink cusk-eel (<i>Genypterus blacodes</i>): Evaluating differences between fishery management zones in the Chilean austral zone	Hilary Byrne, UNBF Identification of vital stains with utility for investigations of <i>Loma morhua</i>	Christine Stortini, DALU Adapting the Marine Protected Area network planning process for Climate Change
11:30 – 11:42am	Jessica Fry, MUN The impact of ozonation of Atlantic cod (<i>Gadus morhua</i>), Atlantic salmon (<i>Salmo salar</i>) and Rainbow trout (<i>Oncorhynchus mykiss</i>) eggs on hatching success and larval growth and survival	Yasmin Chishti, UNBSJ The effects of progesterone on steroid production and gene expression in the male and female fathead minnow (<i>Pimephales promelas</i>) gonad	Jose Cubero, UNBF Understanding the landowner participation in the Alternative Land Use (ALUS) Program in Prince Edward Island
11:45 – 11:57am	Adam Harding, DALU To feed or flee? Effect of predation-risk cues on the foraging activity of <i>Strongylocentrotus droebachiensis</i>	Paul Manning, DALAGRI Potential nocturnal pollinators of lowbush blueberry	-

Saturday, March 16th ~ Afternoon Sessions

Timeslot	~ Aquaculture & Fisheries ~ Patterson Hall Room 224	~ Biology ~ KC Irving Centre Auditorium	~ Environment~ KC Irving Centre Classroom
3:30 – 3:42pm	Gregory Britten, DALU Trends in the productivity of North Atlantic cod (<i>Gadus morhua</i>)	Melanie Gallant, MTA Thermal tolerance of Atlantic salmon and the effects of thermal cycles	-
3:45 – 3:57pm	Danielle Quinn, ACA Smallmouth Bass (<i>Micropterus dolomieu</i>) Dispersal in LaHave River, Nova Scotia, and Evidence of Change in Native Fish Assemblages	Loay Jabre, ACA The Effects of Fungal Endophytes on Physiological and Morphological Traits in <i>Picea glauca</i>	-
4:00 – 4:12pm	Qi Liu, DALAGRI Saprolegnia fungus isolation, identification and control	Sarah Prednam, MUN Microsatellite Analysis of Population Density of Newfoundland Black Bears (<i>Ursus americanus hamiltoni</i>) on the Northern Peninsula	Chelsea Fougere, STFX Influence of <i>Rosa rugosa</i> on the coastal community of Brier Island, Nova Scotia
4:15 – 4:27pm	Mark Earle, MUN The effect of female size and egg size on offspring quality in capelin (<i>Mallotus villosus</i>) developing under two salinities	Allison Copan, SMU The variation of leukocyte counts and heterophil:lymphocyte ratios with adult condition and provisioning rates in breeding European starlings (<i>Sturnus vulgaris</i>)	Conor Leggott, UPEI Networks, Identity, and Resilience in an Island Watershed Group
4:30 – 4:42pm	Gwyn Mason, DALU In-situ Population and Swimming Characteristics of <i>Placopecten magellanicus</i> (Sea scallop) in the Gulf of Maine	Feng Tang, UNBSJ Body condition of juvenile American lobsters, <i>Homarus americanus</i> , living on mud and cobble bottom	Crystal Fullerton, ACA Assessing Biochemical Oxygen Demand Values at different stages of the Wool Washing Cycle
4:45 – 4:57pm	Paula Tummon Flynn, UPEI The impact of injury on the feeding rates of an invasive crab species on Prince Edward Island	Michelle MacDonald, UPEI Assessing pathogenicity and chemical sensitivity of <i>Fusarium</i> spp. infecting carrots	Emma Kinley, SFX Greenhouse Gas Fluxes from Nitrogen Contaminated Wetland Soil
5:00 – 5:12pm	Zeyu Zhang, DALAGRI Effect of surface disinfection during water hardening on survival of eggs of Arctic charr (<i>Salvelinus alpinus</i>) and Atlantic salmon (<i>Salmo salar</i>)	Meg Thomas, DALU Fitness Effects of Mutations in Novel Stressful Environments	Ben Callaghan, ACA Determining feather mercury levels in six species of arctic marine birds
5:15 – 5:27pm	Daniel Oldford, CBU Life history parameterization for sustainable fisheries: balancing size at maturity and size at castration in parasitized populations of the Waved Whelk (<i>Buccinum undatum</i>)	Grace Phillips, STFX Survey of Fouling Communities of Northern Nova Scotia	Drake Tymstra, ACA A Paleolimnological record of anthropogenic impact on water quality in First Lake, Lower Sackville, Nova Scotia
5:30 – 5:42pm	Rebecca Crawford, DALU The relationship between sea surface temperature and recreational catch rates of the blue shark (<i>Prionace glauca</i>) in Nova Scotia waters	Sophie Cormier, UNBF Recovery of Fish Health after Closure of a Bleached Kraft Pulp and Paper Mill on the Miramichi River (Canada)	-

♣ Sunday, March 17th ♣

Timeslot	~ Aquaculture & Fisheries ~ Patterson Hall Room 224	~ Biology ~ KC Irving Centre Auditorium	~ Environment~ KC Irving Centre Classroom
10:00 – 10:12am	Sabrina Inkpen, MUN Interferon regulatory factor characterization and transcript expression studies in Atlantic cod	Julie Colpitts, ACA Biological Evaluation of Metal- Containing Compounds to Assess Potential for Use in Photodynamic Therapy	-
10:15 – 10:27am	Chang Ye, DALAGRI Evaluation of Camelina byproducts fed to Atlantic salmon (<i>Salmo salar</i> L.) parr in practical diets	Jessica Prendergast, CBU Relating heterogeneity in electric signals to electric organ anatomy in adult gymnotiform fish <i>Brachyhyopomus gauderio</i>	Adam Godfrey, ACA Impact of salt marsh reclamation on mercury fate and biogeochemistry
10:30 – 10:42am	William Ross, ACA Structure and Biomass of Small Fish Populations in Oakland Lake, Nova Scotia	Susan Banfield, MUN Analysis of clavulanic acid production in <i>Streptomyces flavogriseus</i> ATCC 3331	Olivia Kester, SFX Methane Soil Dynamics in the Taiga Region of Cape Breton
10:45 – 10:57am	Ryan Horricks, DALU Determining the genetic basis for the effects of intra-specific competition on growth of <i>Salvelinus alpinus</i> raised in an aquaculture setting	Abigail White, MTA Duration of stay and movements of Semipalmated Sandpipers during migratory stopover in the upper Bay of Fundy	Bryan Mood, MTA Forest of the Future? Using Mean Sensitivity as a Measure of Physiological Stress and the Future Climate-Envelope Contraction of White Spruce in Saskatchewan
11:00 – 11:12am	Jordan Poley, UPEI Molecular Pathways Involved in Sea Lice (<i>Lepeophtheirus salmonis</i>) Resistance to Chemotherapeutants	Ashley Lewis, DALAGRI Evaluation of Falconry and Lethal Ammunition as a Biological Control Method	Catherine MacNeil, UPEI Youth livelihood strategies and environmental decision-making in the Humid Forest Zone of Cameroon
11:15 – 11:27am	Michael Schwinghamer, DALU A far-field aquaculture spatial resolution model	Grace Phillips, STFX Survey of Fouling Communities of Northern Nova Scotia	Christopher MacIntyre, STFX Winter soil respiration variance in Cape Breton Highlands Boreal forest
11:30 – 11:42am	Jason Lewis, MUN The effects of salinity on sperm motility in two osmerid fishes	Katie Kowarski, DALU The effects of remote biopsy sampling on long-finned pilot whales (<i>Globicephala melas</i>) in Pleasant Bay N.S.	Lauren Banks, ACA Too Little, Too Much, or Just Right?: Impact of Nutrient Availability on Invertebrate Biomass, Diversity and Species Richness in the Annapolis Valley, Nova Scotia
11:45 – 11:57am	Julia Whidden, ACA Characterizing Populations of Little and Winter Skate in the Avon Estuary, Nova Scotia	Katelyn Cherwonick, SMU The social structure of beluga whales (<i>Delphinapterus leucas</i>) in the St. Lawrence River population	-

Aquaculture & Fisheries Abstracts

Oral Presentations

Abstracts listed in alphabetical order by last name of presenting author.

Reproductive ecology of the female pink cusk-eel (*Genypterus blacodes*): Evaluating differences between fishery management zones in the Chilean austral zone

Presenting Author: Laurie Baker, Dalhousie University

The pink cusk-eel (*Genypterus blacodes*) is a benthic-demersal fish confined to the southern hemisphere. It supports an important commercial fishery in Chile, where it is exploited over an extensive geographic area. Although the fishery was originally divided into a northern (41°28'-47°00'S) and southern (47°00'-57°00'S) zone for the purposes of fisheries management, recent studies have reported significant differences in life history parameters between these zones. Individuals from the southern zone reached larger asymptotic sizes and possessed higher survival rates compared to the northern zone. In the present study we estimate and compare the gonadosomatic index (GSI) and length at 50% maturity (L50%) of female *G. blacodes* between management zones based on biological data collected from the industrial fleet by onboard observers between 1985-2009. Based on Charnov's life history theory, we predict individuals from the southern zone will mature at larger sizes. We found females in the northern zone had higher monthly mean GSI's than females in the southern zone. Our analyses also reveal L50% to be significantly higher in the southern zone than in the northern zone from 1985-2009. The significant differences in life-history traits between fishery management zones agree with the trade-offs predicted by Charnov's life history theory. Together these results provide additional morphological support for the hypothesis that two separate stocks exist and suggest that females from the northern zone have developed a life-history strategy which favours early maturation and a proportionally greater investment in reproduction than the southern zone.

Trends in the productivity of North Atlantic cod (*Gadus morhua*)

Presenting Author: Gregory Britten, Dalhousie University

Population productivity is generally defined as the rate of population replacement or growth. In fisheries, a focus is placed on recruitment which represents the number of fish surviving to a pre-defined life stage, often defined by the stage at which the fish is caught in gear. The maximum rate of recruitment, termed here 'productivity', is of great interest to managers as it sets harvest limits and stock rebound potentials. I present some results of an analysis which aims to track the productivity of 21 separate cod (*Gadus morhua*) stocks distributed throughout the North Atlantic. Results indicate that the productivity of North Atlantic cod has generally decreased over recent decades with notable variability and regional coherence. I attempt to estimate the correlations in productivity among regionally proximate populations, the results of which give evidence for regional environmental regimes. I also outline the implications for altered production regimes on fisheries management by demonstrating how maximum sustainable yield (MSY) is directly related to population productivity. The results have implications for fishery management and exploitation while revealing novel insights into the population ecology of cod.

The relationship between sea surface temperature and recreational catch rates of the blue shark (*Prionace glauca*) in Nova Scotia waters

Presenting Author: Rebecca Crawford, Dalhousie University

The blue shark, *Prionace glauca*, is the most abundant and most commonly caught pelagic shark in Eastern Canadian waters. A highly migratory predator, the blue shark is known to reside in surface waters. Sea surface

temperature has been shown to affect shark distribution in many regions, but its effect is unknown in the waters off the coast of Atlantic Canada. The objective of this study is to determine whether sea surface temperature is positively correlated with the catch rate of blue sharks in Eastern Canadian waters. Catch data was collected at recreational fishing derbies across the province of Nova Scotia from September 1993 to 2012, and corresponding sea surface temperature data was retrieved through satellite imagery. Sea surface temperature had a statistically significant effect on catch per unit effort at Brooklyn, Lockeport, and Yarmouth from 1993 to 2005. This research shows that catch rates increase with temperature off the coast of Nova Scotia, probably because blue sharks are more abundant in warmer waters. For the other derbies in the 1993-2005 data set, the lack of significance may be due to a lack of data, as some derbies such as Riverport were only active for a few years. Significance for the 2006-2012 data sets was not found, presumably because the restriction on shark length implemented in 2006 restricted catches. The development of a statistical model relating catch per unit effort to sea surface temperature may aid in the identification and avoidance of areas where thousands of blue sharks are killed accidentally through bycatch in other fisheries.

The effect of female size and egg size on offspring quality in capelin (*Mallotus villosus*) developing under two salinities.

Presenting Author: Mark Earle, Memorial University of Newfoundland

Reproductive success is influenced by maternal allocation of energy to offspring quality versus quantity, the optimal combination of which is dependent on environmental conditions. This trade-off is a fundamental idea in evolutionary biology and has an effect on recruitment in fishes. Capelin are an important forage fish and live in the open ocean, yet unlike most fish, in some areas, such as Newfoundland, they spawn predominately on beaches. The average size of spawning Newfoundland capelin has decreased in recent decades, resulting in an assumed decrease in spawned egg size. The effect on recruitment is unknown, but in other species larvae that hatch from big eggs are typically larger and more resistant to starvation than those from small eggs. We examined offspring quality of capelin as a function of female size, mediated through egg size, by quantifying hatch success, hatch time and starvation time. To determine if the environment influences the importance of female size, we incubated embryos at high and low salinities. The results of the experiment will be discussed.

The impact of ozonation of Atlantic cod (*Gadus morhua*), Atlantic salmon (*Salmo salar*) and Rainbow trout (*Oncorhynchus mykiss*) eggs on hatching success and larval growth and survival

Presenting Author: Jessica Fry, Memorial University of Newfoundland

The direct exposure of eggs to ozonated water has generated interest as a means of ensuring disease-free eggs without the use of harsh chemicals. However there are numerous knowledge gaps including safe contact times, exposure levels and long-term effects on commercial aquaculture species including the Atlantic cod, Atlantic salmon and Rainbow trout. The effect of different ozone doses (0.5-1.0, 1.5-2.0 and 2.5-3.0 mg O₃ L⁻¹ for 1.5 min) was tested on recently fertilized Atlantic cod and eyed salmonid eggs vis-à-vis the commercial disinfectant Perosan™ (0.004 mg L⁻¹) and Ovadine (100 mg L⁻¹) as well as an untreated Control (similar handling and husbandry). The impact of ozone application was evaluated based on larval nucleic acid concentration, hatching success, larval growth, and survival. Overall, the study showed no negative effect/toxicity of ozonation at < 3.0 mg O₃ L⁻¹ for 1.5 min on cod eggs or the resultant larvae up to 30 dph or of Atlantic salmon and Rainbow trout eggs monitored until 85% yolk sac depletion.

The relationship between shark length and tooth characteristics of the blue shark, *Prionace glauca*

Presenting Author: Danielle Goodreau, Dalhousie University

Bite patterns and teeth left behind by sharks on objects have been used for numerous studies in estimating both the size and species of the individual. For the blue shark, *Prionace glauca*, there have been few studies despite the fact that it is one of the most abundant shark species in our Atlantic region. Blue shark jaws were digitally photographed in shark derbies held across Nova Scotia in 2012 in order to analyze the relationship between shark length and tooth size. Data recorded included fork length, jaw gape, sex, along with tooth height, interdental distance, and base length for all jaw sections for a total of 31 males and 12 females. Image J software was used to measure the tooth parameters from the photographs. Using an analysis of covariance, I tested the hypothesis that tooth length differs between sex, position in the jaw, and fork length. The results of the analysis showed that males have significantly larger tooth lengths compared to females, and tooth length varies in the jaw with the upper middle having the largest teeth, and the lower left having the smallest. Tooth length increased significantly with fork length. The presence of larger teeth in more mature sharks may indicate the need for larger teeth to handle larger prey. The use of larger teeth specifically on the upper jaw, along with the difference in tooth size between sexes may be indicative of males utilizing bite tactics on females during courtship rituals. While this study is the first to explore shark length against tooth characteristics in blue sharks, research on mature females is required for further comparison.

To feed or flee? Effect of predation-risk cues on the foraging activity of *Strongylocentrotus droebachiensis*

Presenting Author: Adam Harding, Dalhousie University

Along the Atlantic coast of Nova Scotia, green sea urchins (*Strongylocentrotus droebachiensis*) can destructively graze kelps and transition the shallow rocky subtidal environment from a kelp-dominated state to a stable urchin barren state where urchins preclude the growth of any new macroalgae. Large-scale disease outbreaks and the commercial urchin fishery can reduce urchin density to a point where the kelp community is able to reestablish. Recent work in the Gulf of Maine suggests that historical overfishing of groundfish in the Northwest Atlantic may be leading to increasing dominance by invertebrate predators such as Jonah crab (*Cancer borealis*), a known predator of sea urchins. As such, crabs may be maintaining the kelp bed state in Maine, and may also be keeping urchin densities low at some sites in Nova Scotia by increasing mortality and modifying urchin behavior. In this study, I investigate the extent to which *C. borealis* reduce the foraging activity of *S. droebachiensis* to cause an indirect positive effect on kelps in Nova Scotia. In field experiments at a wave-exposed site on the Atlantic coast of Nova Scotia, time-lapse video tracking individual movements showed that urchins are strongly attracted to chemical cues emanating from a cage filled with a preferred food, the kelp *Saccharina latissima*, and repelled by cues from a cage containing *C. borealis*. However, when thalli of *S. latissima* are systematically dispersed around a cage with *C. borealis*, the presence of crabs does not reduce urchin foraging rate. Similar responses were observed under controlled flow conditions in the laboratory, both for starved and well fed urchins. These results suggest that *C. borealis* do not exert a trait-mediated indirect effect on kelps by inhibiting the foraging activity of *S. droebachiensis*. This finding is important in elucidating the extent to which Jonah crab exert a stabilizing effect on kelp beds in Nova Scotia.

Determining the genetic basis for the effects of intra-specific competition on growth of *Salvelinus alpinus* raised in an aquaculture setting.

Presenting Author: Ryan Horricks, Dalhousie University

One of the issues surrounding the aquaculture industry lies in the fact that many strains of aquaculture fish have not yet been subjected to efficient breeding programs. Current methods of broodstock selection do not account for the effects of intra-specific competition often displayed by fish raised in the large groups found in an

aquaculture setting. Within these groups strong competitive social interactions can have a substantial effect on an individual's growth which can potentially lead to complications when selecting broodstock since these interactions may have a genetic basis. Simply selecting the largest and fastest-growing fish could lead to accidental selection for a highly aggressive population and ultimately negate any potential genetic gains. Conversely, properly accounting for social interactions has the potential to considerably increase the response to selection. To achieve this, a new genetic model including social effects has recently been proposed, but has yet to be tested in the context of fish aquaculture. Arctic charr (*Salvelinus alpinus*) from 24 different parent sets were identified by family using visible implant elastomer (VIE) tags and reared at Dalhousie University's Aquatron facility in small (3L) tanks. Fish of uniform size were placed into tanks at a consistent density (50 fish/tank) with different family mixes in each tank so that each of the unique families were exposed to as many others as possible given the constraints of available tank and fish numbers as well as adequate replication. Total fish length was compiled into a database built from digital image analysis. Change in total fish length was analyzed using the newly proposed linear mixed model in a collaborative effort with graduate students in the Department of Mathematics and Statistics at Dalhousie University, however, results to date do not show conclusive evidence that genetically-based social interactions are affecting fish growth.

Interferon regulatory factor characterization and transcript expression studies in Atlantic cod

Presenting Author: Sabrina Inkpen, Memorial University of Newfoundland

Interferon regulatory factors (IRFs) are a family of transcription factors that act in the interferon pathway, which is vital in the innate immune response to pathogens. In the current research IRF family genes are studied in Atlantic cod (*Gadus morhua*), an important commercial species with a unique immune system, and for which many functional genomics tools have recently been developed with the goal of enhancing selective breeding programs. As little is known of these genes in cod, IRF4, 7, 8 and 10 were first characterized at the cDNA level using rapid amplification of cDNA ends (RACE), sequencing and sequence assembly. Three IRF4-like paralogues were identified, indicating expansion of the gene family in cod, as previously observed in other teleosts. Semi-quantitative PCR was used to determine in which adult cod tissues these genes are transcribed; of particular interest, all were highly transcribed in the spleen and hematopoietic kidney, two important immune tissues. To determine if transcription of these genes responds to viral or bacterial antigens, paralogue-specific QPCR assays were developed to compare expression in the spleen of fish injected with poly I:C (a viral mimic), killed *Aeromonas salmonicida*, or saline. Using RNA from cod embryos collected daily from fertilization to first feeding stage, QPCR will also be used to obtain transcript expression profiles for IRFs throughout early development. An understanding of fish immune systems is of great importance to improving the aquaculture industry, and to preserving the health of wild and cultured fish species under changing global conditions. This research will broaden our knowledge of a family of immune-relevant genes in Atlantic cod, indicating whether specific IRF genes play a role in development, immune responses or both. Molecular phylogenetic analyses will also show how this gene family has evolved in cod in comparison to other teleost fish.

Riding the tide is no bore: Movement patterns of striped bass in the Minas Passage

Presenting Author: Freya Keyser, Acadia University

The Bay of Fundy's Minas Passage (5 km wide) is currently the site for in-stream tidal energy turbine testing. It is also an important pathway for many commercially and recreationally important migratory fish species. Among these are striped bass (*Morone saxatilis*), a recently listed endangered species. The objectives of this project were to determine the movement patterns of juvenile and adult striped bass within the passage, and to assess the potential risk of interaction with tidal turbines. A total of 40 transmitter-tagged striped bass (20 adults and 20 juveniles) were tracked using 29 bottom-moored VEMCO acoustic receivers. Two lines of receivers spanned the width of the Minas Passage and a third line spanned the turbine test area. All recovered receivers (n=27) logged valid detections, with the highest number of detections occurring in July. Of the 40 striped bass tagged, 25 were detected, with more adults detected (75%) than juveniles (50%). Adult fish were detected at

depths throughout the water column, while juveniles were detected only in the top 20 m (above turbine height). Fifteen striped bass (mostly adults) were shown to move back and forth through the passage at a mean swimming speed of 2.35 ± 0.71 m/s. Fish were detected more at night than during the day. Detection frequency was higher during neap tidal cycles than during spring tidal cycles and was negatively correlated with current speed. There were slightly more detections during ebb tides than during flood tides. Unexpectedly, individual striped bass were shown to make multiple crossings of the Minas Passage during summer; they pass through the turbine test site and adult striped bass swim at depths that include turbine hub height. The ability of striped bass to detect and avoid tidal turbines when travelling at high speed remains unknown.

The effects of salinity on sperm motility in two osmerid fishes

Presenting Author: Jason Lewis, Memorial University of Newfoundland

Capelin (*Mallotus villosus*) are a small, cold water, marine fish that have a circumpolar distribution. They are a key forage species throughout their distribution as a prey item for other fish, birds and mammals. Newfoundland capelin, unlike populations elsewhere, have a high incidence of beach spawning. Most species of the same family, Osmeridae, are anadromous, though some spawn sub tidally. Little is known about why capelin spawn on beaches or the effects of this behavior on the gametes and ultimately the embryos. Fish sperm requires water of appropriate chemistry for activation, and a given taxonomic family generally reproduces either in freshwater or saltwater (not both). In the present study, we compared the sperm swimming characteristics of capelin and another local osmerid, the anadromous rainbow smelt (*Osmerus mordax*), at different salinities. The goal was to determine if capelin sperm function like those of most marine fish, or if phylogenetic constraints partially tie them to their freshwater ancestry. Both species showed higher incidence of movement and faster swimming sperm at lower salinities.

Determination of nutrient digestibility in different fish meals used as high protein feedstuffs in rainbow trout (*Oncorhynchus mykiss*) diets

Presenting Author: Xujie Li, Dalhousie University - Faculty of Agriculture

Fish meal is limited and expensive due to the expanding aquaculture industry. Not all fish meals have the same nutrient contents. The choice of fish meal to use in diet depends on the price, nutrient content and nutrient digestibility. Available fish meals caplin fish meal (CFM), herring fish meal (HFM), menhaden fish meal (MEN) and prime fish meal (PFM) were evaluated in a digestibility study by using 240 rainbow trout (*Oncorhynchus mykiss*), initial weight 256 ± 9.6 g. Fish were randomly distributed to an 8-tank recirculating system (30 fish/tank). Water temperature was maintained at 12 ± 0.6 °C with dissolved oxygen above 90% during the experiment. All test diets contained 69.5% of control diet, 30% of a test ingredients CFM, HFM, MEN or PFM and 0.5% chromic oxide as the inert marker. After four days of feeding, stripping method was used to collect fecal samples until two 90g samples per tank were obtained. When analysis of variance indicated treatment differences, means were differentiated using LS means ($P \leq 0.05$). The ADC of crude protein (CP) in CFM, HFM, MEN and PFM were 98.3%, 96.9%, 89.7% and 92.4% respectively. The ADC of gross energy (GE) were 98.5%, 95.3%, 90.8% and 92.2% respectively. There were no differences ($P > 0.05$) between CFM and HFM for ADC of CP and GE; however, the ADC of CP and GE for CFM were significantly higher ($P < 0.05$) than those MEN and PFM. The digestible crude protein (DCP) in CFM, HFM, MEN and PFM were 62.9%, 70.2%, 68.8% and 64.4% respectively. The digestible energy (DE) in CFM, HFM, MEN and PFM were 4361, 4995, 4625 and 4207 Kcal/Kg respectively. The DCP and DE in HFM were the highest among the four fish meals. The ADC of nutrients and digestible nutrient content in these fish meals can be used in formulation of diets for rainbow trout.

Saprolegnia fungus isolation, identification and control

Presenting Author: Qi Liu, Dalhousie University - Faculty of Agriculture

Saprolegnia is a common fungus in freshwater hatcheries, especially among salmonid eggs. Historically, malachite green provided effective control, but use of this carcinogen on food fish is now banned. Formalin is an effective replacement, but the volumes used in Atlantic Canada have escalated recently as the Saprolegnia problem has increased, possibly due to more virulent types of the fungus. To investigate what types of Saprolegnia were present at Dal-AC Aquaculture Centre, I isolated the fungus from the eggs of both Atlantic salmon and Arctic charr and from the gill and skin of striped bass. Gross morphology of the fungi on the fish and fish eggs showed clear contrasts. However, in vitro, the cellular morphology and asexual reproductive organs of the four isolates were very similar. DNA analysis of 536 base pairs of internal transcribed spacer (ITS) region was compared. The four isolates shared an identical ITS sequence and were indistinguishable from: *S. parasitica*, *S. delica* and *S. salmonis*, the taxonomy of these species being unclear. The efficacy chemical controls of Saprolegnia are being tested including bronopol, formalin, hydrogen peroxide, malachite green, phosphite and sodium chloride chemicals control of Saprolegnia are being tested, seeking an alternative to the noxious formalin.

In-situ Population and Swimming Characteristics of *Placopecten magellanicus* (Sea scallop) in the Gulf of Maine

Presenting Author: Gwyn Mason, Dalhousie University

The Sea scallop, *Placopecten magellanicus*, forms dense aggregations on coarse sediment off the east coast of North America. Scallops have the ability to swim from ~30 - 100 mm shell height (SH), but > 100 mmSH become recessed on the seabed due to reduced swimming abilities. Patterns in abundance, size distribution and swimming were measured in a bed on German Bank that supports an active fishery for scallops > 70 mm SH by analyzing high-definition (HD) video footage of a ~9-km transect done by a remotely-operated vehicle (ROV) in July 2010. All scallops were counted and subsequent associations with substrate were made. Systematic subsamples at set intervals were used to measure SH and determine the population size distribution. Of 535 observed swims, swim distance, time, velocity and distance travelled per adductor clap for 195 of these were characterized. The substrate of the scallop bed was mostly composed of fine-grained sediment and sandy gravel. Size ranged from 2.44 to 193.78 mmSH (mean \pm SD: 70.29 \pm 34.87 mmSH). The SH frequency distribution was bimodal with high abundance in the 25 to 40 mm SH size classes, likely due to a recruitment event in the area. It declined for individuals >100mmSH due to increased likelihood of being retained by dredges because of reduced swimming abilities. Significant, quadratic relationships were observed between velocity and distance travelled per adductor clap and SH, peaking at ~70 mmSH. Mid-sized scallops (60 - 70 mmSH) exhibited the greatest swimming abilities likely because their light weight in combination with muscle mass can overcome drag and gravitational forces. This study provided a unique opportunity to characterize swimming performance in-situ for the first time for this species. It can provide baseline data for future studies on scallop populations and when assessing the implications of scallop fisheries.

Population monitoring, nutrient analysis and the management of European green crabs in Prince Edward Island

Presenting Author: Cassandra Mellish, University of Prince Edward Island

European green crabs are an alien invasive species which have successfully colonized many coastlines worldwide, including a large portion of the Canadian Maritimes. Due to their high abundances, ability to alter habitats and consumption of commercially-important shellfish species, there is a need to develop potential management strategies. Systematic trapping is one potential method of management, but it is not feasible in the long-term without a commercial fishery based upon an established market for green crab. In order to

implement these, more knowledge on green crab population dynamics and the chemical composition of their meat is needed. This study addressed both these issues by monitoring green crab population dynamics at two PEI locations over the course of the summer and by conducting meat chemical analysis (protein, lipid, dry matter, and ash content) early and late in the summer season. Crabs were trapped weekly from North River and Souris to determine if abundance, size, sex ratio, and physical condition varied based on location or time of year. Results show North River crabs were on average smaller than Souris crabs, and that females were smaller than males at both locations. North River female crabs carried eggs during the first two weeks of June only, while Souris crabs were found with eggs later in the summer. Chemical analysis showed that North River crabs have higher lipid and protein content but lower ash content than Souris crabs. Percent protein decreased in the late season results at both locations. Based on the data collected to date, the Souris River population seems more suitable for a directed and sustainable fishery, a result that is likely related to its longer time of invasion and its closeness to other areas with well established populations.

Life history parameterization for sustainable fisheries: balancing size at maturity and size at castration in parasitized populations of the Waved Whelk (*Buccinum undatum*)

Presenting Author: Daniel Oldford, Cape Breton University

The decline of many traditionally fished stocks in Atlantic Canada has forced the fishing industry to explore commercial fishing operations for new species. In recent years, interest in pursuing a fishery for one such species, the Waved Whelk (*Buccinum undatum*), has developed in Nova Scotia. While the Waved Whelk has not yet been subjected to commercial fishing in Nova Scotia fisheries for this species do exist in Quebec, Newfoundland, and Europe. Previous work on the life history characteristics and fisheries potential of near-shore whelk populations has been conducted in our laboratory. From this work size at first sexual maturity and castration due to parasitic infection arose as important parameters for the development of a sustainable fishery management plan. Working under the hypothesis that size selective fishing methods can be used to successfully harvest mature and parasitized whelk without compromising the stability of their isolated populations, the goal of this study is to further investigate these parameters in two offshore Whelk populations located on Banquereau Bank. Six hundred individuals sampled from these two offshore populations over three years (2009, 2011, and 2012) were measured, sexed, aged, and assessed for the presence of castrating digenean trematode parasites. Sampled whelk ranged in length from 29 to 94mm and from age 2 to age 10. The parasitic prevalence was found to be as high as 50.4% with reproductively castrated whelk reaching a larger average size compared to unparasitized whelk of the same age. The results of this sampling will be used to determine the size and age at first sexual maturity (L_{m50}), the size and age at sterility, and create parameters for Leslie Matrix population models. Runs of these models using various size-selective fishing mortalities will be used to test the working hypothesis.

Molecular Pathways Involved in Sea Lice (*Lepeophtheirus salmonis*) Resistance to Chemotherapeutants

Presenting Author: Jordan Poley, University of Prince Edward Island

Sea lice (*Lepeophtheirus salmonis*) are an ectoparasitic copepod which affect salmonid aquaculture in Canada, Norway, Scotland and the United Kingdom. They impose a financial burden of close to 500 million dollars per year by feeding on the blood, mucus and skin of salmonids; causing severe skin lesions, increased stress, and often times mortality. The aquaculture industry depends on a limited number of treatments against sea lice, leading to overuse, and consequently problems with drug resistance. Until a few years ago emamectin benzoate (EMB) was the most common treatment used against sea lice, however due to resistance, the drug is rarely used in the Bay of Fundy, Canada, and has been administered up to 3x the original dosage. The present study examined several mechanisms of drug resistance using quantitative polymerase chain reaction (qPCR) to monitor gene expression differences amongst EMB-resistant and EMB-susceptible lice populations. Bioassay trials exposed lice populations to differing concentrations of EMB for 24 hours to determine half maximal effective concentrations (EC₅₀), while in vivo trials exposed lice to EMB using the 3x the prescribed dose

(150 Mg/kg for 7 days) fed to Atlantic salmon (*Salmo salar* L.). Lice were collected for gene expression analyses, targeting P-glycoprotein, which is involved in intracellular xenobiotic removal, peroxinectin, involved in lice feeding, and components of the cytochrome p450 pathway which are responsible for drug oxidation.

Smallmouth Bass (*Micropterus dolomieu*) Dispersal in LaHave River, Nova Scotia, and Evidence of Change in Native Fish Assemblages

Presenting Author: Danielle Quinn, Acadia University

Smallmouth bass (*Micropterus dolomieu*) is a non-native, invasive piscivore in Nova Scotia, thought to threaten native fish populations through predation and increased competition for resources. This species has spread to many watersheds via recreational angler introductions and through connected watercourses. As an example of riverine colonization, electrofishing surveys at multiple sites in LaHave River between 1965 and 2009 were used to track probable movement patterns in this watershed. The first record of smallmouth bass in LaHave River occurred in 1995, and dispersal and colonization patterns were visualized. Evidence of contributions by smallmouth bass to the structure of native fish assemblages was noted and compared. The influence of smallmouth bass on native fish assemblages in Nova Scotia may be less than reported in other areas, as the province has relatively low regional species richness and moderate niche requirement plasticity of native species.

Structure and Biomass of Small Fish Populations in Oakland Lake, Nova Scotia

Presenting Author: William Ross, Acadia University

From 2009 to 2012, American eel (*Anguilla rostrata*) population dynamics with respect to habitat has been studied within Oakland Lake – a municipal water supply. Habitat use by eels was determined through eel trapping using baited eel traps. In 2012, small fish species were investigated because they were frequently caught in eel traps with large mesh size; presumably smaller-sized fish also resided in the lake. As well, the impact of adding bait to a small lake has yet to be investigated. In total, 35 eel traps and eight minnow traps were set out in the lake. Eel traps were set at fixed stations and minnow traps were periodically moved. The goals of this project were twofold: 1) Determine the biomass of small fishes within the lake, and 2) Investigate the relationship of fish biomass to bait biomass. Five fish species were caught regularly: white perch (*Morone americana*), yellow perch (*Perca flavescens*), banded killifish (*Fundulus diaphanous*), golden shiners (*Notemigonus crysoleucas*) and white suckers (*Catostomus commersonii*) along with many tadpoles. Fish were measured for total length and fin clipped (for population size estimation). Weight-length relationships were determined from known relationships in lakes within this region in an attempt to reduce fish stress and because of practical issues with weighing small fishes in a boat. Preliminary population estimates of each species were determined by capture-mark-recapture using the Schnabel method. Biomass for each species and overall biomass were related to bait biomass as a preliminary step to evaluating the ecological impacts of adding bait to a small lake.

A far-field aquaculture spatial resolution model

Presenting Author: Michael Schwinghamer, Dalhousie University

Wastes from salmonid aquaculture and fish processing plants can cause significant impacts on the local environment around the sea cages and processing plant. Organic matter loading associated with fish feces and food wastes under some conditions can result in reduced benthic biodiversity as well as a shift of ecosystem function toward hypoxia. In many cases, these effects are restricted to the local area (near-field). Examination of more distant far-field effects requires a coupled physical-ecological model. A hydrodynamic model was created to track water flow in Port Mouton Bay, NS. The model was groundtruthed with current velocity measurements from field current meter records. Conservative tracers were used to further track concentrations of materials released from the farm sites and fish processing plant. The extent of dilution and potential for tracers to settle

on beaches or other sensitive locations was assessed. Numerical experiments were run with both sources of organic matter to examine their interaction and its implication for system-wide impacts.

The impact of injury on the feeding rates of an invasive crab species on Prince Edward Island

Presenting Author: Paula Tummon Flynn, University of Prince Edward Island

The green crab (*Carcinus maenas*) was first identified on Prince Edward Island (PEI) in 1997. Since then, populations have expanded and the crab has been identified as a threat to the commercial shellfish industry and to native decapod populations. A common injury among decapod crustaceans is the loss of a claw, as crabs are able to autotomize (self-amputate) limbs, dropping them in response to injury or the threat of injury. This study was designed to examine how the loss of a claw modifies the feeding rates of the green crab on two commercially important shellfish species, the soft-shell clam (*Mya arenaria*) and the American oyster (*Crassostrea virginica*), and juvenile decapods of the rock crab (*Cancer irroratus*) and its own juveniles. Because the green crab is heterochelous, with its claws differentiated into a major crusher and a minor cutter, the effect of the two types of claw loss were also compared. Feeding experiments were conducted in laboratory tanks with healthy crabs and then paralleled with crabs that were induced to autotomize a claw. The crabs were allowed to feed on shellfish of two different size ranges (1.5-2.5 cm and 2.5-3.5 cm) or juvenile crabs at standard conditions and times. Experiments with juvenile crabs were also performed in field inclusion cages to measure feeding rates in an uncontrolled environment. The results of the study show that injury generally reduces the feeding rate of green crabs on shellfish and juvenile decapods. The loss of the crusher claw tended to have a greater effect than the loss of the cutter claw, particularly on the feeding rate on oysters. These results suggest that injuries as well as the nature of the injuries in this invasive population should be taken into account when assessing the impact of green crabs on native species.

Characterizing Populations of Little and Winter Skate in the Avon Estuary, Nova Scotia

Presenting Author: Julia Whidden, Acadia University

Winter skate (*Leucoraja ocellata*) and Little skate (*Leucoraja erinacea*) are an important part of the demersal fish assemblage in the Atlantic Ocean. These sympatric and morphologically similar species have been scarcely studied yet bear the status of endangered and near threatened, respectively, by the IUCN Red List. This research was undertaken to determine species composition, estimate population size of each species, and to examine diel movement patterns. Over a 6-week period from July – September 2013, 530 skates were sampled at a commercial weir on the Avon estuary. Skates were measured for length and weight, sexed, and ocellations counted. As well, approximately 170 skates were tagged for use in a mark-recapture analysis. A total of 5 recaptures were found over the 6-week period, and were used to hypothesize timing of movement through the bay and estimate population size. Length-weight relationships and size distributions were created for known Winter skate (with ocellations) and all skates. Fin clips were taken for species identification, which involved a restriction digest of the mitochondrial DNA cytochrome oxidase I gene using *Sty I*, followed by Sanger sequencing. Initial results suggest that the inner Bay of Fundy population is dominated by Winter skate. This preliminary work provides insights into the population structure and movement of these poorly understood species, which may be of importance in their conservation and management.

Evaluation of Camelina byproducts fed to Atlantic salmon (*Salmo salar* L.) parr in practical diets

Presenting Author: Chang Ye, Dalhousie University - Faculty of Agriculture

Camelina (*Camelina sativa* L. Crantz) is also known as false-flax. It contains a relatively high level of protein and oil compared to other plant seeds. The goal of research on camelina as an ingredient in finfish feed is to reduce the reliance on fish meal and oil without impacting the growth and health of the fish. In this ongoing study,

Atlantic salmon parr (initial weight: 8.4g) were fed 5, 10, 15, 20% solvent extracted camelina meal (SECM), 50% and 100% camelina oil diets. There were 21, 200 L tanks, with 50 fish per tank were raised at 12 °C in a flow through system for 16 weeks. Weight gain, feed consumption, protein efficiency ratio, specific growth rate (SGR) and feed conversion rate (FCR) will be determined at 0, 4, 8, 12, and 16 weeks. Carcass and gut samples will be taken at week 0, 8 and 16. Carcass analysis includes crude protein, lipid, dry matter and ash. Gut histology analysis includes length, width, and area of villi; width of lamina propria; number of goblet cells; and size of supranuclear vacuoles. There was no significant difference on growth performance among all the diets at week 4. However a decline trend in weight gain was seen from 5 to 20% SECM.

Effect of surface disinfection during water hardening on survival of eggs of Arctic charr (*Salvelinus alpinus*) and Atlantic salmon (*Salmo salar*)

Presenting Author: Zeyu Zhang, Dalhousie University - Faculty of Agriculture

Disinfecting eggs soon after fertilization has the potential advantage of killing intracellular pathogens, but runs the risk of also killing the ova. To assess how the margin of safety differed between species of fish and disinfectant type, survival of eggs from both Arctic charr and Atlantic salmon were assessed following treatment with either an iodophore (Ovadine 100 ppm for 10 minutes) or hydrogen peroxide (1.5% for 2 minutes). Each trial compared three disinfection timings: 0, 30 and 120 minutes post-fertilization against a control group. Thereafter, eggs were incubated at 6-8 °C for several weeks. At the 'eyed' stage, the eggs were shocked and the percent survival was determined. Arctic charr egg survival was significantly ($p < 0.05$) reduced by H_2O_2 disinfection at 0, 30 and 120 min post-fertilization (13, 26 and 30% survival) compared to controls (45%). Similarly, Atlantic salmon egg survival after H_2O_2 disinfection was also decreased by up to 39%. By contrast, Ovadine disinfection had no effect on the survival of salmon eggs and only reduced charr egg survival immediately after fertilization. Survival of both charr and salmon eggs disinfected with either Ovadine or H_2O_2 at 30 and 120 mins post-fertilization was similar ($P > 0.05$). Clearly, Ovadine was safer than H_2O_2 , and the literature indicates iodophores are more effective disinfectants than hydrogen peroxide.

Biology Abstracts

Oral Presentations

Abstracts listed in alphabetical order by last name of presenting author.

Analysis of clavulanic acid production in *Streptomyces flavogriseus* ATCC 3331

Presenting Author: Susan Banfield, Memorial University of Newfoundland

Approximately 500 species of *Streptomyces* have been described so far, and many species in this genus of Gram positive bacteria are known to produce small molecular weight metabolites that function as antibiotics. In the past century antibiotics have become indispensable to modern medicine and have extended the lifespan of humans substantially. Clavulanic acid (CA) is one such clinically important metabolite that is industrially produced by fermenting *S. clavuligerus*. CA is a weak antibiotic by itself but it has potent β -lactamase inhibitory activity. β -lactamases are enzymes that inhibit the action β -lactam antibiotics leading to antibiotic resistance. Combinations of CA with β -lactam antibiotics are used for treating infections caused by bacteria possessing β -lactamases. Although initially discovered to be produced by *S. clavuligerus*, recent genome sequencing projects have suggested that several other *Streptomyces* species have putative CA biosynthetic capabilities, including *S. flavogriseus* ATCC 3331. This species carries the CA gene cluster in its genome, including all the genes comprising the CA gene cluster in *S. clavuligerus*. The aim of this project is to determine if *S. flavogriseus* ATCC 3331 can actually produce CA under laboratory conditions and to conduct preliminary genetic manipulations with this organism.

Identification of vital stains with utility for investigations of *Loma morhua*

Presenting Author: Hilary Byrne, University of New Brunswick - Fredericton

Loma morhua is a microsporidian parasite that infects Atlantic cod (*Gadus morhua*) throughout their home range. This parasite causes reduced growth rates and mortalities and has been a limiting factor in the establishment of cod aquaculture as a viable industry in many regions. In an effort to gain further knowledge on the life history of this parasite, the need arose for development of tools to study *L. morhua*. One basic tool that is critical for all aspects of empirical study is the ability to discriminate live from dead spores. This is necessary for preparation of defined inoculums to establish experimental infections, determination of optimal parasite storage conditions in the laboratory, and for subsequent studies aimed at investigating parasite inactivation. A panel of fluorescent stains were investigated individually and in combination for utility in determining spore viability: Calcofluor White 2MR (chitin stain), Syto® 9 (cell-permeant stain), Sytox Green (vital stain), and Propidium Iodide (vital stain). A fluorescence assay employing Propidium Iodide and Syto® 9 was judged most effective in elucidating spore viability. Spore survival was assessed using these fluorescent stains under different storage conditions used commonly in the laboratory. Spores survived storage at 4°C both with and without antibiotics. However, spores did not survive storage at -20°C or -80°C either with or without the cryoprotectant glycerol. Determining spore viability over time will be crucial for identifying optimal storage conditions for maintenance of parasite stocks for lab investigations. Studies investigating methods of parasite inactivation will be pursued with enthusiasm using this new fluorescence assay.

The social structure of beluga whales (*Delphinapterus leucas*) in the St. Lawrence River population

Presenting Author: Katelyn Cherwonick, Saint Mary's University

The St. Lawrence River beluga whale (*Delphinapterus leucas*) population is geographically and reproductively isolated from other beluga populations. Little is understood about this small endangered population. Therefore learning the population dynamics and social structure of the St. Lawrence belugas is of great interest. My work

involved genotyping DNA of beluga whales in the St. Lawrence by amplifying 22 microsatellites from samples ranging between the years 2008 to 2011. Genetic relatedness and network analysis were performed from the resulting allele scores of 222 individuals. The main objective of this study was to uncover information on the social structure of the St. Lawrence River beluga population, and in particular to establish if the population follows a matrilineal social structure, similar to other intelligent cetaceans. The results indicate that the population displays clustering, with females showing significantly more clustering than males, and that males have higher connectivity than females. These findings suggest that the St. Lawrence River beluga population does follow a matrilineal social structure. Future studies will combine this network data with field observation as a means to identify how the genetic clusters reflect habitat-use patterns and differential exposure to anthropogenic disturbances in the area.

The effects of progesterone on steroid production and gene expression in the male and female fathead minnow (*Pimephales promelas*) gonad

Presenting Author: Yasmin Chishti, University of New Brunswick - Saint John

Progesterone (P4) is a precursor for steroid hormones and regulates vertebrate reproduction and development. P4 effects in mammals have been well described; however, less is known about its action in teleost fish. The objective of this study was to examine the effects of P4 in the testis and ovaries of mature fathead minnows (*Pimephales promelas*) (FHM) on steroid hormone production and to identify genes regulated by P4. Fathead minnow (FHM) testis explants were treated *in vitro* with P4 (10-8 M and 10-6 M) for 6 and 12 hours, and FHM ovary explants were incubated with P4 (10-6 M) for 3, 6, and 12 hours. In the testis, P4 significantly increased testosterone (T) production but did not affect 11-ketotestosterone (11KT). E2 production in the ovary was highly variable and was unaffected by P4. In the testes, microarray analysis revealed that cell pathways involving insulin growth receptor 1 signaling and prostaglandin were significantly depressed in the testis with 10-6 M P4 (12 hours). Real-time PCR revealed that genes related to steroid metabolism were not significantly affected by P4, nor were steroid receptors (androgen and estrogen receptor). The data suggest that pre-existing molecular machinery may be involved in the increased production of T rather than de novo expression of steroid-related transcripts and receptors. This study improves our understanding of P4 action in the mature FHM gonad and characterizes gene regulatory network that are P4-responsive.

Biological Evaluation of Metal-Containing Compounds to Assess Potential for Use in Photodynamic Therapy

Presenting Author: Julie Colpitts, Acadia University

Current cancer therapies have many limitations; effective drugs often cause significant systemic toxicity or are prohibitively expensive. Research is currently being conducted to develop chemotherapeutic agents which are activated to express their cytotoxic effects, thereby reducing systemic toxicity and cost as a larger number of cancers can be targeted with a single drug. One such treatment is known as photodynamic therapy (PDT), which uses light to activate the drugs. Current use of PDT is limited by available drugs; metal-containing compounds are synthesized in the McFarland lab for optimal clinical relevance in PDT. To assess the effectiveness of each compound as a potential agent for PDT, a series of relatively simple biological experiments was performed. Such experiments used a variety of techniques and procedures to evaluate the presence and method of DNA binding, light-induced damage to DNA, enzyme targeting, uptake mechanisms, as well as cytotoxicity and photocytotoxicity of each compound in two cancer cell lines. A new technique to determine the mechanism of action (necrosis vs apoptosis) of cell death was employed to assess its value as a potential screening procedure for photodynamic compounds, and although it was informative, it was deemed impractical as a screening method. Experiments were implemented as a means for understanding the intricacies of each compound and to judge which compounds should be sent on through the resource intensive process of *in vivo* experiments, leading eventually to human clinical trials. Several compounds deemed successful by *in vitro* experimentation have now been used in a PDT model in mice with varying degrees of success. This process has

led to an increased emphasis on complexity in models used to pre-screen effective PDT agents as *in vitro* results do not necessarily predict *in vivo* activity, and has therefore been extremely important to developing methodology in the McFarland lab.

The variation of leukocyte counts and heterophil:lymphocyte ratios with adult condition and provisioning rates in breeding European starlings (*Sturnus vulgaris*).

Presenting Author: Allison Copan, Saint Mary's University

Parental care requires substantial energy to be allocated towards offspring that would normally be used to maintain the adult's own health. Female birds tend to provide most of the care, but a male's assistance increases fledging success. This stress can take its toll on the bird with decreases in body condition. White blood cells (WBC) increase in response to both stress and disease, and a high heterophil:lymphocyte ratio in particular indicates stress in birds. This study aims to examine how WBC counts and heterophil:lymphocyte ratios vary with adult condition and offspring provisioning rates in breeding European starlings (*Sturnus vulgaris*). European starlings are a facultatively polygynous passerine that typically exhibits social monogamy and bi-parental care. It was predicted that WBC counts and heterophil:lymphocyte ratios would be negatively correlated with adult condition. Also, it was examined whether these two measures of stress are correlated with parental provisioning effort. WBC counts were not correlated with body condition or provisioning, but males tended to have lower counts than females. More results will be discussed.

Recovery of Fish Health after Closure of a Bleached Kraft Pulp and Paper Mill on the Miramichi River (Canada)

Presenting Author: Sophie Cormier, University of New Brunswick - Fredericton

In Canada, the potential impacts of pulp and paper mill effluent on fish have been studied through a regulated and cyclical environmental effects monitoring (EEM) program. This program detected effects on fish exposed to effluent from a bleached kraft pulp and paper mill discharging effluent in the Miramichi River (New Brunswick, Canada). The present study examined whether these effects disappeared after the mill closed its pulping operation and reduced effluent discharge in 2004 and then closed altogether in 2007. Two sentinel species studied in the EEM cycles, the mummichog (*Fundulus heteroclitus*) and threespine stickleback (*Gasterosteus aculeatus*), were resampled in 2012 using the same method, time and sites as previous EEM cycles. During full effluent discharge in 2003, reproduction (gonad weight) and energy storage (liver weight) in mummichog were reduced compared to a reference site. In 2006, after the effluent discharge was decreased, energy storage did not differ between sites in mummichog, but the reproduction impact endured and growth (size-at-age) was reduced. In 2012, reproduction did not differ between sites. For sticklebacks, growth and reproduction were reduced in females relative to the reference site in 2003 but not in 2006 or 2012. Energy storage was reduced in both sexes of stickleback exposed to the reduced effluent discharge in 2006 but in 2012 no differences between sites were observed. These results support conclusions of the EEM program that the pulp and paper mill effluent was having negative sublethal impacts on fish and that recovery had occurred within 5 years of the mill closing.

Thermal tolerance of Atlantic salmon and the effects of thermal cycles

Presenting Author: Melanie Gallant, Mount Allison University

Atlantic salmon, *Salmo salar*, is a commercially and recreationally important fish; however, there is relatively little known about their thermal tolerance in their natural environment. Fish are greatly affected by changes in surrounding water temperatures and we know that the Miramichi River, NB reaches exceptionally high water temperatures during the summer months, exceeding the putative lethal limit for Atlantic salmon. In the present study, we examined the effects of natural thermal cycles on the critical thermal maximum of Atlantic salmon

and cellular and physiological markers of stress and recovery such as the induction of heat shock proteins (HSPs), plasma cortisol levels and changes in red blood cell morphology. Juvenile salmon were exposed to thermal cycles based on recent water temperature data from the Miramichi River. For the critical thermal maximum, fish were either maintained at control conditions or subjected to a single thermal cycle followed by an increase in water temperature at a rate of $0.33^{\circ}\text{C} \cdot \text{min}^{-1}$. The thermal cycle was 34 h and reached a peak water temperature of 26°C . There was no significant effect of this thermal cycle on the critical thermal maximum of Atlantic salmon; however, condition factor and critical thermal maximum were positively correlated. Preliminary data suggests that there is an increase in red blood cell surface area and plasma cortisol concentrations by the time the fish have reached the peak temperature in the thermal cycle. I am currently measuring red blood cell, heart, liver and muscle HSPs prior to and during recovery from the thermal cycle.

The Effects of Fungal Endophytes on Physiological and Morphological Traits in *Picea glauca*

Presenting Author: Loay Jabre, Acadia University

Endophytes are organisms that live symbiotically within plants. The two have been intermingling for millions of years with relationships varying from mutualistic to antagonistic. Fungal endophytes can produce secondary metabolites (e.g. rugulosin) with anti-herbivory characteristics providing protection for their host and suggesting an eco-friendly solution to insect pests for the forest industry. Previous research also shows that endophytes can affect their hosts' physiology and morphology. This study examined the effects of three fungal endophytes on photosynthetic rate, stomatal conductance and leaf/shoot morphology of 24 white spruce genotypes. In vivo gas exchange measurements were conducted using an 'open flow gas exchange system' to survey physiological responses. Tree height and stem volume measurements were recorded along with needle length and width to survey morphological responses. Effects of treatment were strongly influenced by endophyte strain and white spruce genotype. Responses varied between positive and negative, with one endophyte strain increasing needle width and stem volume. The same strain also improved stomatal conductance when measured under decreasing light levels. The different genotypes responded in a variety of ways to treatment and showed marked differences in their characteristics. These results, combined with entomological data, can be useful in determining which spruce genotypes and endophyte strains are most suitable for use in the forest industry.

The effects of remote biopsy sampling on long-finned pilot whales (*Globicephala melas*) in Pleasant Bay N.S.

Presenting Author: Katie Kowarski, Dalhousie University

A long-term photo-identification study on long-finned pilot whales (*Globicephala melas*) off Pleasant Bay N.S. expanded to include remote biopsy sampling in 2006 via airgun and 2010-2012 via crossbow. The present study aims to investigate any negative effects this more invasive technique may have on the animals. During sampling, each shot was recorded with video and later analyzed with the reaction of the target individual ranked on a scale of 1-4, where 1 was no response, 2 was a low level response, 3 was a moderate response, and 4 was a strong response. In the 2012 field season before and after sampling group behaviour was recorded and wound healing was opportunistically observed. Short term responses to sampling were found to be mostly low level with no strong responses observed. No evidence to indicate medium-term effects was found as sampling was rarely followed by a change in group behaviour and whales were easily re-approached by vessels post sampling on numerous occasions. Wounds observed post sampling showed no evidence to indicate infection or other problems with healing. This study found no indication that remote biopsy sampling has detrimental effects on long-finned pilot whales; therefore the method may be continued on the Pleasant Bay population.

Evaluation of Falconry and Lethal Ammunition as a Biological Control Method

Presenting Author: Ashley Lewis, Dalhousie University – Faculty of Agriculture

Within the past few decades, the use of predator birds to disperse scavenging birds has been mostly limited to airports and to a lesser extent, landfills and agricultural settings. In the livestock industry, uncontrolled birds can cause major problems. Feed meant for livestock pose as an easy food supply for birds, feces contaminate food and water supplies, and many birds can carry zoonotic pathogens that pose a threat to humans and livestock. A number of control methods exist in an attempt to deter birds; however research into their effectiveness is limited. Falconry offers a ‘natural’ way to control birds by using the scavenging bird’s instinct to stay away from possible. Research into this use of falconry in an agricultural setting is limited, and this experiment poses to explore this opportunity. A Harris Hawk was flown every two weeks for a 16 week period around the Ruminant Animal Center of the Dalhousie University. Approximately one a month, some birds were eliminated using a pellet gun. Daily counts and point transects were then taken to assess the population of two common bird species, pigeons and starlings. Data was also collected on the surroundings such as temperature; wind speed and precipitation in order to assess other variables that may affect bird presence and location. Results showed that there was a decrease in the presence of the pest species; however this decrease was only significant for the first few days of each trial. This was amplified when the use of lethal control, and birds stayed away from the farm for an extra day on average. This suggests that while the hawk was effective in deterring birds for a short amount of time, habituation happened within a few days. The use of lethal force can increase the amount of time the birds take to re-habituate. Implications of this experiment suggest that this could potentially be a useful method in an agricultural setting if intervals of the hawk’s flight are constant. The data suggests that it may increase effectiveness if the hawk is flown every second or third day as opposed to once every two weeks. Overall, bird control requires a dynamic solution and falconry could be a valuable part of it.

Assessing pathogenicity and chemical sensitivity of *Fusarium* spp. infecting carrots.

Presenting Author: Michelle MacDonald, University of Prince Edward Island

Fusarium crown rot, formerly a storage disease of carrots, was present in Prince Edward Island (PEI) fields in 2011 and 2012. Crown lesions on carrots resulted in rejection rates as high as 60-70% during grading for storage in 2011. Infecting organisms were identified as *F. avenaceum* and *F. oxysporum* in samples obtained from field and storage. Research was conducted to assess the pathogenicity and chemical sensitivity of isolates of each species. In a replicated trial conducted according to Koch’s postulates, all isolates (10) of *F. avenaceum* were highly pathogenic to carrot tissue and all isolates (4) of *F. oxysporum* were weakly pathogenic in comparison to *F. avenaceum* and treatment controls (uninoculated). Five fungicides including Bravo (chlorothalonil), Manzate (mancozeb), Polyram (metiram), Pristine (pyraclostrobin/boscalid) and Quadris Top (azoxystrobin/difenoconazole), were applied in a replicated field trial containing nine treatment schedules (eight with fungicide plus one control). Field ratings indicated that all treatments significantly decreased the prevalence of *Sclerotinia* rot and *Alternaria* leaf blight. Data collected post-harvest indicated that none of the treatments significantly decreased *Fusarium* crown rot in the field. Isolates were tested for fungicide sensitivity in an amended agar assay, using six concentrations of the five fungicides as well as technical grade difenoconazole, fludioxonil, and thiabendazole. EC₅₀ values (the concentration at which fungal growth is inhibited by 50% of the control) were determined for each isolate. Preliminary analysis of isolates indicated growth suppression occurred when *F. oxysporum* was treated with Quadris Top, difenoconazole, and thiabendazole and when *F. avenaceum*, the organism of greater pathogenicity, was treated with thiabendazole and fludioxonil. Broad spectrum responses among *F. avenaceum* isolates were evident for Pristine and Quadris Top, with growth suppression in six out of ten isolates and four out of eight isolates, respectively. Both isolates exhibited insensitive responses when treated with Manzate.

Applying the Reference Condition Approach to Remediated Streams in Cape Breton Island, Nova Scotia, Canada.

Presenting Author: Kristen MacLeod, Cape Breton University

Our lab has developed a Reference Condition Approach (RCA) model which was developed and applied in Cape Breton Island (CBI) in Nova Scotia, Canada. Initially, >1000 catchment areas of first to fourth order streams across CBI were delineated, and information about forestry, transportation, mining, residential, and other industry was used to determine a Human Activity Gradient (HAG). We then sampled macroinvertebrates in 40 reference streams at the lower end of this HAG, and the biota at the sites was correlated with landscape-scale natural environmental conditions, and used correlation as a predictive model to assess remediation of four sites that were exposed to decades of groundwater effluent from former coal mines. We consider the deviation of each remediated site from the predicted biota if the site is in reference condition as an inverse measure of the effectiveness of the remediation. This approach provides a clear test of whether or not remediation that makes sense in theory has a measureable effect on ecosystem health.

Potential nocturnal pollinators of lowbush blueberry

Presenting Author: Paul Manning, Dalhousie University – Faculty of Agriculture

Lowbush blueberry is a valuable crop of eastern North America that is dependent upon insect-mediated cross-pollination for production. A recent study showed that nocturnal insect activity may contribute significantly to lowbush blueberry fruit-set. Using light traps, and sweep-netting we captured nocturnal insects in a blueberry field. Through removal of pollen from insects and subsequent pollen identification, we found that a large diversity of nocturnal insects carry blueberry pollen. In addition to wild bees, conservation of nocturnal insect diversity could help sustain yields of lowbush blueberry.

Survey of Fouling Communities of Northern Nova Scotia

Presenting Author: Grace Phillips, Saint Francis Xavier University

Biofouling is the accretion of unwanted biological material on a submerged surface. In the marine environment biofouling occurs first by the formation of a biofilm, which facilitates the adhesion of larger fouling organisms. Biofouling is an economic burden for marine industries of all types, and threatens the security of certain ecosystems and their services through the introduction of invasive species. Previous attempts to manage biofouling relied upon toxic paints, the use of which is now prohibited. Newer, environmentally neutral solutions proposed to combat biofouling include biomimicry and naturally secreted fouling deterrents. Fouling-release coatings, made of polymers, are also a potential solution as they increase the ease of biofilm removal. The development of regionally specific anti-fouling solutions requires both lab and field-testing. I have conducted a baseline study to determine the nature of the fouling community in northeastern Nova Scotia and to characterize suitable test sites for candidate anti-fouling solutions. This research also aimed to investigate the potential environmental factors influencing the development of the biofouling community, and to determine which locations were suitable for the testing of candidate solutions. Four harbours in northeastern Nova Scotia were selected. At each site, seven PVC plates holding microscope slides were suspended below the water for six consecutive weeks, with weekly samplings to record fouling development. Temperature, light and flow were recorded at each site for one-week periods. Temperature differences between all sites were small while light intensity varied significantly among sites. Fouling patterns varied between locations, and the predominant fouling organisms also differed among sites: the invasive solitary tunicate *Ciona intestinalis*, the colonial forms of another species, potentially *Botrylloides violaceus*, and the green alga *Ulva* sp. dominating. It appears that variations in water temperature and light between plates at Port Hawkesbury did not affect the development of

Ciona intestinalis. It may be concluded that significant differences exist between chosen locations, and these differences can be exploited for future field-testing of potential antifouling solutions targeted to specific taxa.

Sequencing the Male Control Region of *Modiolus modiolus*

Presenting Author: Amy Powell, Acadia University

It has been proposed that the mitochondrial control region of marine mussels (Family Mytilidae) could play a role in sex determination. In most animals, the control region plays an important part in the regulation of transcription and replication of genes, but is not known to perform any other function. Marine mussels have a unique system of mitochondrial DNA inheritance, called doubly uniparental inheritance (DUI). In this system, two mitochondrial genomes exist – the F genome, which is female-transmitted, and the M genome, which is male-transmitted. The objective of my project was to amplify and sequence the control region from the male mitochondrial genome of *Modiolus modiolus*, commonly known as the horse mussel. Initially, DNA from *M. modiolus* sperm was isolated, and the COI and 16S rRNA genes were amplified using PCR. These genes are known to flank the *M. modiolus* control region and surrounding genes, based on female *M. modiolus*. Partial COI and 16S rRNA sequences were used to design primers for the male control region and surrounding DNA. Nine primers were designed to target both sides of the genome, between COI and 16S rRNA. Using long PCR, three different pairs of primers amplified a region of approximately 10 kb, which is close to the size of the known female control region and surrounding genes. Further sequencing will be required to determine if any of the samples contain the male control region. Analysis of the control region sequence will help provide valuable information toward further exploration of its function and relatedness to other Mytilidae mussels.

Microsatellite Analysis of Population Density of Newfoundland Black Bears (*Ursus americanus hamiltoni*) on the Northern Peninsula

Presenting Author: Sarah Prednam, Memorial University of Newfoundland

The Northern Peninsula population of insular Newfoundland black bears (*Ursus americanus hamiltoni*) was investigated with sixteen microsatellite loci isolated from three taxa within the order Carnivora (Mustelidae, *Ursus* and *Canis*) to estimate population density and genetic diversity. Of ninety-five samples taken at 23 traps between June and October of 2011 by non-invasive sampling of hair, 16 individuals were identified. Twelve of these were males, and three were female. Although microsatellite analysis does not require much DNA, many samples did not provide usable DNA quantities for microsatellite analysis, a common issue with non-invasive sampling due to the type of samples that it yields. It was found that a multiplex method of microsatellite amplification provided more dependable results than analysis of loci singly. There were microsatellite null alleles present at locus G10C, but no other loci showed any evidence of null alleles or other microsatellite anomalies, such as, large allelic dropout. The population was determined to be in Hardy-Weinberg equilibrium in that there were no significant homozygote excesses or deficiencies at any of the loci. The population density for the test area was determined to be 1 individual for 107.8km². The samples were also subjected to mitochondrial cytochrome b sequencing to ensure that they were in fact from black bear, which all samples were. The population has one variable site in a 346 base pair segment of the cytochrome b gene, a C/T transition. This study is part of a 5-year study of the Northern Peninsula, Baie Verte Peninsula, and Bonivista Peninsula to revisit the license restrictions.

Relating heterogeneity in electric signals to electric organ anatomy in adult gymnotiform fish *Brachyhypopomus gauderio*

Presenting Author: Jessica Prendergast, Cape Breton University

Nocturnal gymnotiform fishes produce an electric field and use distortions in this field to navigate and electrocommunicate. A detailed characterization of this electric field and an understanding of how it is controlled by the fish are needed to better understand how information from the environment is encoded in the electric field distortions. The behavioural and electric signal tractability of *Brachyhypopomus gauderio* make it an ideal model for characterizing the electric signals and their anatomical source. For instance, the electric field projects a biphasic waveform when measured approximately 10 cm away from the fish's body, yet when this electric field is measured within 1 cm or less of different regions of the body, the local electric signal pattern is heterogeneous. In this study, I characterized a detailed map of the electric signal's heterogeneity and its electric organ anatomical correlates along the rostrocaudal axis of a male and a female *B. gauderio*. Local electric signal's waveforms measured at 1 cm intervals along the female fish's body revealed a transition from triphasic to inverse biphasic, and then to the characteristic biphasic pattern within the body's mid region, while the male's pattern showed a more gradual change in waveform along the body's mid region. Rostrocaudal differences in electric organ anatomy, which could account for the electric signal heterogeneity, were characterized using histochemically-stained sections of sequential 0.5 cm tissue segments to visualize changes in the electrocytes, the cells of the electric organ. Preliminary results revealed changes in electrocyte dimensions along the female's rostrocaudal axis.

Body condition of juvenile American lobsters, *Homarus americanus*, living on mud and cobble bottom

Presenting Author: Feng Tang, University of New Brunswick - Saint John

Juvenile American lobsters, *Homarus americanus*, prefer cobble bottom for settlement and early development but new evidence suggests they may also exploit mud bottom. However, because of differences in availability of food and shelter, body condition of juvenile lobsters may differ in the different bottom types. This may be reflected in difference in biochemical indicators and morphometric measurements. We used cobble-filled cages to sample juvenile lobsters on cobble and mud bottom in Maces Bay, Bay of Fundy, and compared the body condition of lobsters on each substrate. Juvenile lobsters living on different substrates had similar body mass when standardized for carapace length. We are currently examining the body condition of these lobsters by measuring the triglyceride content, the RNA/DNA ratio, as well as the total protein content of their abdomen. This study will generate new information concerning the body condition of juvenile lobsters on mud bottom relative to their preferred cobble substrate, which will improve our understanding of the potential contribution of mud bottom to recruitment of the species in the Bay of Fundy.

Cranberry (*Vaccinium macrocarpon*) extract inhibits matrix metalloproteinase expression in aortic smooth muscle cells by affecting key cell signaling pathways

Presenting Author: Amanda Thomas, University of Prince Edward Island

A whole cranberry (*Vaccinium macrocarpon*) extract was shown to inhibit matrix metalloproteinase (MMP-2 /MMP-9) activity (assessed by zymography) in A7R5 aortic smooth muscle cells *in vitro*. Cranberry extract [CE] decreased cellular viability ~10% post 6 hours of treatment. Treatment of A7R5 cells with 100 µg/mL cranberry extract for 6 hours resulted in increased expression of TIMP-1 & TIMP-2 protein levels [inhibitors of MMPs] and decreased protein expression levels of EMMPRIN [an activator of MMPs]. In response to CE treatment, increased expression of JNK-1, JNK-2, pJNK-1, pJNK-2 & p38 protein levels occurred. No change in ERK-1, ERK-2 and pERK-1 protein levels (assessed by Western blot analyses) occurred in response to cranberry treatment for 6 hours. However, a decrease in p-p38 and in p-ERK-2 protein expression levels was noted in response to CE treatment. Treatment of A7R5 cells with CE, for 6 hours, also resulted in no apparent

change in either AKT, p-AKT, or P-I-3 kinase p85 protein level expression, but a slight decrease in p110 protein level occurred. Furthermore, treatment of A7R5 cells with CE (100 µg / mL) for 6 hours resulted in inhibition of FAK & p-FAK protein expression levels. These results suggest that a whole cranberry extract has the ability to inhibit the expression of MMP-2/-9 activity in A7R5 aortic smooth muscle cells and suggests that this occurs via alterations in the expression of key protein modulators of MMPs' expression and also involves changes in signal transduction pathways.

Fitness Effects of Mutations in Novel Stressful Environments

Presenting Author: Meg Thomas, Dalhousie University

The effect mutations have on fitness varies depending on the environment in which the mutation arose as well as the environment in which the fitness is being tested. By measuring fitness, genome by environment interactions can be elucidated and mutational parameters can be examined such as mutation rate, the distribution of effect, and the proportion of beneficial mutations. Mutation accumulation (MA) is a relatively fast way to obtain de novo mutations (that is, mutations that were not previously present in the organism) by repeatedly reducing a population to one individual, allowing it to recover, and then reducing it again, etc. In this project, the budding yeast *Saccharomyces cerevisiae* lineages that had either undergone mutation accumulation in a stressful environment or a benign environment were compared to the ancestor when grown in media acidified by acetic, lactic, or hydrochloric acid. Initial results show that in all acidic environments, the stress-MA lineages have a lower average fitness than normal-MA lines and both MA types had a lower fitness than the ancestor. There is some degree of genome by environment interaction for both MA treatments where the mutations in a single yeast lineage have different fitness effects depending on the acid environment. Interestingly, only the normal-MA lineages had beneficial mutations for lactic acid, while only the stress-MA lineages had beneficial mutations for acetic acid. These results imply that the mutations originating in a stressful MA treatment versus a benign MA treatment are different and consequently have varying effects in novel stressful environments.

Duration of stay and movements of Semipalmated Sandpipers during migratory stopover in the upper Bay of Fundy

Presenting Author: Abigail White, Mount Allison University

Semipalmated Sandpipers (*Calidris pusilla*) use the upper Bay of Fundy as a migratory stopover site during their annual fall migration from their Arctic breeding grounds to their South American wintering grounds. While in the area they feed extensively on prey inhabiting intertidal mudflats, doubling their weight from roughly 20 to 40 g. Historically it was thought that individual Sandpipers remained in the Bay for approximately 2 weeks and moved little except between preferred roosting and foraging sites. However, it is now known that movements are more frequent. Similarly, the current diet of these birds differs from information obtained in the 1970s, and there are clear dietary differences between regions of the Bay (Chignecto Bay & Minas Basin). Effects of these changes on length of stay in the two arms of the Bay are unknown. Further, it is unknown whether factors influencing movement and habitat use, which links to diet, have changed in recent years. To address this knowledge gap, in summer 2012 we used radio telemetry to track movements of 44 birds throughout the Bay. We collected prey samples from important mudflats and measured physical characteristics of sites that may influence the extent to which birds use them. Average length of stay has increased in both arms of the Bay to at least 19 d, with all but 4 birds remaining longer than 2 weeks. Our data suggest that birds no longer fatten at a steady rate or leave as soon as they have gained sufficient mass. Use of high tide roosting sites is best predicted by site safety. At low tide, distance to nearest roosting site, site safety and prey availability predict foraging site use. Models are generally consistent among arms of the bay, though the importance of particular prey species varies with location.

Biology Abstracts

Poster Presentations

Abstracts listed in alphabetical order by last name of presenting author.

DNA barcodes reveal cryptic diversity in Glaucophytes

Presenting Author: Jasmine Chong, University of New Brunswick - Fredericton

Our study is the first molecular investigation of diversity within Glaucophytes (the “blue-green” plants), the earliest divergent lineage within the supergroup Plantae (Glaucophyta, Chlorophyta, and Rhodophyta). Addressing the branching history of Plantae is critical to understand one of the most relevant moments of eukaryotes evolution: the emergence of the autotrophic life-style. Diverse molecular and cellular evidence suggests that Glaucophytes represent the earliest divergent branch within the Plantae, but this scenario is still contentious and further investigations are required. One of the areas that require significant efforts to gain insights into Plantae evolution is the study of Glaucophytes. Molecular studies of these species are limited, and an evaluation of their inherent diversity has yet to be completed. We evaluated three different DNA barcodes to explore “diversity” between Glaucophyte strains obtained from several culture collections and novel isolates. The analysis of the plastid gene *psbA* and the internal transcribed spacer (ITS) region revealed genetic distances between strains of the “same species” comparable to interspecific distances reported for other algal lineages. DNA barcoding results unveiled cryptic genetic diversity between strains deposited as the same species. Our approach has identified potential useful DNA barcodes to explore species diversity within this rare but evolutionary important algal group.

An analysis of forelimb musculature in the soldier caste of *Kladothrips intermedius*

Presenting Author: Greg Furey, Memorial University of Newfoundland

An individual that performs a behavior that harms its fitness in order to aid the fitness of a conspecific (i.e. altruism) is a challenge to explain via evolutionary theory. Darwin spoke directly, in the Origin of Species, of the ‘special difficulty’ that insects with altruistic castes presented for his theory of evolution via natural selection. In 1964, William Hamilton provided us a framework that brought the observation of altruism into line with evolutionary theory: the inequality $r b > c$. The fitness cost to the altruist is represented in the formula by c . Any reduction of this cost would make the evolution of the behavior in question more likely to evolve. My taxonomic focus is *Kladothrips intermedius*. This is an Australian gall-inducing thrips (a small insect, <2 mm long) species with an altruistic caste called soldiers. These self-sacrificing individuals possess enlarged forelimbs used for defense against invertebrate colony invaders. It has been presumed that these forelimbs are energetically costly to produce and that the vulnerability of the colony to invasion wanes over time. Queens of many social insects are known to self-cannibalize flight muscle and to redirect this material to reproductive organs, and perhaps soldiers are doing something similar with forelimb musculature. I utilized histological techniques and also polarizing light microscopy to observe muscle development in soldiers of various ages to test the hypothesis that: soldiers are reallocating forelimb materials and energy as the risk of colony invasion subsides. Also I have compared my results from soldier caste musculature to the musculature of the disperser caste as a control.

Food web comparison and analysis of an immature vs. a mature temperate salt marsh

Presenting Author: Lindsey Gillard, Dalhousie University

Salt marshes are productive and valuable ecosystems, providing numerous ecosystem goods and services to surrounding coastal regions. They serve as a nursery and feeding ground for commercially viable fish species

and migratory birds, as well as provide a habitat for many micro- and meiofaunal species that together form and sustain an elaborate food web. Salt marshes are threatened by various disturbances such as climate change and coastal development, leading to their global loss and/or degradation, to which the full effects on overall community trophic structure are not well understood. In Nova Scotia, approximately 80% of salt marshes are degraded, emphasizing the imminent need for proper restoration efforts. A high resolution food web was assembled for an immature salt marsh in Windsor, Nova Scotia and compared to a pre-existing food web for a mature salt marsh in Chezzetcook, Nova Scotia to analyze the differences and similarities in their respective community structures and trophic dynamics. Results indicated that both salt marshes contained similar species in each zone (mudflat, low, middle and high marsh); however the species diversity of the mature salt marsh (Chezzetcook) was greater than the younger marsh (Windsor). Conversely, the young salt marsh exhibited greater meiofaunal abundance despite the low diversity. Assembling a low resolution web for Windsor highlighted the importance of meiofauna to the energy flow and the structure of the ecosystem, demonstrating how their exclusion resulted in an inaccurate representation of these complex communities. The high resolution food web revealed remarkably similar trophic structure and energy flow of these immature versus mature salt marshes, offering insight to the recovery and restoration process of degraded coastal salt marsh ecosystems. If physical and hydrological conditions favour salt marsh formation and development, as demonstrated in Windsor, these valuable ecosystems will mature to a functioning state in a relatively short time frame.

Photosystem II inactivation and repair in the brown tide algae *Aureococcus anophagefferens*

Presenting Author: Ian Hamilton-Burge, Mount Allison University

Photosystem II photooxidizes water, supplying electrons to the electron transport chain in photosynthetic organisms. Photosystem II is, however, susceptible to photoinactivation, which must be countered by a repair system that replaces the PsbA subunit of Photosystem II. An increase in light or inhibition of the repair process will result in photoinhibition, decreasing the quantum yield of photosynthesis. We investigated photoinactivation and repair in the brown algae *Aureococcus anophagefferens*, a marine pelagophyte that forms non-toxic blooms along the eastern coast of the United States and Mexico, outcompeting other phytoplankton species and disrupting fisheries. We subjected *Aureococcus* to upward light shifts, using chlorophyll fluorescence to track photoinactivation, and protein immunoquantitations to track Photosystem II protein turnover. *Aureococcus* showed a moderate susceptibility to photoinactivation of Photosystem II, comparable to its ecological competitors the diatoms. Under low to moderate light *Aureococcus* thus suffered only slow photoinactivation, but under a shift to near-surface light levels *Aureococcus* used rapid protein turnover to counter photoinactivation. In bloom-forming algae like *Aureococcus*, understanding Photosystem II function across fluctuating light provides insight into future ecological changes in blooming patterns.

Rapid characterization of anoxic plankton blooms using molecular techniques

Presenting Author: Travis James, University of Prince Edward Island

Estuarine anoxia is a common problem in many areas of Prince Edward Island. Blooms are observed every year and display a characteristic milky white colour and smell of hydrogen sulfide. This has been attributed to heterotrophic bacteria, but no research has been done to characterize the groups or species associated with these blooms. Water samples were collected from blooms in nine estuaries during the summer of 2012. DNA was extracted from the organisms in these blooms and sequencing of the 16 and 18s rDNA genes is being used to identify the organisms involved. Samples from each site were collected for analysis with flow cytometry which was used to preform cell counts and determine cell density within the water column. We have also used flow cytometry to differentiate groups based on natural pigments, size, complexity and by the use of specific stains such as BacLight Green. In order to monitor the status of water quality in the estuaries over time, a YSI 6600 sonde was used to take measurements of physical water chemistry, turbidity and chlorophyll content. The chlorophyll reading were compared to a number of water samples which were collected and processed using established HPLC methods of measuring chlorophyll. The results between the two methods were not

comparable and it has been suggested that backscattering of light caused by turbidity in the water is interfering with the readings from the YSI meter. Work continues and attempts will be made to image organisms from these blooms using SEM.

Peptidoglycan deacetylase SfpGdA is involved in regulation of invasion and type three secretion in *Shigella flexneri*

Presenting Author: Haila Kottwitz, Dalhousie University

Shigella flexneri is a Gram-negative pathogenic bacteria responsible for bacillary dysentery and death in developing countries where sanitation is poor. *Shigella* harbors a virulence plasmid encoding a type three secretion system (T3SS) that is required for invasion of host epithelial cells in the gut mucosa. Virulent strains of *Shigella* use the T3SS to inject effector molecules directly into the host cell cytosol, promote invasion and interfere with innate immune responses. Strains with an active T3SS bind Congo red dye and colonies appear red on agar media in the presence of this compound. To study the function of genes on the virulence plasmid that may play a role in invasion, a collection of single-gene deletion mutants was screened to identify mutations that resulted in a Congo red negative phenotype. I have characterized two Congo red negative mutants *ipgF* and *sfpGdA*. Using a Gentamicin-protection assay as a measure of invasiveness, I demonstrated that both *ipgF* and *sfpGdA* were less invasive than Wild-type *Shigella*. The *ipgF* mutation was determined to result in a polar effect on the downstream gene *mxiG*, likely explaining its non-invasive phenotype. The *sfpGdA* gene encodes a putative peptidoglycan deacetylase and is under the control of the response regulator PhoP. A *phoP* deletion mutant was constructed and found to display a similar invasion defect as seen with the *sfpGdA* deletion mutant. In vitro assays indicate that SfpGdA is required for proper T3SS function. My data suggest that *sfpGdA* may encode a novel regulator of T3SS function and is required for host cell invasion, an essential *Shigella* virulence determinant.

Seasonality of a Nova Scotian rockweed (*Ascophyllum nodosum*) associated community and the potential impacts of rockweed harvesting

Presenting Author: R. Simon Lay, Dalhousie University

Ascophyllum nodosum (rockweed) is a dominant brown alga found in the rocky intertidal zone of Atlantic Canada. An annual harvest of approximately 40,000 metric tonnes in the Maritimes region is used primarily as an agricultural fertilizer or animal feed supplement. The sustainability of the *A. nodosum* harvest is primarily attributed to its ability to regenerate from shoots cut during the harvest. Recent research has focused on the effects of the rockweed harvest on rockweed regeneration, with less known impacts on associated faunal and floral assemblages. Monthly monitoring of the flora and fauna associated with an un-harvested rockweed bed in Jeddore, on the Eastern Shore of Nova Scotia, Canada was conducted during the typical harvesting season, May to October 2012. Preliminary results indicate that the rockweed associated community is represented by few abundant species, many rare species. ANOVA, MANOVA, and PERMANOVA statistical tests will be used to investigate seasonal variation in species abundances, and community composition. Comparing the timing of the rockweed harvesting season to seasonal abundance variations and the timing of life histories for species associated with rockweed will provide an assessment of the potential ecological impacts of the rockweed harvest in Nova Scotia.

Phylogeographic Analysis of Genetic Structure Present in Purple Sandpipers

Presenting Author: Nathalie LeBlanc, Acadia University

The Purple Sandpiper (*Calidris maritima*) is a small shorebird that breeds in the Arctic and winters along northern coastlines. It has a wide geographic distribution, ranging from Nunavut, east to Greenland, Iceland, and Norway in the summer, and wintering farther south along eastern North America and western Europe.

Due to difficulty in recapturing banded birds, migration routes between breeding grounds and wintering grounds are poorly understood. Populations appear to be declining, and future conservation efforts for this species will benefit from a thorough understanding of their migration patterns. This study uses two mitochondrial DNA loci to identify underlying genetic differences between breeding populations of Purple Sandpipers. Samples were taken from wintering sites along the coast of Maine, as well as from breeding sites in northern and southern Nunavut. Results indicate some genetic structure present within the samples tested, though variation is not specific to either breeding location. These results lay the groundwork for further analyses using both mitochondrial loci and microsatellite markers.

Intra(Sub)Specific Differentiation of Migratory Alaskan Dunlin, *Calidris alpina*

Presenting Author: John Loggie, Mount Allison University

Breeding populations of *Calidris alpina* have recently been shown to follow a complex pattern of migratory connectivity. In particular, a northerly breeding population of the *pacifica* subspecies leapfrogs more southerly breeding populations to spend the winter much further south, in Mexico. This study tested for genetic differentiation among these populations, as well as between the *pacifica* and *articola* subspecies. We sequenced 1266 base pairs of mitochondrial DNA from the Control Region and cytochrome b gene of 48 individuals sampled from four breeding populations, and then analyzed haplotype frequencies and phylogenetic structure. Our results confirm previous work in showing that all Alaskan Dunlin fall within a single major mtDNA lineage that lacks well-defined phylogeographic structure. However, our results also show no haplotypes shared between the *pacifica* and *articola* subspecies. Moreover, haplotype diversity is unevenly distributed amongst populations. The frequencies of haplotypes differ significantly between subspecies and amongst the geographic areas of the *pacifica* breeding range. This pattern of haplotype divergence corresponds with observed differences in migratory destinations. These genetic data indicate that divergence of these population is relatively recent, that lineage sorting within *pacifica* is incomplete, and that divergence at neutral loci is presumably being outpaced by the evolution of genes affecting migration.

Characterization of Ag-Au Alloy Nanoparticles and Their Potential as Antibiotic Alternatives

Presenting Author: Katelyn MacDonald, Crandall University

Antibiotic application is advantageous in combating with various pathogens, but frequent application can increase chance of developing antibiotic resistant bacterial strains. This problem could be solved by creating new antibiotics to which there is no bacterial resistance, however, each time a new drug was introduced a new resistance was formed (Palumbi, 2001). Probably, within ten years of introducing a new antibiotic we would begin to see signs of resistance and in fact we might see it occur at an even faster rate if this trend was continued (Wright, 2010). This growing resistance demands novel alternatives to traditional antibiotics (Keyser et al, 2008). One such possible alternative is metallic nanoparticles (NPs), particularly Ag-Au alloy nanoparticles, which show greater potential than do monometallic nanoparticles due to their great tenability (Zhang et al, 2007). In this study, compared with citric acid derived Ag nanoparticles, significantly antimicrobial activities ($p < 0.05$) of Ag-Au alloy nanoparticles prepared via the PVP method were detected in both Gram-negative (*Escherichia coli*) and Gram-positive (*Staphylococcus aureus*) bacteria according to NCCL Disc Diffusion Test guidelines. The nanoparticles showed greater inhibition on G+ than that on G- bacteria. Our results indicated to the great potential of Ag-Au NPs as an effective future antimicrobial agent which might replace antibiotics in medical treatment.

The Mechanism of [10]-Gingerol-induced Cytotoxicity in Breast Cancer Cells

Presenting Author: Jason McConnery, Dalhousie University

In Asia, where the consumption of functional foods is high, the population's health is characterized by a lower incidence of inflammatory diseases and cancer. Functional foods contain phytochemicals, which are hypothesized to be the natural agents responsible for these anti-inflammatory and anti-cancer effects. Ginger, a spice commonly consumed in Asian foods, contains the phytochemicals 6-, 8-, and 10-gingerol. Research into the use of gingerols, especially 6-gingerol, has been carried out due to the promise of its anti-inflammatory and anti-emetic properties. Little research, however, has been carried out on 10-gingerol, perhaps the most potent of the three. Colorimetric MTT assays were performed on MDA-MB-231, MDA-MB-468, MCF-7, SkBr3, and T-47D human breast carcinoma cells, to determine the effect of 10-gingerol on cancer cell growth. MDA-MB-231 and SkBr3 cells were also cultured in the absence or presence of 10-gingerol with or without a pan-caspase inhibitor (Z-VAD-FMK) or an antioxidant (N-acetyl cysteine). Cells were then stained with Annexin V/propidium iodide to determine whether cytotoxicity was dependent on caspases and/or reactive oxygen species (ROS), respectively. MDA-MB-231 cells were also cultured in the absence or presence of 10-gingerol and assessed for mitochondrial membrane permeabilization (MMP) by staining with DiOC6 for flow cytometry. *In vitro* exposure of breast cancer cell lines to 10-gingerol reduced the growth of these cells in a time- and dose-dependent manner. In addition, the cytotoxic effect of 10-gingerol on breast cancer cells did not require caspase or ROS activity but was associated with MMP. The ability of 10-gingerol to induce MMP and kill human breast carcinoma cells in a caspase- and ROS-independent manner suggests a non-conventional mechanism of cancer cell death induction. This may be useful in circumventing common mechanisms of breast cancer cell resistance to chemotherapy.

Can the Perkins Eye Index be used to predict hatch time of American Lobster (*Homarus americanus*) in the field?

Presenting Author: Erin Miller, University of New Brunswick - Saint John

In order to manage lobster effectively it is important to have a working knowledge of larval dispersal patterns, which can be modeled when the date of larval hatch is known. Time of hatch will determine the temperature experienced by the developing larvae, which in turn will affect the time the larvae spend drifting before settling on the bottom. The most efficient method of collecting data on lobsters over a broad geographic area is to collaborate with fishermen; however, the lobster fishing season ends before hatching begins in many regions, which prevents determining the timing of hatch directly through observation. To address this problem we will test the ability of two formulas developed in the lab to predict hatch time of larvae in nature based on the eye size of embryos sampled during the fishing season and water temperature experienced by the developing embryo between sampling and hatch.

The effect of sodium percarbonate on the free-living stages of *Lepeophtheirus salmonis*

Presenting Author: Frauke Nijhof, University of New Brunswick - Fredericton

Sea lice (*Lepeophtheirus salmonis*) is an ectoparasite of salmonid fishes that feeds on mucous, skin and blood. Sea lice is one of the most pressing problems facing the Atlantic salmon (*Salmo salar*) aquaculture industry causing fish and economic losses. Sodium percarbonate (SPC) is a possible environmentally friendly bath treatment. SPC dissociates in water into sodium carbonate (SC) and hydrogen peroxide (the chemotherapeutant). The effect of SPC was tested on the free-living stages of *L. salmonis* (nauplii and copepodid). The lice were exposed to 80, 160 and 320 mg/L SPC for 1 or 2.5 hours. The lice were assessed for responsiveness 0, 1, 24 and 48 hours post treatment. An increase in SPC concentration decreased the percentage of life lice. The biggest reduction of life lice occurred with 2.5-hour exposure to 160 mg/L SPC where life copepodid were reduced by 93 %. Exposure of nauplii to SPC not only caused a reduction in life lice, but also reduced moulting from

nauplii into the copepodid stage compared to the control. SPC increased the pH from 8.0 in the control to 9.2 in 320 mg/L. The effect of the pH increase was determined using 320 mg/L SPC and 220 mg/L SC (one of the dissociate products of SPC that does not contain hydrogen peroxide) that resulted in the same pH. There was an 82% decrease of nauplii moulting to copepodid compared to the control after a 1-hour SPC treatment and only a 18% reduction after the SC treatment. Fish trials will have to be conducted to test the effect of SPC on the parasitic stages.

Infecting bone-marrow derived dendritic cells with *Shigella flexneri* causes down-regulation of CD40

Presenting Author: Jessica Pickrem, Dalhousie University

Shigella flexneri is a member of the Enterobacteriaceae family of Gram-negative bacilli, and is the causative agent of Shigellosis, or bacillary dysentery. Upon infection, *Shigella* invades the host colonic epithelium using a type III secretion system (T3SS) that is encoded by a large virulence plasmid. This secretion system injects protein virulence determinants, or 'effectors' directly into the host cytosol where they interfere with host immune surveillance systems. The innate immune response to *Shigella* infection has been the subject of intense research. By comparison, there is little known about how *Shigella* may affect the adaptive immune system. To investigate the interaction between *Shigella*-infected antigen presenting cells and adaptive immune cells, I used flow cytometry to monitor expression levels of surface molecules on *Shigella*-infected bone-marrow derived dendritic cells. I observed that wild-type *Shigella* down-regulated the surface expression of CD40, which is required for formation of the immunological synapse and dendritic cell activation. Avirulent *Shigella*, lacking the virulence plasmid, did not down-regulate CD40, nor did a mutant lacking the type III secretion apparatus. A third mutant deleted for *mxiE*, a major transcriptional regulator of T3SS substrates, also did not down-regulate CD40 levels. Taken together, these data indicate that *Shigella* uses one or more substrates of the T3SS that are under control of *MxiE* to down-regulate CD40. These results pave the way toward understanding the adaptive immune response to *Shigella* and may prove useful in the search for a vaccine against Shigellosis.

Cannabinoid 2 Receptor reduces leukocyte adhesion in dispase-induced Proliferative Vitreoretinopathy

Presenting Author: Ross Porter, Dalhousie University

Proliferative vitreoretinopathy (PVR) is the most common complication of surgery to correct rhegmatogenous retinal detachment (RRD). PVR can result in loss of vision and is characterized by proliferation of ectopic cell sheets in the vitreous and/or periretinal area causing formation of a contractile periretinal membrane, which results in new retinal breaks, re-opening of treated breaks and distortion of the retina. Although extensive research has been conducted into the pathogenesis of the proliferative stage of PVR, the inflammatory stage is poorly understood. This study aimed to investigate the anti-inflammatory role of cannabinoid 2 receptor (CB2R) agonists on intraocular inflammation in a dispase-induced PVR model in mice. Dispace-model of PVR was induced in male CD-1 mice by intravitreal injection of 3.0 µl dispase/collagenase (0.3 U/µl). Treatments of cannabinoid 2 receptor (CB2R) agonists and antagonists were tested for anti-inflammatory effects in PVR. Cannabinoid treatments consisted of intravenous injection of HU308 (1mg/kg in a 1:10 dilution of DMSO and saline), AM630 (2.5 mg/kg in a 1:10 dilution of DMSO and saline) and AM630 + HU308 15 minutes after intravitreal injection of dispase. Intravital microscopy (IVM) was used to observe leukocyte-endothelial adhesion 24 hours after the initial injection of dispase. Treatment with a CB2R agonist, HU308, significantly reduced leukocyte-endothelial adhesion 24 hours after induction of PVR. This decrease in the number of adherent leukocytes to the microvasculature was abolished when animals were treated with the CB2R antagonist alone or CB2R antagonist prior to treatment with HU308. Therefore, CB2R activation by intravenous injection of HU308 reduces leukocyte recruitment to the iris during the inflammatory stage of PVR. Currently, vitreous surgery is the standard treatment for PVR. Drugs targeting the CB2R may serve to be potential therapeutics by decreasing acute inflammation.

Effectiveness of Halifax Produced FDG in the PET/CT Evaluation of Patients with Suspected Lung Cancer and Impact on Patient Management

Presenting Author: Shane Rajaraman, Saint Mary's University

Integrated Positron Emission Tomography and Computerized Tomography (PET/CT) is a powerful imaging technique that combines functional and anatomical information for early and accurate detection of cancer. Limited availability and cost necessitate appropriate case selection based on its impact on patient management. The Halifax-based Lung Cancer Site Team (LCST) oncologists request PET/CT scans using online requisitions that prospectively capture pre-PET/CT case information including cancer indication, stage, management intent (curative or palliative) and treatment modality (surgery, chemotherapy, radiotherapy, multimodality therapy, or observation) in a database. Using the database we identified 77 scans completed on patients with suspected lung cancer (SLC, including solitary pulmonary nodule, SPN) during July 3rd, 2010 to November 30th, 2010. After considering PET/CT results and subsequent follow up medical records, with the aid of oncologists we determined similar post-PET/CT information to assess for changes in these parameters as well as confirmation of the nature of the suspected lung lesion. When used to diagnose a SLC or SPN, the PET/CT showed 88.6% sensitivity, 83.3% specificity, 86.5% accuracy, 88.6% positive predictive value, and 88.3% negative predictive value. PET/CT established a different diagnosis (usually benign) in 41.6%, and changed stage in 58.4% of cases. PET/CT changed management intent in 7.8% of cases (usually to palliative) and altered treatment modality in 59.7%. If lung nodule size measured above 30mm there, 61% were confirmed as malignant. The Halifax PET/CT protocol is effective in correctly diagnosing malignancy in cases of suspected lung cancer at rates similar to that reported in literature. As utilized by the LCST oncologists, the impact of PET/CT on expected management (59.7%) is higher than that reported in literature (26%) suggesting a widening of the case selection criteria. In those cases where nodule size was >30 mm, where an unexpectedly low number of malignant cases were confirmed, further analysis is planned to investigate pre-PET imaging criteria of malignancy.

Recently-Masculinized and Standard Male Mitotypes of *Mytilus edulis* in natural mussel beds of Nova Scotia

Presenting Author: Marion Sinclair-Waters, Acadia University

Mytilus edulis, the Atlantic blue mussel, has an unusual system of mitochondrial DNA (mtDNA) inheritance. In most animals, mtDNA inheritance is exclusively maternal, but in *M. edulis*, males also inherit paternal mtDNA. Sometimes, pieces of the maternal and paternal mtDNA will recombine and create a “recently-masculinized” or RM mitotype. Studies show that sperm with RM mtDNA swim faster than sperm with standard mitotype (SM) mtDNA. It is hypothesized that faster sperm are at an advantage in dense mussel beds whereas slower but longer-lived sperm are advantageous in sparse mussel beds. Because of this advantage we would expect to see higher RM to SM ratios in dense beds compared to sparse beds. Using primers specific for standard males, polymerase chain reaction and DNA sequencing, the ratio of RM to SM mitotypes in dense versus sparsely distributed beds was examined. Two densely distributed sites in Digby County (N.S.) showed the presence of only SM males. Ocean currents and larvae distribution may explain the absence of RM individuals in Digby County. Therefore, additional sampling was done on the southern and eastern shore of Nova Scotia. Two densely populated sites were studied. At Site 3 in Ship Harbour, the frequency of RM males at this site is 24.1% and 75.9% for standard males. At Site 4 in the Halifax area, the frequency of RM males at this site is 13.0% and 87.0% for standard males. This confirms the presence of RM males in these regions of Nova Scotia. To compare this ratio versus sparsely distributed beds, additional sampling is needed. Furthermore, sampling from sites on the southwest coast of Nova Scotia will help determine the geographic distribution of RM mitotype individuals around Nova Scotia.

Determination of Sex from the Human Hyoid Bone using a Modern White European Population

Presenting Author: Stephen Walls, Saint Mary's University

This project evaluates a method of sex estimation using the human hyoid bone in forensic cases. It evaluates the accuracy of six discriminant functions developed by Kindschuh et al. (2010) on an archaeological skeletal population and then applies the functions to a contemporary white European skeletal population from the McCormick Skeletal Collection at the University of Tennessee, Knoxville. The hyoid body and the left and right greater cornua were measured from 134 individuals (68 male; 66 female). Fifteen measurements were taken from fused hyoids and 12 measurements were taken from unfused hyoid bones. Applying discriminant functions developed from archaeological hyoid bones yielded accuracy rates ranging from 79.1% to 92.3% when compared to a contemporary white European skeletal population. Mean and sex specific accuracy rates indicate that two functions developed on archaeological fused hyoids were not accurate in estimating female sex on a contemporary white European skeletal population. Discriminant functions developed on the unfused full hyoid and the hyoid body of fused and unfused hyoids had accuracy rates ranging from 88.1% to 92.3%, indicating that they were efficient for determining sex for a contemporary white European skeletal population. Two-sample t-tests indicate statistically significant differences between archaeological and contemporary populations in the height of the anterior cornua (CHI) of both fused and unfused males. Significant differences are also observed between the archaeological and contemporary populations' total hyoid length (THL) in both males and females. Four of the six discriminant functions developed by Kindschuh et al. (2010) can be applied to contemporary white European hyoid bones; however significant differences in THL and CHI between archaeological and contemporary skeletal populations indicate that discriminant functions developed solely on archaeological fused hyoids are less accurate when applied to contemporary white European hyoid bones.

Strategies for activating and increasing the production of medicinally relevant secondary metabolites in *Streptomyces clavuligerus*

Presenting Author: Maria Watton, Memorial University of Newfoundland

Members from the bacterial genus *Streptomyces* are known to produce more than half of the antibiotics used in the clinic. *S. clavuligerus* is industrially used to produce clavulanic acid (CA), a metabolite used in medicine to treat certain antibiotic resistant infections. Recently, the genome of *S. clavuligerus* was sequenced, revealing that this organism has the genetic capacity to produce more than thirty different unrelated metabolites, but only four or five are produced under laboratory conditions. There is a lot of interest in 'activating' the production of metabolites not observed under laboratory conditions, in addition to increasing the production of known metabolites for medicinal use. Random ultra violet (UV) light induced mutagenesis has traditionally been used to increase the production of metabolites in bacterial producers. In one part of the described study, UV mutagenesis was used as a treatment in an attempt to increase CA yields and to activate the production of previously uncharacterized metabolites. As a second strategy, co-culture of *S. clavuligerus* with other bacteria was employed to see if the same or different outcome could be obtained. Both strategies have been successfully used in the past to increase and activate the production of metabolites and the results from my study will be presented and discussed in poster format.

Some Like it Hot! - The Critical Thermal Maximum (CTMax) and hematology of shortnose sturgeon (*Acipenser brevirostrum*) acclimated to three temperatures.

Presenting Author: Yueyang (Brian) Zhang, University of New Brunswick - Saint John

Temperature is the most pervasive environmental factor controlling an organisms biology. Thermal regimes of rivers can be altered by hydrologic alterations, which cause increases in water temperature. High water temperature has been reported to increase mortality rate, decrease growth rate and reduce swimming ability of fish. Quantifying a species thermal tolerance is critical to assessing biological impacts of anticipated increases in

temperature (e.g., climate change, effects of hydrological alterations). While many studies have documented the critical thermal maximum of fish, there is a limited amount of research on thermal biology of sturgeon. Sturgeon are important to study because most species are subjected to many environmental challenges and they are endangered. The shortnose sturgeon, *Acipenser brevirostrum*, for example, is a threatened species that exists along the eastern coast of North America. They can be exposed to temperatures ranging from freezing to above 25°C. However, to date, little is known about their thermal biology. Using a heating rate of 6°C h⁻¹, a critical thermal maxima test (CT_{Max}) and the associated hematological responses of shortnose sturgeon acclimated to 10°C, 15°C and 20°C were determined. The effect of body weight (10-320g fish) on critical thermal maxima of shortnose sturgeon was significant. In larger fish, critical thermal maxima significantly increased with increases in acclimation temperature. In general, hematology of thermally stressed fish was modified relative to control fish. Hematocrit, lactate, and blood ions (Na⁺ and Cl⁻) of fish were all significantly influenced by thermal stress and acclimation temperature. Glucose and K⁺ were only significantly influenced by thermal stress. While these experiments demonstrate one aspect of thermal tolerance in shortnose sturgeon, future studies should address the importance of other stressors, such as salinity and toxicants, on thermal relationships of sturgeon.

Environment Abstracts

Oral Presentations

Abstracts listed in alphabetical order by last name of presenting author.

Too Little, Too Much, or Just Right?: Impact of Nutrient Availability on Invertebrate Biomass, Diversity and Species Richness in the Annapolis Valley, Nova Scotia

Presenting Author: Lauren Banks, Acadia University

The importance of wetlands has been often overlooked in favour of land conversion for industrialization and modern agriculture. According to Ducks Unlimited (DU), over 90 percent of the wetlands in the Annapolis Valley have been lost to development. In order to mitigate these losses DU has constructed wetlands throughout the agricultural regions in the Annapolis Valley. In addition, most farms have wetlands and ponds that are used for irrigation but can still serve as an important habitat for a variety of species. In 2008, the Nova Scotia Eastern Habitat Joint Venture (NS-EHJV) developed a plan to assess wetland habitat quality for duck broods of various species. The current project follows the NS-EHJV plan and involves a partnership with several academic institutions, not-for-profit organizations, and government whose goals of protecting wetland biodiversity are aligned. To evaluate the assumptions of the NS-EHJV for increasing duck production in the agricultural landscape, surveys of duck broods and invertebrates were carried out in 2009, 2010, and 2011. During 2012 evaluation of chemical and physical parameters were added to the assessment. The chemical limnology portion has been assessed through nutrient analysis (phosphorous), pH measurements, and chlorophyll *a* measurements. In-situ measurements of water temperature and specific conductivity were also taken. This study compares DU wetlands and farm ponds/wetlands with respect to chemical and physical properties and examines the effects of paradox of enrichment for nutrient load and invertebrate richness and diversity. Farm ponds/wetlands had consistently higher invertebrate species richness and diversity, based on the Shannon-Wiener Diversity Index. Results indicate eutrophication of most wetlands by the end of the sampling period; however, invertebrate species richness and diversity appear unaffected by eutrophic and hyper-eutrophic conditions. Greater numbers of ducklings were found on wetlands with higher invertebrate species richness and diversity, suggesting that invertebrate community structure may indicate more suitable habitat conditions.

Determining feather mercury levels in six species of arctic marine birds

Presenting Author: Benjamin Callaghan, Acadia University

Although the Canadian Arctic appears to be a region removed from the harmful effects of pollution, environmental contaminants occur in significant concentrations, particularly in marine ecosystems. Mercury (Hg) levels especially have been of increasing concern in the Canadian Arctic. Current attempts to quantify bio-accumulated mercury often involve invasive sampling methods, such as blood sampling. The objectives of this study were to determine: (a) whether Hg was higher in feathers from top predators and scavengers, similar to patterns found in their eggs; and (b) whether the non-invasive method of sampling feathers is an appropriate alternative to invasive methods. Methyl Hg and total Hg levels were determined from feather samples of six species of Arctic marine birds: Thick-Billed Murre (*Uria lomvia*), Northern Fulmar (*Fulmarus glacialis*), Black-Legged Kittiwake (*Rissa tridactyla*), Ivory Gull (*Pagophila eburnea*), Glaucous Gull (*Larus hyperboreus*), and Common Eider (*Somateria mollissima borealis*). Consistent with my expectations, Hg levels were markedly greater in feathers for species that fed higher in the food web in Arctic marine environments. Consequently, sampling feathers for mercury concentrations appears to be a suitable alternative to employing invasive methods to assess and monitor mercury concentrations.

Unearthing the Secret to Lower Agricultural Greenhouse Gas Emissions: Quantifying Nitrogen and Carbon Emissions from Crop Residue Degradation

Presenting Author: Jacqueline Carverhill, Mount Allison University

The need to quantify nitrogen losses from agricultural practices stems from concerns about rapidly increasing N₂O-N emissions and food security issues. Thus, this study utilized ¹³C-depleted substrates to determine N₂O-N losses from crop residue. Canola, pea, flax, and wheat residues were applied to soil, and resultant gas fluxes were measured. N₂O-N and CO₂-C losses were quantified by gas chromatography. In addition, isotope ratio mass spectrometry and cavity ringdown spectroscopy were used to measure decomposition of the ¹³C-depleted residues. Residue decomposition (measured as CO₂) increased in the order: canola, flax, pea, wheat whereas N₂O emissions increased in the order: wheat, flax, pea, canola. The percent N and percent C present in the residues that was released as N₂O or CO₂ was also determined. In Saskatchewan, the emission factor for N-N₂O is currently set at 0.4-0.6%, with no distinction made between nitrogen from organic sources versus applied fertilizer. This study determined that N₂O emissions from wheat, flax, and pea residues were lower than those expected from applied fertilizers while N emissions from canola residue fell within the current prairie emission factor range. Canola residue exhibited the highest rate of N emissions at 0.57% followed by pea, flax and wheat at 0.11, 0.054, and 0.0043% respectively. These results have implications for nitrogen accounting, agricultural best management practices, and climate change public policy including the Intergovernmental Panel on Climate Change (IPCC) methodology for determining N₂O emission coefficients. Ultimately, this study identified key differences between organic sources of nitrogen (crop residue) and synthetic sources of nitrogen (urea fertilizer). Thus, the findings support the contention that the IPCC methodology should be changed to reflect the differences between these two sources of nitrogen.

Understanding the landowner participation in the Alternative Land Use (ALUS) Program in Prince Edward Island

Presenting Author: Jose Cubero, University of New Brunswick - Fredericton

The government of Prince Edward Island (PEI) has been implementing a program to reduce the environmental impacts of the agriculture. The program is called Alternative Land Use Services (ALUS) and it is an incentive-based voluntary program for the PEI farmers and landowners. The participants received an annual financial compensation to establish and maintain best management practices (BMPs). After almost five years of implementation the government of PEI has decided to evaluate the operation of the program from the farmer's perspective. A mail survey was sent to 400 ALUS participants (members) and 400 landowners randomly chosen who are not currently involved in the program (non-members). The response rates to the survey were 51% for members and 31% for non-members. The purpose of this study is to assess the characteristics of who is and who is not involved in the ALUS program in PEI by using land size, type of production and the income of the farmers like explanatory variables. The logistic regression analysis suggests that some types of production and income are significant characteristics related with participation in the ALUS Program.

Influence of *Rosa rugosa* on the coastal community of Brier Island, Nova Scotia

Presenting Author: Chelsea Fougere, Saint Francis Xavier University

Rosa rugosa is an established garden escape in Nova Scotia, Canada. It is adaptable and robust; growing in various ecosystems such as fields and coastal areas. It is readily dispersed asexually by propagating shoots and sexually by the dispersal of hips. This study investigates the ecology of *R. rugosa* on the coastal headlands and dunes of Brier Island. The spatial distribution of *R. rugosa* bushes along the perimeter of the island was determined and the dimensions of each bush were recorded. Identifying the degree to which *R. rugosa* may be displacing the dominant native shrubs, *R. virginiana* and *Morella pensylvanica*, was a primary research objective.

Data loggers were used to compare the maximum temperature and maximum light intensity under each shrub type. Soil samples were taken from within, on the apron, and outside of six of each type of bush (N=54) to compare the plant available nitrogen under the shrub types and determine whether *R. rugosa* may be influencing the distribution of nitrate patches. Seedlings of *M. pensylvanica* were planted in transects under the three shrub types to verify whether *R. rugosa* may be outcompeting the native shrubs. *R. rugosa* colonies have increased in number and size since 2010, and appear to be dispersing along the shore by hips and inland by shoots. Maximum temperature, maximum light intensity, and seedling success did not differ between the invasive and the native roses. Furthermore, there was evidence to support niche partitioning and the facilitation of *M. pensylvanica* seedlings by *R. rugosa*. It is an established community member of coastal ecosystems in Nova Scotia and does not appear to be ecologically detrimental.

Assessing Biochemical Oxygen Demand Values at different stages of the Wool Washing Cycle

Presenting Author: Crystal Fullerton, Dalhousie University – Faculty of Agriculture

Historically, wool processing has been a mainstay of many industrial communities along eastern North America but pollution issues with its effluent has been a major limiting factor in its growth in today's context. Renewed interest in wool as an insulating material has reignited the interest in wool processing. The main objective of this research was to evaluate if different stages of the wool washing cycle would yield a liquid effluent that could be land applied without any environmental impact and without further treatment. Encouraging previous studies using wool scour wastes have been shown to contribute to the soil nutrient input, to reduce the use of water irrigation and increase soil aeration porosity allowing for greater root penetration and growth (Maheswaran et al.). The experimental design focused on five separate breeds of sheep native to this location. The fleeces from these breeds were subjected to a hot wash treatment followed by a hot wash with soap treatment of cleaning. Each breed had the two treatments and was tested for BOD and each treatment had three replicates. The average BOD value for the hot wash for all breeds was 7724 mg/L and the average BOD value for the hot soak with soap for all breeds was 2827 mg/L. There was 25-53% drop in BOD values from the hot wash to the hot wash with soap. Using Irrigation systems to dispose of treated effluent on land has strict regulations in Atlantic Canada requiring BOD values be between 5-150 mg/L (EC, 2006) and the original drop in BOD levels are still well above the stipulated BOD level of 150 mg/L to be legally re released into the surrounding environment (EC, 2006). The preliminary results show a +95% drop in BOD values would have to occur to make the hot soak with soap environmentally feasible to spread on agricultural lands. Since the hot soak alone cannot remove all the lanolin, suint or debris from the raw wool, the soap must be applied. The results of this study show that the wool still requires further treatment to become clean enough for processing and that the effluent requires another mechanism to render its BOD value to an environmentally acceptable level if land application is to remain a primary method of disposal.

Impact of salt marsh reclamation on mercury fate and biogeochemistry

Presenting Author: Adam Godfrey, Acadia University

Much of the world's coastline has been dyked to increase the area of arable farmland and eliminate seawater inundation. Efforts are being made in some areas to intentionally breach these dykes and restore the land and re-create the original salt marsh habitat. Salt marshes accumulate sediments over time and build up natural levees that protect the coastline against storm surges and, potentially, against sea level rise. We investigated one such reclamation site (Beaubassin, New Brunswick, Canada) that was breached in October of 2010. Sediment cores were taken from (i) behind a dyke after it was intentionally breached, (ii) a neighbouring salt marsh, and (iii) the mudflats on the seaward side of the dyke. These samples were compared with cores collected the previous summer, before the breaching. Cores were sectioned, dried, and the solids analyzed for both total mercury (using thermal degradation AAS) and methylmercury (using ethylation, tenax trap, and GC-AFS). Other parameters measured and discussed were pH, percent organic matter, water-extractable organic carbon, clay content, oxidation-reduction potential, and electrical conductivity. Total mercury concentrations post-

breach were approximately double the concentrations in the pre-breach cores, throughout the depth profile. Methylmercury, which has been shown to increase dramatically during freshwater flooding events, unexpectedly declined in the area of reclamation. The geochemical influence of seawater and sedimentation as well as twice daily tidal flushing both reduce the methylation of mercury during salt marsh restoration and facilitate its removal from the ecosystem.

A new field portable instrument for in-situ gas diffusivity, porosity, and tortuosity measurements

Presenting Author: Christian Hart, Saint Francis Xavier University

The production of all main greenhouse gases in soil is highly sensitive to gaseous transport. Researchers commonly defer to diffusivity models, which relate diffusivity changes to variation in soil physical properties. The use of these models is problematic, and displays inherent weakness especially where spatial heterogeneity is large. Natural eluvated soils are vertically distinct and even small layers can change diffusive fluxes by orders of magnitude. In-situ gas diffusivity studies commonly show advantages over model generated values, however standard point source in-situ diffusivity measurements alone cannot distinguish between the effects porosity and tortuosity would have across space. We outline the development of an iterative mathematical routine and membrane apparatus, to quickly measure gaseous transport properties of soil or rock at a high spatial resolution. Using a numerical 3D soil atmosphere transport model, we performed through sensitivity analyses of instrument and inverse routine performance across diverse soil structure, soil micro meteorological, and soil background biological conditions. We then performed laboratory testing to confirm the synthetic testing across a range of parameters seen in natural soils. Results indicate that the technique is valid and has potential for application in a wide range of environments.

Methane Soil Dynamics in the Taiga Region of Cape Breton

Presenting Author: Olivia Kester, Saint Francis Xavier University

As the climate is changing, many mid-high latitude regions are experiencing warmer temperatures, and this raises concerns for how these changes will affect soil dynamics. Increased methane emissions are dangerous because methane is a strong greenhouse gas. The Taiga region in the Cape Breton Highlands was selected to study methane emissions from soils at different seasons to see if seasonality affects the methane flux. This site was selected because of its accessibility, but also because of its similarities to forests in the Taiga Shield, where melting permafrost is a great concern for methane release. Site soils are highly organic and have a relatively high water table, which leads to the question of whether or not methane would be produced here. Six gas chambers were used to collect methane data at 10-minute intervals during the fall season. During the winter season, snow depth gas measurements were also conducted. These gas samples were analyzed using a gas chromatograph and converted to flux measurements. Additionally, METS sensors were used to take long-term methane concentration measurements at different depths in the soil. Results show that methane concentrations in the soils are below limits of detection and the flux into the atmosphere is very low compared to typical high latitude Taiga regions. These values could be lower than typical because most leading methane research focuses on the emissions from wetlands soils. This study, therefore, is possibly indicative of methane values in drier areas of the Taiga Shield with organic rich soils.

Greenhouse Gas Fluxes from Nitrogen Contaminated Wetland Soil

Presenting Author: Emma Kinley, Saint Francis Xavier University

Salt marshes are important ecosystems in their services such as storm protection for developed areas, nutrient removal and carbon sequestration. It has been suggested that nitrogen (N) loading can increase greenhouse gas (GHG) emissions from salt marsh soils, and that such nutrient enrichment may be the cause of recent loss of

salt marsh ecosystems. This project investigates how the natural soil exchanges of the greenhouse gases carbon dioxide (CO₂), nitrous oxide (N₂O) and methane (CH₄) in a salt-water marsh environment are altered by contact with seawater containing elevated concentrations of dissolved nitrogen. GHG production processes in salt-water marsh soil profiles of shallow and deep cores from Kouchibouguac National Park, NB are examined over a 10-day gas sample collection period. A total of twelve frozen core samples were collected in the winter of 2012. Three of the shallow and three of the deeper profile serve as the control and had non-N-polluted salt-water solution added. The other six shallow and deep profiles had nitrate-N enriched salt-water solution added. Gas fluxes were collected and analyzed using infrared analysis for CO₂, and gas chromatography for CH₄ and N₂O. Results show that shallow soil profiles produce more GHGs than deeper profiles, and there was a slight increase in GHG emissions from N-treated soils. Results are compared to other salt marsh studies, which have had issues related to nitrogen pollution. Nitrogen loading in salt marshes has potential to increase GHG emissions.

Networks, Identity, and Resilience in an Island Watershed Group

Presenting Author: Conor Leggott, University of Prince Edward Island

Actor-Networks are comprised of individual actors, both human and nonhuman, and the relationships that link these actors together. Social Movement Organizations can use networks to build their identity. This study investigates the role of Social Movement Organizations in building their identity through networks, which can lead to community resilience, or the ability to 'bounce back'. In this qualitative, case study research project, I investigate how one Island watershed group, the Stratford Area Watershed Improvement Group, uses networks to face challenges, build an identity, and foster resilience. The data were gathered from a triangulation of semi-structured interview, participant observation, and document review sources. These are filtered through existing theories of Actor-Networks, identity of Social Movement Organizations, and resiliency.

Winter soil respiration variance in Cape Breton Highlands Boreal forest

Presenting Author: Christopher MacIntyre, Saint Francis Xavier University

The soils of open bog areas associated with mid-latitude Boreal forests have organic rich surfaces and store significant quantities of carbon. Unfortunately, there are few winter soil respiration studies in these areas, with most being focused in high latitude permafrost thaw areas. The goal of this study is to observe soil respiration coupling with soil water chemistry, soil temperature, and other potentially influential variables during the Boreal forest winter. Sites were located in the Cape Breton Highlands National Park, Nova Scotia, in a representative Boreal forest area. Within this area there are three distinct ecotypes. The first is dominated by mature black spruce trees (*Picea mariana*), the second is an open area dominated by Sphagnum peat moss with grass and sheep laurel (*Kalmia angustifolia*) present, and the third is an intermediate area with young spruce trees and sphagnum moss. A permanent meteorological station was established to monitor surface CO₂ flux, air temperature, soil temperature, soil moisture, oxygen, and methane. Soil cores were sampled from three sites representative of the area. Soil analysis was done for total organic carbon (TOC) by loss on ignition (LOI) and microbial respiration rates by soil incubation at 1°C for shallow soil and 3°C for deep soil to simulate snow insulation. Dissolved organic carbon (DOC) was monitored through depth using two well nests and SUVA analysis. Results from the TOC analysis concluded that the open bog areas contained by far the most carbon. We observed depth dependent patterns of TOC, DOC, and respiration rates. Lab and field results show that microbial communities were respiring readily through the cold temperatures. Since the presence of snow influences the carbon budget by allowing water movements and microbial process to continue, this has implications for the greater Boreal region and future changes in snow cover.

Youth livelihood strategies and environmental decision-making in the Humid Forest Zone of Cameroon

Presenting Author: Catherine MacNeil, University of Prince Edward Island

Youth are an important group within forest communities of Central Africa but are often underrepresented within traditional decision making structures. Since youth will be affected by the long term impacts of forest management decisions, they have a large stake in the successful management of resources. This is particularly important given the context of international discussions on mechanisms to mitigate climate change, particularly under REDD+ (Reducing Emissions from Deforestation and Forest Degradation) which will affect those who are dependent on forests as a source of livelihood. Given that youth are underrepresented in research studies, this research aimed to understand whether youth (aged 19 - 30) gain a large proportion of their livelihoods from the forest and if they are currently represented in local decision-making institutions that relate to forest governance. The research also aimed to understand what barriers may exist for youth gaining access to such institutions. A mixed methodological approach was used in six villages in the Eastern province of Cameroon. Surveys with youth provided a detailed view of livelihood strategies and forest dependence. Focus groups with traditional authorities, community forest committees, and youth provided information about the role of youth in decision making. Despite changes in educational opportunities, youth continue to derive a large proportion of their livelihood from forest resources. However, changes have been noted in the gender division of work. While youth remain underrepresented in formal village authorities and community forest committees, they play a large role in the development and functioning of other institutions. Barriers to involvement were identified as youth attitudes, adult perceptions of youth, and tradition. It was noted that in villages where the youth had formally organised that it was easier for them to become integrated into the formal institutions. In these villages, youth, particularly young men, had a means to contribute to decision-making.

Determining rate constants for photochemical reduction of mercury in Arctic snow

Presenting Author: Erin Mann, Acadia University

The arctic is a region where mercury (Hg) contamination is a problem. Snow is an important scavenger for atmospheric mercury, and once present in the snowpack, Hg may be transported to aquatic food webs, where accumulation and toxicity issues can occur. Photochemical oxidation and reduction reactions largely control mercury retention in snow; however, the rates of these reactions are uncertain. To accurately model mercury behavior in Arctic regions and better understand exposures and risk, reliable Hg reduction rate constants are required. This work presents photoreduction rate constants for mercury in solid snow with varying radiation intensity and snow chemistry. Snow was collected in the Canadian high Arctic from 3 sites near Resolute, NU in March 2012, using 2L Teflon containers and clean techniques. Triplicate samples were exposed to a range of environmentally realistic intensities of ultraviolet radiation ($1.26 - 5.78 \text{ W/m}^2$ for $\lambda = 280$ to 400 nm) using a quartz beaker inside a Luzchem photoreactor maintained at -10°C . Elemental mercury produced in snow was quantified using continuous analysis by gold amalgamation AFS (Tekran model 2537A). Pseudo-first order reduction rate constants were found to range between $0.5 \pm 0.07 \text{ h}^{-1}$ and 0.1 ± 0.03 for triplicate analyses. These rate constants were then compared over the studied irradiation intensities, and the range of snow cation, anion and DOC concentrations observed. This study is the first to generate controlled pseudo-first order mercury reduction rate constants in snow which will be useful for modeling mercury retention in the Arctic.

Forest of the Future? Using Mean Sensitivity as a Measure of Physiological Stress and the Future Climate-Envelope Contraction of White Spruce in Saskatchewan

Presenting Author: Bryan Mood, Mount Allison University

Climate change has become a major concern in the Prairie Provinces of Canada. Changes in weather patterns may adversely affect the biomass production of crops in addition to shelterbelt systems. Shelterbelts provide a vital service to the agricultural sector through protection from wind and their ability to accumulate snowfall.

Understanding how white spruce (*Picea glauca*) shelterbelts grow across southern Saskatchewan may offer insight into future physiological stresses on the boreal forest in central and northern Saskatchewan. A regional pattern of radial growth for white spruce in both shelterbelts and natural forests throughout Saskatchewan was constructed using dendrochronological techniques. Thirty chronologies were established ranging from 36 to 188 years old and it was found that mean sensitivity, a measure of year-to-year variation, had a significant relationship with latitude and longitude ($R^2 = 0.790$; $p < 0.0001$). Prominent climate variables contributing a significant amount of radial growth to white spruce were June temperature and spring precipitation. Using eigenvector analysis, these significant climatic growth factors were further understood as spring precipitation was found to explain 43.9% of the variance, June temperature explained 8.9% of the variance, and the other major contributing factor explaining 9.3% was soil. Using mean sensitivity as a measure of physiological stress on white spruce, three significant contributions can be projected. First, the spatial relationships suggest that white spruce should no longer be planted in shelterbelts of certain areas. Second, results of past growth taken in combination with future climate predictions of increasing surface temperatures and changes in precipitation patterns suggest a higher frequency of white spruce mortality events will occur throughout southern Saskatchewan in the future. And third, a future contraction of the optimum climate-envelope of white spruce in the southern boreal forest range margins will likely occur.

Adapting the Marine Protected Area network planning process for Climate Change

Presenting Author: Christine Stortini, Dalhousie University

Canada's oceans are adapting to a changing climate. The latest projections indicate that ocean temperatures on the Scotian Shelf, Atlantic Canada could increase by 2-3°C on the 50-year time scale (Trends and Projections working group for the ACCASP Atlantic LAB RA, 2012). Not only are the oceans warming, they are experiencing decreased pH, decreased salinity, lowered oxygen levels and increased occurrence of invasive species and diseases (Frank et al., 1990). Marine species that are unable to adapt quickly to changes in their environments are being forced to move towards the poles to maintain their preferred temperature ranges (Cheung et al., 2009; Sumaila et al., 2011). Those that are unable to escape or adapt to new conditions are consequently declining in numbers; some, especially polar species, risk extinction (e.g. Cheung et al., 2009). With changes in species distributions, patterns of biodiversity and structure of ecosystems are also changing. This project aims to develop and use a method to incorporate predicted climate change-induced ecosystem-level changes into the Marine Protected Area (MPA) planning process, which, in many countries including Canada involves input of spatial data to 'Marxan' (Ball et al., 2009), an internationally recognized geospatial planning tool. A spatially-explicit species-level vulnerability assessment, generalized for global use, will be employed to develop quantitative scores depicting species vulnerabilities to the effects of climate change on the Scotian Shelf. These vulnerability scores will be incorporated with species' spatial distributions, to allow for spatial identification of vulnerability and adaptability 'hotspots' on the Scotian Shelf. This will provide an input layer to the Marxan analysis for the Scotian Shelf MPA network currently being planned. It is hoped that this methodology will be a valuable contribution to Canadian and global MPA network planning processes and that its use will ensure MPAs designed now will continue to protect marine biodiversity and productivity into the future.

A Paleolimnological record of anthropogenic impact on water quality in First Lake, Lower Sackville, Nova Scotia

Presenting Author: Drake Tymstra, Acadia University

Lakes situated in urban environments are subject to a variety of anthropogenically induced pressures including nutrient loading, erosion, metal and salt inputs, and hypolimnetic anoxia. Since the 1920's, First Lake in Lower Sackville, Nova Scotia has been the focus of watershed development and degradation of lake water quality is an ongoing concern. A time stratigraphic, multi-proxy, geochemical investigation was conducted on a sediment core from First Lake in order to determine pre- and post-development water quality conditions. A year-long

study of limnological conditions, local weather conditions, and existing historical data was conducted in 2012. First Lake is 82 ha in size with a maximum depth of 23m. Survey results indicate shallow secchi depths (<2m), strong stratification (~6m) and neutral pH values (6.48-8.67). Oxygen-deprived bottom waters (<5%) commonly develop as the summer progresses. Water temperature trends indicate continual mixing in the epilimnion. Atmospheric Pb concentrations found within the sediment core were used to approximate sedimentation rates. Pre-development (pre-1920) data indicates a mesotrophic lake that may have experienced occasional eutrophic conditions. Post-development proxy data indicates higher $\delta^{15}\text{N}$ values and lower C/N ratios indicative of increased primary productivity within the lake as a result of increased nutrient input from early agricultural development during the 1920's. Changes in concentrations of Ti, Cu, K, loss-on-ignition and magnetic susceptibility values indicate landscape instability and increased sediment and toxin transfer into the lake associated with urbanization in the 1960's. Collectively, these data indicate that though First Lake was a moderately productive lake before development, recent water quality degradation is strongly linked to specific anthropogenic activities in the watershed, an understanding of which is a fundamental factor in developing effective lake management strategies.

Environment Abstracts

Poster Presentations

Remote assessment of instantaneous changes in water chemistry after liming in a Nova Scotia catchment

Presenting Author: Maria Armstrong, Dalhousie University

Southwestern Nova Scotia (SWNS) has some of the most acidic freshwaters in North America due to its location downwind of major emission sources and due to a resistant geology with little acid buffering capacity (Clair et al. 2007). Because of the poor buffering and regionally high runoff, hydrological events such as snowmelt and rain storms are frequent and can cause sudden changes in water chemistry which can have devastating effects on freshwater biota due to increases in acidity and metals (Dennis and Clair, 2012). Here we take advantage of recent advances in equipment to monitor water chemistry in an experimental catchment, and explore the response to catchment liming. Catchment liming is thought to be the best strategy for mitigating long-term effects of acid deposition in sensitive areas. We limed a segment of the dynamic source zone at a rate of 5 t/ha in a 50 ha catchment in SWNS to examine interactions between application of lime with the geological and climatological conditions of this region. In order to assess changes of episode frequency caused by liming, we established two mobile environmental monitoring platforms in the catchment: a control site located immediately above the limed area, and a treatment site 320 m below the limed area. We monitor pH, DO, water temperature, conductivity, stage height, air temperature, wind speed and direction as well as precipitation every 15 minutes with the data being accessed in real-time. The high frequency measurements were supplemented by chemical analysis of bi-weekly to monthly grab-samples at the site. pH values before treatment were as low as 4.9 and Ca²⁺ as low as 0.7 mg • L⁻¹ demonstrating the need for liming treatment. In this work, we show real-time outputs of pre- and post-treatment stream chemistry and present the short-term effects of liming on this acid sensitive ecosystem.

The toxicological effects of insecticides on *Chrysocus auratus*

Presenting Author: Heather Crozier, Dalhousie University – Faculty of Agriculture

Dogbane beetle (*Chrysocus auratus*) (Coleoptera: Chrysomelidae) is a native insect to eastern North America. It feeds exclusively on spreading dogbane (*Apocynum androsamifolium*), an emergent weed problem for lowbush blueberry production. The conventional management of lowbush blueberry often requires significant insecticidal sprays, which may have detrimental effects on non-target beneficial populations including *C. auratus*. I tested the effects of five different commercial insecticides registered for use on lowbush blueberry both orally and through direct contact. Two widely used pesticides had minimal effect on *C. auratus* survival, and consumption of spreading dogbane.

Factors Affecting Plant Re-colonization on Quarried Limestone Barrens Habitat on the Great Northern Peninsula, Newfoundland

Presenting Author: Garry Dart, Memorial University of Newfoundland

Quarrying has caused habitat loss and degradation in Limestone Barrens which is a unique biodiversity hotspot on the island of Newfoundland. The habitat is home to the endangered Longs Braya (*Braya longii*) and the threatened Fernald's Braya (*Braya fernaldii*). Naturally, it is limestone substrate with patchy cover of low-growing evergreens and small perennials; after quarrying it is covered in a diversity of native and non-native flora with more uniform and homogenous substrate. This study assessed factors that affect plant re-colonization of quarried Limestone Barrens on the Great Northern Peninsula, Newfoundland. The purpose of

this research is to identify and study which plant species recolonize after quarrying that ended in the late 1980's. Vegetation was sampled using belt transects across the study site. Plant cover of all species was sampled in 1 X 1 m plots every 2 m along the transect. To compare mean cover and species composition, Shannon-Weiner Index (SWI) was calculated, across transects and sites. In addition the study determined which of the following factors limit which species recolonize the quarried site without restoration: seedbank size and composition, substrate nutrient composition and substrate depth to bedrock. Results to date show that no *Braya* seeds were found in the seedbank samples analyzed. SWI calculations indicate that the natural undisturbed transects did not have the greatest biodiversity. *Braya* were only found growing in transects one and two which corresponded with minimal substrate depth. Human disturbance across the site directly affects plant re-colonization, substrate depth and species diversity.

Lead accumulation in constructed open water wet ecosystems in the Border Marsh region of New Brunswick and Nova Scotia

Presenting Author: Patrick Englehardt, Acadia University

Open water wet ecosystems (OWWE) in the Border Marshes region (BMR) provide productive avian and invertebrate habitat. In the BMR lead (Pb) is a contaminant of interest due to potential biomagnification and subsequent uptake by migratory waterfowl in OWWE. This study focuses on the relationships between constructed OWWE, autochthonous productivity and lead accumulation. Eleven sites were selected to represent the spectrum of the OWWE environments in the BMR. Sites variability was determined by measuring salinity (0‰- 2.83‰), pH (6.6 - 9.1) and specific physical parameters. Variability at each site was defined through weekly determination of water pH, temperature, dissolved oxygen (DO), salinity and total dissolved solids (TDS). Top-of core and bottomcore sediment samples were collected for each site and analyzed for loss on ignition (LOI), carbon-nitrogen ratios (C:N) and elemental concentrations of Pb and other environmental proxies (Ti, Fe, Mn) using X-ray fluorescence (XRF). C:N $\Delta^{13}\text{C}$ data indicates variable productivity (C:N 6.73 - 17.62) and that the organic sediment in all environments is dominantly autochthonous. Excavated sites had lower lead concentrations (0-14 ppm) in top-of-core sediment samples than non-excavated sites (>16 ppm). Bottom-of-core sediment sample exhibited highly variable lead concentrations (5-92 ppm) that reflect either natural lead sources (erosion of till) or the lack of an anthropogenic atmospheric source due to the pre-industrial age of the sediment. The variation in surficial sediment lead concentrations is likely due to a combination of factors including variable shoreline erosion, variable autochthonous productivity and, in some cases point source pollution. There was little evidence to indicate that lead sequestration correlates with salinity or pH. Results to date indicate recently excavated sites have higher autochthonous productivity and lower lead in surface sediments than either older excavated sites or natural OWWE.

Determinants of overwinter variation in CO₂ emission from natural landscapes

Presenting Author: Laura Graham, Saint Francis Xavier University

The northern regions of this continent hold vast reserves of soil organic carbon stored in wet and frozen areas, but recent anthropogenic climate change could lead to the acceleration of soil CO₂ decomposition and respiration. For snow-covered environments, wind-induced CO₂ flux enhancements are common due to ventilation of the high-permeability snowpack. Numerical modelling allows for the investigation of the interrelationships between microbial production, transport through the soil-snow column, and wind. A one-dimensional soil-snow model was developed and validated based on a previously developed soil physics model. Features in real winter flux datasets from Alaska were explained using basic sensitivity tests of the model. These features included rapid step changes in CO₂ fluxes, which were found to be common in the winter datasets studied. Sensitivity tests showed that even when snowpack diffusivities are higher than atmospheric, it is difficult to mimic field-observed events, suggesting that wind may be causing a more profound step change in CO₂ flux than we would have expected. Future recommendations involve sensitivity testing of the soil-snow

model on the ACEnet HPC cluster to allow for in-depth exploration of various soil, snow, and atmospheric parameters on observed fluxes, with particular attention being paid to snow effective diffusivity.

Wind Effects Urban Forest on the Halifax Peninsula: A Proactive Approach to Identifying Trees at Risk

Presenting Author: Heather Kerr, Dalhousie University

With the potential for climate change and rising temperatures, the frequency and intensity of storms are predicted to increase in Atlantic Canada. As a coastal city, Halifax is exposed to strong winds, which can result in damage to its urban forest, as seen in 2003 following Hurricane Juan (HRM Urban Forest Planning Team, 2012). This project examines the vulnerability of the Halifax Peninsula's trees to future wind events. This is an adaptive approach to assess urban forest vulnerability rather than a response to damage. While the majority of literature relating wind and street trees focuses on post-storm data collection and analysis, this project examines pre-storm tree conditions. The goal is to create a windthrow vulnerability index for individual trees. One hundred trees from across the Peninsula were sampled in random but evenly-distributed sites, and they were examined based on a variety of characteristics: location, species, height, diameter at breast height, tree height, height of nearest building, average crown width, distance to nearest building, soil conditions, and pruning. A vulnerability index was built based on literature support and expert opinion, and weighed on a three-level scale of low, medium, and high. A meta-analysis was undertaken where the Peninsula divided into ten neighbourhoods and the most vulnerable neighborhoods were elicited. These results may contribute to adaptation strategies being undertaken for the urban forest in Halifax (HRM Urban Forest Planning Team, 2012).

Investigating seasonal dynamics in soil CO₂ at contrasting sites in the Cape Breton Highlands National Park

Presenting Author: Daniel MacDonald, Saint Francis Xavier University

During the winter months in Canada, many plants and organisms become dormant. Trees shed their leaves and photosynthesis becomes minimal. Soils, on the other hand, stay relatively active throughout the winter months and though there may be no fresh supplies of organic matter to the soils, microbial activity continues to produce CO₂. The purpose of this experiment was to generalize differences between winter and growing season soil CO₂ concentrations and magnitudes of soil CO₂ production at two sites in the Cape Breton Highlands National Park. The sites investigated were of very different characteristics, both in elevation and vegetation and included a disturbed Acadian forest plot. Each site was equipped with soil profile CO₂ sensors, CO₂ flux auto-chambers, and meteorological stations with loggernet and cell telemetry. Gas wells were also installed for this study, from which 14CO₂ samples were extracted to indicate sources of carbon to the microbial community. It was found that at very shallow depths, CO₂ concentrations were extremely high, and increased further with depth. Carbon dioxide flux was found to be extremely variable on a daily basis. Furthermore, it was found that CO₂ concentrations and magnitudes of production were highly variable between seasons and sites. Seasonal variation in soil carbon dynamics is clearly evident, with site-specific characteristics having an important role in observed patterns.

Uncertainty in Modeled Climate Response to Deforestation due to Albedo Variability

Presenting Author: Sarah MacLeod, Saint Francis Xavier University

The conversion of forested areas into croplands is the result of the expansion of agriculture and industry. Deforestation is associated with increased atmospheric CO₂ and alterations to the surface energy and mass balances that can lead to local and global climate changes. An important component of these deforestation effects on climate are radiative changes due to the difference in albedo between forest and croplands/pastures. While observations clearly show albedo variability within similar vegetation classes, most GCMs make use of

only one snow-free albedo value for each vegetation class. Here we use the University of Victoria Earth System Climate Model to estimate the sensitivity of deforestation simulations to observed albedo variability based on experiments that simulate 50% deforestation over high, mid and low latitudes. The magnitude of the uncertainty in the modelled global surface air temperature (SAT) response due to albedo variability represents 0.30, 1.60 and 1.80 of the deforestation signal for the high- mid- and low-latitude experiments respectively. The uncertainty associated with the local (over deforested area only) soil temperature ranges from 0.63 in high-, 0.64 in mid-, to 1.25 in low-latitudes. High forest density appears to cause large uncertainties within the low latitudes, along with increased exposure to radiation from the sun. The albedo sensitivity of the modelled climate response to deforestation indicates that caution should be taken when using GCMs to predict deforestation effects.

Employee Behaviour and Sustainability in the Kitchens at Dalhousie University

Presenting Author: Brittany Maguire, Dalhousie University

Due to the volume of food production, industrial-sized foodservice facilities are more energy and water-use intensive than other facilities. In addition, they utilize food and material inputs and control the utilization and waste diversion rates of these resources. Resource waste can be reduced by installing upgrades, such as water and energy efficient equipment, efficient lighting and improved heating, ventilation, and air conditioning systems; however, as operators of the kitchen, employees also have control over resource use. Little research has been done on the impact of employee behaviour on resource use in the kitchen. This study looks at sustainability in the dining halls at Dalhousie University, specifically in terms of employee behaviours. In order to address this, the study will attempt to answer, in a case study of the dining hall in the Sheriff Hall Residence at Dalhousie University: 1) What behaviors in the dining hall impact sustainability objectives?; 2) What are the barriers that dining hall employees face in meeting sustainability objectives?; 3) What changes or programs could be implemented in order to reduce energy waste, water waste, food waste and enhance waste diversion in the dining hall? Qualitative research methods employed include interviews with dining hall staff from the Sheriff Hall Residence, Aramark management at Dalhousie University and other stakeholders. In addition, guided walk-throughs of the kitchen were done with three key informants.

Evaluation of Public Recreational Greenspace in Halifax Peninsula for Physical Activity Promotion Using The Quality of Public Open Space Tool

Presenting Author: Caroline McNamee, Dalhousie University

The purpose of this research is to determine the ability of public recreational greenspace in Halifax Peninsula to promote physical activity. Past research has determined particular features and characteristics of greenspace that influence physical activity. However, objective measurements of a greenspace's quality, in terms of the presence of these characteristics, have rarely been performed in Canada. The Quality of Public Open Space Tool modified for a Canadian context will be used to audit greenspaces in the study area using direct observation to collect information on the characteristics of greenspace that are known to influence physical activity. It is predicted that most of the greenspaces in Halifax Peninsula will have medium quality scores. The greenspace quality scores will also be analyzed using deprivation data for the area to determine if there is a connection between social/material deprivation and the quality of greenspaces located in that area. The results from this project can influence urban planning strategies in Halifax by providing decision makers with current information necessary to identify strengths and weaknesses of public recreational greenspace, so that improvements can be made. The results can also guide decision makers in determining specific areas of Halifax Peninsula that may benefit greatly from the addition of new or improvement of existing parks. The ability for public greenspace to be used as an urban planning tool to promote physical activity could be an important progression towards sustainable cities that simultaneously encourage healthy environments and healthy people.

The effects of estrogen on early life stages of rainbow trout (*Oncorhynchus mykiss*)

Presenting Author: Jinying Sun, University of New Brunswick - Saint John

Environmental pollutants mimic the action of natural sex steroid 17 β -estradiol and these compounds are referred to as environmental estrogens. Environmental estrogens are ubiquitously detected in aquatic environment and are a growing concern. These chemicals have been shown to exert effects on fish by disrupting endocrine systems and altering sex differentiation. The objectives of this study were to investigate the effects of estrogen on early life stage of rainbow trout (*Oncorhynchus mykiss*) at the molecular level by measuring gene expression using real-time polymerase chain reaction (RT-PCR). Rainbow trout embryos were exposed to 1 μ g/L of estrogen (E2) for 47 days, initiated either pre-hatching eyed-embryo stage or post-hatching upon entering alevin stage. Dilution water control and 0.01% MeOH control initiated pre-hatching at eyed-embryo stage were used as controls. Endpoints measured including survival, deformities, body length and weight, and gene expression of steroid hormone receptors and stress related genes. The results demonstrated that E2 treatment significantly decreased survival rates when exposures were initiated at the eyed-embryo developmental stage. There were no significant differences in body lengths and weights of fry exposed post-hatch to 1 μ g/L E2. The most responsive gene was found to be vitellogenin (vtg) and it was induced 100 fold higher with E2 exposure compared to controls. Thus, this biomarker for estrogens is inducible at very early stages of development. Hepatic steady state mRNA abundance of estrogen receptor isoforms (esrb1 and esrb2), and androgen receptor (arb) were found to be down-regulated in both E2 treatment groups. Stress-related genes such as cyp1a3, glutathione peroxidase (gp), and glutathione transferase (gstk) were found to be down-regulated in E2 treatment groups. This study provides novel insight into the role of estrogens at early stages of embryonic development in salmonids.

What is the significance of “community” wind energy? The influence of local project initiation, participation, and investment on local perceptions

Presenting Author: Tiffany Vass, Dalhousie University

This study examines the relative influence of local project initiation, local participation, and local investment on local perceptions of three small-scale wind energy projects in Nova Scotia. In the literature, it has been increasingly suggested that how wind energy projects are developed has a significant influence on whether local people support or oppose those projects. This acknowledgement is reflected in a growing interest in promoting “community” wind energy, in which local people are involved in planning and/or owning wind energy projects. In Nova Scotia, the provincial government has recently introduced a Community Feed-in Tariff (COMFIT) Program, which has helped drive an increased interest in “community” wind energy in the province. Many of the newly proposed projects under COMFIT have offered local people the opportunity to invest in the projects through Community Economic Development Investment Funds. However, there has been little research into how shareholding and other forms of local involvement influence local support for wind energy projects in Nova Scotia. Furthermore, studies have not examined what factors lead to a sense of “community ownership” of these projects. This study explores these topics through an analysis of local perceptions of the Maryvale, Spiddle Hill, and Watt Section wind energy projects, which have varying degrees of local involvement. A mail-out questionnaire was sent to local residents surrounding the three projects. A comparison of local perceptions among the three projects was conducted using analysis of variance, and predictors of local support among individual community members were determined using multiple linear regression. The results of the study will contribute to an understanding of what “community” wind energy means to local residents and how wind energy can be developed in Nova Scotia in a way that local communities welcome.



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| 2. Vaughan Memorial Library | 14. Dennis House | 22. Carnegie Hall | 30. Eaton House |
| 3. Wong International Centre | 15. Raymond House | 23. Emerson Hall | 31. Cullen House |
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| 5. Godfrey House | 17. Harvey Denton Hall | 25. Willett House | 33. DeWolfe House |
| 6. Centre for Organizational Research & Development | 18. Seminary House | 26. Chipman House | 34. Woodland Trails |
| 7. Bancroft House | 19. Manning Memorial Chapel | 27. Roy Jodrey Hall | 35. Harriet Irving Botanical Gardens |
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| 9. Old Sub | | | 37. Patterson Hall |

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 12. Crowell Tower

38. Biology Building
 39. Horton Hall
 40. War Memorial House
 41. Huggins Science Hall
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Our small upper-level classes, our focus on student-centred learning and our dedication to undergraduate research are only a few of the reasons why so many **Acadia University** graduates move on to successful careers in the health sciences, environment, education, industry or government.



Atlantic Elver Fishery is an eel elver harvesting and exporting operation based in Queens County, NS. The company also has numerous research projects and stewardship campaigns throughout Eastern and Central Canada.



The **Canadian Centre for Fisheries Innovation** is a non-profit organization owned by Memorial University of Newfoundland and funded by the Government of Newfoundland and Labrador with additional support from the Maritime Provinces' Governments. CCFI provides the tools of scientific research and technology to the fishing industry.



Cooke Aquaculture is a fully integrated corporation with operations in New Brunswick, Prince Edward Island, Nova Scotia, Newfoundland, Maine and Chile.



The Science Atlantic Environment Conference Award, made possible through the **KC Irving Environmental Science Centre**, goes to the best oral or poster presentation of undergraduate student research relating to the flora or fauna of the Acadian Forest Region.



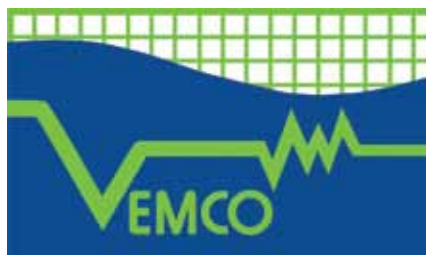
Novartis Animal Health is supporting aquaculture through continued in-depth study of health solutions for the challenges that face both currently cultured and emerging species of fish. Novartis developed the first licensed vaccines against several salmon viruses including ISA and IHN.



Skretting delivers outstanding nutrition and services to fish farmers worldwide for the sustainable production of healthy and delicious fish.



Valox is a Fredericton-based aquaculture supply company.



From transmitters and receivers to temperature and depth data storage recorders, Halifax-based company **VEMCO** has revolutionized how scientists conduct field research.



Do your part.

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ADDITIONAL SPONSOR



Clearwater is a wild seafood company dedicated to sustainable seafood excellence, with a large fleet of vessels and several processing plants throughout Eastern Canada.

and please note:

In the Biology Oral Presentation section,
Sarah Predham will be presenting, not Sarah Prednam.

In the Environment Oral Presentation section,
Christine Stortini is not attending the conference.

