

WELCOME!



Welcoming Remarks



Dear Delegates:

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

Mount Saint Vincent 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 Halifax, the Mount and the 2014 Science Atlantic Aquaculture & Fisheries and Biology Student Conference! The organizing committee hopes you are looking forward to an exciting, fun and enlightening experience. If all goes as planned – and even if there are a few surprises – you should not be disappointed. Most importantly, we have more than twenty oral presentations in each of Aquaculture & Fisheries and Biology and a similar number of poster presentations in Biology. For the first time, presentations and posters will be judged not only by a committee of faculty but also in a “peoples’ choice” poll. Our keynote speakers will bring us to the frontiers of vertebrate skeletal developmental biology and fish aquaculture. There are planned social activities, including a musical open-mike on Friday evening and dinner and live entertainment on Saturday night. Of course, we know you will be talking with old and new friends about nature, research academia, industry, public policy, careers, opportunities, and much more. Please make the most of your time at MSVU and the 2014 SAAFBC!

The organizing committee offers a special welcome to a delegation of high school students who will be attending one of the poster sessions. We encourage all attendees to make these young scientists feel at home and appreciated. They are the future.

If you need any assistance, do not hesitate to track down a member of the organizing committee or speak with one of our student volunteers (look for a T-shirt with the conference logo).

The organizing committee is very grateful for financial support received from the offices of the President and the Dean of Arts & Science at MSVU. We also appreciate the assistance we received from the Executive Director of Science Atlantic and the 2013 organizing committee.

Your 2014 SAAFBC organizing committee:

Kevin Shaughnessy, Biology, Conference Coordinator
Ron MacKay, Biology
Christine Hammer, Student Representative and Volunteer Coordinator
Nazha Feniyanos, Student Representative and Public Relations
Christophe Herbinger, Aquaculture & Fisheries
Tim Frasier, Aquaculture & Fisheries

Table of Contents

Schedule of Events	4
Notes on Keynote Speakers	6
Schedule of Oral Presentations	7
Abstracts	
<u>Aquaculture & Fisheries</u>	
Oral Presentations	10
<u>Biology</u>	
Oral Presentations	18
Poster Presentations	26
Biology Poster Presenter Index	34
Summary of Poster Sessions	34

Schedule of Events

Friday, March 14th, 2014

5:00 – 8:00pm **Check-in** (Rosaria Student Centre, Mezzanine)

Students

5:00 – 7:00pm **Poster setup** (Rosaria Student Centre, Multi-Purpose Room)

5:30 – 6:30pm **Faculty/student mixer** (Rosaria Student Centre, Vinnie's Pub)

6:30 – 1:00am **Pizza and open mike social** (Rosaria Student Centre, Vinnie's Pub)

Faculty

5:30 – 6:30pm **Faculty/student mixer** (Rosaria Student Centre, Vinnie's Pub)

6:30 – 7:30pm **Faculty banquet** with cash bar (Faculty Lounge – Seton Academic Centre, Rms. 404/405)

7:30 – 8:00pm **Joint meeting of the SA Aquaculture & Fisheries and Biology committees**
(Faculty Lounge – Seton Academic Centre, Rms. 404/405)

8:00 – 10:00pm **SA committee meetings**
Aquaculture & Fisheries (Seton Academic Centre, Rm. 529)
Biology (Seton Academic Centre, Rm. 504)

Saturday, March 15th, 2014

7:30 – 8:30am **Breakfast** and check-in (Rosaria Student Centre, Multi-Purpose Room)
Poster Session 1 (Rosaria Student Centre, Multi-Purpose Room) – authors *not* required
at posters - all are welcome

8:30 – 8:45am **Joint welcoming remarks** (Rosaria Student Centre, Multi-Purpose Room)
Mr. Kevin Shaughnessy, Conference Organizer
Dr. Ramona Lumpkin, President MSVU
Dr. Brook Taylor, Dean of Arts and Science MSVU

8:45 – 9:30am **Keynote Address** (Rosaria Student Centre, Multi-Purpose Room)
Speaker: Dr. Tamara Franz-Odenaal (MSVU)
Presentation: *Inside and Outside Skeletons*

9:30 – 10:00am **Break**
Dispersal to oral presentation sessions

10:00 – 12:00pm **Oral Presentations 1** (15 minutes each)
Aquaculture & Fisheries – Seton Academic Centre, Auditorium A
Biology – Seton Academic Centre, Auditorium D

12:15 – 1:15pm **Lunch** (Rosaria Student Centre, Multi-Purpose Room)
Poster Session 2 (Rosaria Student Centre, Multi-Purpose Room) – exclusive viewing by
high school students (12:15-12:45, authors at odd-numbered posters; 12:45-1:15, authors
at even-numbered posters)

- 1:15 – 2:15pm** **Poster Session 3** (Rosaria Student Centre, Multi-Purpose Room) – all welcome (authors at posters)
- 2:15 – 3:00pm** **Keynote address** (Rosaria Student Centre, Multi-Purpose Room)
 Speaker: Melissa Rommens (Sustain Aqua)
 Presentation: *The development of the Atlantic halibut aquaculture industry – a story of innovation and persistence*
- 3:00 – 3:30pm** **Nutrition break** (Rosaria Student Centre, Multi-Purpose Room)
 Dispersal to oral presentation sessions
- 3:30 – 5:45pm** **Oral Presentations 2** (15 minutes each)
 Aquaculture & Fisheries – Seton Academic Centre, Auditorium A
 Biology – Seton Academic Centre, Auditorium D
- 6:00 – 7:15pm** **Dinner & cash bar** (Rosaria Student Centre, Multi-Purpose Room)
Dinner will be served at 6:15pm
- 7:15 – 8:45pm** **Poster Session 4** (Rosaria Student Centre, Multi-Purpose Room) – all welcome (authors at posters)
- 9:00 – 1:00am** **Evening at Vinnie’s** with *The Laughing Freeman* (Rosaria Student Centre, Vinnie’s Pub) - music

Sunday, March 16th, 2014

- 8:00 - 9:15am** **Breakfast** (Rosaria Student Centre, Multi-Purpose Room)
 Dispersal to oral presentation sessions
- 9:15 – 9:30am** **Organizational remarks/announcements** (Seton Academic Centre, Auditoriums A and D)
- 9:30 – 11:30am** **Oral Presentations 3** (15 minutes each)
 Aquaculture & Fisheries – Seton Academic Centre, Auditorium A
 Biology – Seton Academic Centre, Auditorium D
- 11:45 – 12:45pm** **Lunch** (Rosaria Student Centre, Multi-Purpose Room)
- 12:45 – 1:30pm** **Awards ceremony** (Rosaria Student Centre, Multi-Purpose Room)

Notes on our Keynote Speakers

Dr. Tamara Franz-Odenaal, Associate Professor of Biology, Mount Saint Vincent University, NSERC Chair for Women in Science and Engineering, Atlantic Region

Dr. Tamara Franz-Odenaal was born and raised near Cape Town, South Africa. She graduated from the University of Cape Town with a PhD in Zoology with a focus in paleontology and completed her post-doctoral studies at Dalhousie University in Evolutionary-Developmental Biology. Dr. Franz-Odenaal joined the Mount in 2006 as a NSERC University Faculty award recipient (2006-2011) and has since launched an active productive research program as a morphologist and developmental biologist in the field of skeletal biology. Dr Franz-Odenaal serves as an excellent role model to her students, many of which have published their research and have continued their careers in the science fields. She was the 2013 recipient of the Young Investigators Award in Morphological Sciences by the American Association of Anatomists. In 2011, Dr Franz-Odenaal was awarded the NSERC Atlantic Chair for Women in Science and Engineering. She is one of five chairholders across Canada that are working to increase the participation of women in science and engineering and to provide role models for women considering careers in these fields. Dr Franz-Odenaal is also one of the Discovery Centre's 2013 Science Champion Award holders, serves on a NSERC Discovery Grants Review Panel and on a Canadian Council of Academies Expert Panel.



Conference Keynote Topic: Evo-Devo approaches to understanding the complexity of the vertebrate skeleton

Melissa Rommens, Vice President, Sustain Aqua

Melissa received her BSc and MSc from the University of New Brunswick in Fredericton, NB. After working at Fisheries and Oceans for a number of years with their Broodstock Aquaculture Alternative Species Program, she opted to begin working in industry as a hatchery manager for Scotian Halibut Limited, the only commercial producer of Atlantic halibut juveniles in North America. Within this position, she managed their R&D program which has allowed the advancement of intensive culture practices for Atlantic halibut and demonstrated an ongoing commitment to an extensive halibut broodstock development program. Melissa has initiated and coordinated international and regional working groups on halibut aquaculture which have instigated multi-country research programs and organized co-operative industry efforts. Melissa still oversees Scotian Halibut's hatchery operation and R&D efforts. In addition, Melissa works with Canaqua Seafoods Limited, a forward-thinking multi-species land-based aquaculture company in Advocate Harbour, NS; Halibut PEI, a new land-based halibut aquaculture venture in Victoria, PEI; and Atlantech Companies, an innovative recirculation aquaculture system and water treatment engineering company in Charlottetown, PEI. Melissa has been a course instructor for the Canadian Aquaculture Institute as well as several industry specific training programs.



In 2013, Melissa co-founded the company Sustain Aqua, a consulting firm that specializes in working directly with producers, government and industry associations to help develop or integrate new technologies or processes to improve productivity while minimizing environmental impacts. Sustain Aqua promotes the use of Life Cycle Analysis (LCA) for environmental impact determination and Sustainability Return on Investment (SROI) for critical decision making. With Sustain Aqua, Melissa currently enjoys working with the Sea Farmers of Nova Scotia in developing their Codes of Practice and converting select farms to organic production.

Conference Keynote Topic: The development of the Atlantic halibut aquaculture industry – a story of innovation and persistence

Schedule of Oral Presentations

Saturday, March 15th ~Oral Presentations 1~

Timeslot	~Aquaculture & Fisheries~ Seton Academic Centre, Auditorium A	~Biology~ Seton Academic Centre, Auditorium D
10:00 – 10:12am	Guo, Yue (DAL AGRI) Determination of the digestibility of different sources of poultry by-product meal by Atlantic salmon (<i>Salmo salar</i>)	Fielden, Miles (MUN) West Nile Virus and the Arboviral Mosquito Community in St. John's, Newfoundland and Labrador
10:15 – 10:27am	Kindree, Meagan (DAL) Association between graft recipient characteristics and weight/colour of pearls produced by the pearl oyster <i>Pinctada margaritifera</i>	McPhee, Iain (UPEI) Effect of flavonoid-rich apple peel extract (FAE) on biomarkers of blood pressure in spontaneously hypertensive rats
10:30 – 10:42am	Didychuk, Amanda (UNBF) Polyploid induction in Zebrafish (<i>Danio rerio</i>)	Ghassemi Rad, Javad (DAL) Myricetin inhibits T-cell proliferation through the generation of hydrogen peroxide
10:45 – 10:57am	Nader, Nicole (UNBF) Effects of ploidy and cell size on erythrocyte volume control in brook charr (<i>Salvelinus fontinalis</i>)	Annan, Henry (SMU) Molecular basis of cell migration inhibition by the dietary phytochemical piperine.
11:00 – 11:12am	Grosicki, Kathleen (SFX) Trying to stop invasive tunicates from overtaking mussel farms using goo from the dentist's office	Hammer, Christine (MSVU) A comparative shape analysis of the oral jaws of the Mexican tetra (<i>Astyanax mexicanus</i>) and the zebrafish (<i>Danio rerio</i>)
11:15 – 11:27am	Hall, Stephanie (DAL AGRI) Spatial and temporal monitoring of <i>Hydroides dianthus</i> in environmental water samples at Eel Lake using a species specific molecular assay	Warner, Trevor (DAL) Plant Cell Death Morphology in <i>Aponogeton madagascariensis</i> : A Comparison Between Developmental and Induced PCD
11:30 – 11:42am	Gallardi, Daria (MUN) Comparison of the health and condition of cultured mussels (<i>Mytilus edulis</i>) from deep and shallow water sites in Newfoundland	Wilson, Kaitlyn (MSVU) Investigations into the development of the conjunctival papillae using fluorescent dye labeling
11:45 – 11:57am	Lin, Feng (DAL AGRI) Rate of increase in salinity affects acclimation of rainbow trout, <i>Oncorhynchus mykiss</i> to seawater	Ogden, Mike (UPEI) A comparative analysis of leaf development in two species of <i>Cecropia</i> with contrasting leaf morphology

Saturday, March 15th ~Oral Presentations 2~

Timeslot	~Aquaculture & Fisheries~	~Biology~
	Seton Academic Centre, Auditorium A	Seton Academic Centre, Auditorium D
3:30 – 3:42pm	Zhang, Yangfan (DAL AGRI) Egg quality in domesticated wild and F1 Atlantic halibut (<i>Hippoglossus hippoglossus</i>)	Bishop, Adam (UNBF) Error prone PCR generated mutants of YvrHa used to determine critical binding amino acid residues in the unusual YvrHa/YvrI two-subunit sigma factor system of <i>Bacillus subtilis</i>
3:45 – 3:57pm	Minch, Taryn (UNBSJ) Size-at-age of juvenile American lobsters (<i>Homarus americanus</i>) inhabiting cobble and mud bottom in Mace Bay, Bay of Fundy	Slade, Frankie (MUN) Hips don't lie: Understanding Huntington Disease through interactions of Hip1, Hippi, htt and deltex In <i>Drosophila melanogaster</i>
4:00 – 4:12pm	Thurlow, Samantha (UNBSJ) Effect of maternal geographic origin and size on offspring size and morphology of swimming structures in American lobster (<i>Homarus americanus</i>)	Curry, Dennis (CBU) Adsorption of Doxorubicin on Gold Nanoparticle Surfaces: The Feasibility of Gold Nanoparticles as Cancer Drug Delivery Vehicles
4:15 – 4:27pm	Baker, Elizabeth (DAL AGRI) Bacterial surveys of haemolymph of the American lobster (<i>Homarus americanus</i>) in Eastern Nova Scotia	Perry, Laura (CBU) Epidemiological study of dogs with otitis externa in Cape Breton, Nova Scotia
4:30 – 4:42pm	Samson, Alexandre (DAL AGRI) Abundance and Prevalence of the Intestinal Parasite <i>Polymorphus botulus</i> in American lobsters (<i>Homarus americanus</i>) in Nova Scotia	Filiaggi, Corey (MTA) Assessing the Risk of Lyme Disease in New Brunswick: Testing Ixodes ticks for the presence of <i>Borrelia burgdorferi</i>
4:45 – 4:57pm	Morrison, Kaycee J. (ACA) Seasonal migration and habitat of the American lobster, <i>Homarus americanus</i> , in Minas Passage, Bay of Fundy	Benfey, Nick (UNBF) Cloning and expression of <i>Ancylostoma</i> -secreted-protein homologues secreted by <i>Parelaphostrongylus tenuis</i>
5:00 – 5:12pm	Nau, George (ACA) Commercial American Lobster Fisheries and Long-Term Environmental Cycles	van den Heuvel, Connie (DAL AGRI) Effectiveness of several class of anthelmintics for the control of <i>Haemonchus contortus</i> in sheep
5:15 – 5:27pm	Saunders, Jennifer (DAL) Modelling of porbeagle shark (<i>Lamna nasus</i>) bycatch in the Scotia-Fundy groundfish fishery	
5:30 – 5:42pm	Halat, Laryssa (SFX) Epidermal cell shedding is an overlooked factor in rockweed (<i>Ascophyllum nodosum</i>) harvesting	

Sunday, March 16th ~Oral Presentations 3~

Timeslot	~Aquaculture & Fisheries~ Seton Academic Centre, Auditorium A	~ Biology~ Seton Academic Centre, Auditorium D
9:30 – 9:42am	Andrews, Samuel (ACA) Fishway Efficiency and Passage Behaviour of Alewife (<i>Alosa pseudoharengus</i>) in Three Fishways near Amherst, NS	Vogel, Jakob (DAL AGRI) Effect of Exposure to Individual Ration Components on Feed Sorting Behaviour of Dairy Heifers.
9:45 – 9:57am	Lawrence, Elizabeth (DAL) Stochastic effects of dams on the population persistence of Atlantic salmon (<i>Salmo salar</i>)	Yuill, Hillary (SMU) The relationship between condition and measures of stress in nestling European starlings
10:00 – 10:12am	Anthes, Livia (DAL) Population structure and effective size of the Common Galaxias (<i>Galaxias maculatus</i>) in a Patagonian post-glacial lake system	Millet, Lee (ACA) Factors affecting duck brood rearing in small wetlands in the Annapolis Valley, Nova Scotia
10:15 – 10:27am	Whidden, Julia (ACA) Population Characteristics of Little Skate and Winter Skate in the Minas Basin, Bay of Fundy	Pitts, Wesley (ACA) Determining if ex situ, in situ or one month captive-reared Blanding's turtle (<i>Emydoidea blandingii</i>) hatchlings are more robust
10:30 – 10:42am	Buhariwalla, Colin (ACA) Description and origin of Striped Bass (<i>Morone saxatilis</i>) collected from a winter fish kill in the southern Gulf of St. Lawrence	Woodard, Krystal (UNBSJ) Burrowing behaviours of juvenile soft-shell clams (<i>Mya arenaria</i>) in response to intertidal sediment acidification
10:45 – 10:57am	Dionne, Kaitlyn (DAL) Phenotypic divergence of reproductive energy allocation and morphometrics in a managed population of Chinook salmon (<i>Oncorhynchus tsawytscha</i>)	Carverhill, Jacqueline (MTA) What Goes In Must Come Out: Quantifying Nitrogen Emissions from Crop Residue Degradation
11:00 – 11:12am	Burnell, Celene (DAL) Using external accelerometers tags to identify scouring behaviour in Atlantic cod	Gould, Jessica (DAL) Investigation of possible non-thermal effects on Uk'37 values from Atlantic and Western Equatorial Pacific suspended particulate samples: Implications for Uk'37 Paleothermometry
11:15 – 11:27am	Stewart, Nathan (ACA) Age and growth of Atlantic sturgeon (<i>Acipenser oxyrinchus</i>) in the Saint John River, New Brunswick	

Aquaculture & Fisheries Abstracts

Oral Presentations

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

Fishway Efficiency and Passage Behaviour of Alewife (*Alosa pseudoharengus*) in Three Fishways near Amherst, NS

Presenting Author: Andrews, Samuel (Acadia University)

When migrating inland to spawn the anadromous alewife (*Alosa pseudoharengus*) often must pass man-made fishways. Despite their prevalence, the effectiveness of fishways is still poorly understood and passage efficiencies can range widely between designs, location and environmental conditions. In order to quantify passage efficiency and guide design for new fishway construction migratory alewives were tagged with Passive Integrated Transponders (PIT) tags and tracked through three technical fishways on the Tantramar Marsh, near Amherst NS. Fishway passage efficiencies ranged from 75% - 0.005% between structures. Characteristics of successful, unsuccessful and undetected fish were quantified. Tagging data also provided information on passage behaviours, migratory durations and migrant survival, information that is rarely measured or discussed in the context of fishway passage.

Population structure and effective size of the Common Galaxias (*Galaxias maculatus*) in a Patagonian post-glacial lake system

Presenting Author: Anthes, Livia (Dalhousie University)

Knowledge of the genetic structure of a fresh-water fish population can offer valuable insight on how genetic variation is maintained within a system. This information is crucial in evaluating the viability and stability of a population in midst of demographic and environmental change, applicable directly to both fisheries management and species conservation. This study was focused on a remarkably wide-spread species, *Galaxias maculatus*, that is an essential prey-fish in the post-glacial Manso River system of southern Argentina where it sustains abundant populations of both native and introduced predatory fish. Analyses were conducted on *G. maculatus* samples (n~600) collected in years 2007 and 2008 from 8 lakes in the Rio Manso system, amplified at 17 polymorphic microsatellite loci. The data was consequently analyzed for population structure, effective population size (N_e), degree/ directionality of gene flow and genetic divergence (FST). Preliminary results have shown evidence of hierarchical structure and asymmetric gene flow between lakes. Glacial headwaters are largely isolated from immigration, but are contributing a significant amount of migrants to downstream populations. These gene flow patterns have been found to maintain the observed genetic variation within the Rio Manso metapopulation, providing us with a better understanding of how changes to habitat and potential barriers to migration may affect this species in the future.

Bacterial surveys of haemolymph of the American lobster (*Homarus americanus*) in Eastern Nova Scotia

Presenting Author: Baker, Elizabeth (Dalhousie University, Faculty of Agriculture)

The lobster fishery is the highest valued fishery in Canada, involving over 10 000 licenses and supporting the livelihoods of many families within the Atlantic Provinces. It is crucial that we investigate potential problems concerning the health of the American lobster (*Homarus americanus*) to ensure the long-term sustainability and success of the industry due to this economic importance. Twenty lobsters were sampled from each of six ports along the Eastern shore of Nova Scotia during the 2013 lobster season including: Port Bickerton, Wine Harbour, Marie Joseph, Little Liscomb, West Quoddy and Port Dufferin. Characteristics of the lobsters were recorded including: carapace length, sex, shell hardness and shell condition, and haemolymph samples were drawn and incubated in bacterial grown media. Bacteria isolated from lobster haemolymph were subcultured, preserved and identified using Matrix Assisted Laser Desorption Ionization Time of Flight mass spectrophotometry. Identified bacteria were compared to the recorded morphological characteristics to determine any correlations between the two. Isolated bacteria include: *Pseudomonas putida*, *Bacillus subtilis* and *Proteus hauseri*. It is important to continue studying bacteria found within lobster haemolymph in order to understand infections that may cause health problems in *H. americanus*, and subsequently cause problems for the lobster fishing industry.

Description and origin of Striped Bass (*Morone saxatilis*) collected from a winter fish kill in the southern Gulf of St. Lawrence

Presenting Author: Buhariwalla, Colin (Acadia University)

Striped Bass (*Morone saxatilis* Walbaum, 1792) in the southern Gulf of St. Lawrence occupy the northern extreme of the species range and, unlike southern populations, exhibit obligate estuarine and freshwater overwintering to escape potentially lethal marine temperatures. The Miramichi River, NB is thought to be the sole spawning stock within the southern Gulf with opportunistic overwintering reported in estuaries as far as East River (Pictou), NS. In January 2013 a shutdown of the warm water outfall of the Trenton, NS power generating facility, located at the mouth of the East River (Pictou), resulted in a fish kill event. Striped Bass were collected (n= 98) from the shore of Pictou Harbour and sampled for length, weight, age, and stomach contents. Sampled bass ranged in size from 11.8 to 60.2 cm total length, weight from 12.6 to 2731 g, and ages 1 to 5 years. Fourteen stomachs contained food with Striped Bass and Fourspine Stickleback (*Apeltes quadracus*) the only prey species identified in 57.1 and 28.6% of stomachs containing food, respectively. DNA microsatellite analysis determined that the bass from the kill were statistically different ($P < 0.004$) from the Miramichi stock and may represent a new Striped Bass stock in the Gulf of St. Lawrence region.

Using external accelerometers tags to identify scouring behaviour in Atlantic cod

Presenting Author: Burnell, Celene (Dalhousie University)

Ectoparasites can adversely influence fish behaviour and reduce functional efficiency. Clinical indicators of ectoparasite infection include skin abrasion, abnormal colouration, emaciation, loss of buoyancy and erratic swimming behaviour exhibited as substrate scouring to dislodge the parasite(s). Atlantic cod (*Gadus morhua*) maintained in captivity have been observed to engage in such scouring behaviour, as well as when tagged with a Petersen disc tag. To quantify this behaviour, I use 50 Hz tri-axial (lateral, longitudinal, vertical) acceleration data collected from Atlantic cod of various sizes. A supervised algorithm was developed as an automated method of detecting and extracting scouring behaviour from the acceleration signals. Through the use of signal processing, this study aims to determine 1) the frequency of scouring events 2) associated energy expenditure, and 3) the frequency of scouring behaviour in relation to cod size and duration of tag attachment. Quantifying the behaviour can provide insights to the potential impact parasites may have on cod, as they are a key species in the North Atlantic ecosystem, and provide economical value in commercial fisheries and aquaculture production. In addition, the application of high-frequency accelerometers offers the possibility to acquire and interpret high-resolution data about an animal's movement in 3-dimensions, improving methods to infer animal behaviour.

Polyploid induction in Zebrafish (*Danio rerio*)

Presenting Author: Didychuk, Amanda (University of New Brunswick Fredericton)

Polyploidy refers to the state of having more than two sets of chromosomes and can occur naturally in some organisms, or be induced with shock treatments. Triploids have three sets of chromosomes and tetraploids have four. The induction of polyploidy in fish has been used mainly for creating sterile populations for aquaculture. I am investigating polyploidy in Zebrafish, chosen for their hardiness and use as a model vertebrate species; their size and developmental biology make them useful for this study. I want to determine the optimum treatments for producing triploid zebrafish using heat, cold, and pressure shocks, and for producing tetraploid zebrafish using heat and pressure shocks.

Phenotypic divergence of reproductive energy allocation and morphometrics in a managed population of Chinook salmon (*Oncorhynchus tshawytscha*)

Presenting Author: Dionne, Kaitlyn (Dalhousie University)

The energetic demands of migrating to natal streams to spawn can lead to certain trade offs in the allocation of energy in Pacific salmon. More arduous migrations can lead to less energy being available for reproductive purposes and secondary sexual traits. In order to determine if phenotypic divergence of these traits is occurring in a managed population of chinook salmon (*Oncorhynchus tshawytscha*) in the Atnarko River of British Columbia, coded wire tagged river entry fish and spawning ground gravid females were examined and compared between lower and upper river migrants. River entry fish were sampled for various morphometrics by a First Nations biosampler while hatchery

staff coordinating brood stock efforts collected morphometrics and measures of reproductive effort in gravid females. In order to provide further evidence that these stocks may be diverging, differences in morphometrics of hatchery juveniles will also be analyzed. Preliminary statistical analysis of the data suggests that divergence may be occurring between these stocks as is demonstrated by significant differences in the fecundity of gravid females not related to the length of the fish.

Comparison of the health and condition of cultured mussels (*Mytilus edulis*) from deep and shallow water sites in Newfoundland

Presenting Author: Gallardi, Daria (Memorial University of Newfoundland)

Mussel aquaculture in Newfoundland is expanding. Typically culture sites are situated in sheltered areas near shore. However land run-off, user conflicts and environmental impact are concerns. Developing deeper water mussel culture may help to address different issues: limiting contamination, reducing carry capacity limits and food depletion and increasing sustainability. Increased water quality and food sources suggest a possible improvement in culture conditions and decreased stress for the animals and therefore enhanced mussel condition and health. In Notre Dame Bay, Newfoundland, data suggests that the region between 10 and 20m depth is the most productive and it provides the most stable environment. This study shows a comparison between shallow and deep water mussel culture sites. Three blue mussel (*Mytilus edulis*) sites were evaluated every four months, starting September 2012: shallow and deep water mussel line were compared for condition, biochemical parameters (total lipid, fatty acid and glycogen content), immune-response and environmental conditions. Between September 2012 and May 2013 the mussels in shallow water achieved a better growth and condition than the ones in deep water. However, by September 2013 the condition of mussels in deep water was comparable to those in shallow water. Biochemical analysis shows seasonal variation, but no differences between shallow and deep water sites. Environmental data show that the location of the deep water sites corresponds with the thermocline region. Deep water sites appear to have larger and longer lasting spring bloom effects. Also immune-response genes shows seasonal variation in expression levels between shallow and deep water sites.

Trying to stop invasive tunicates from overtaking mussel farms using goo from the dentist's office

Presenting Author: Grosicki, Kathleen (St. Francis Xavier University)

The globally invasive tunicate *Ciona intestinalis* is a sessile filter feeder that causes extensive biofouling on artificial substrates in its non-native environments. Here in the Maritimes, *C. intestinalis* fouls mussel farms extensively, which has led to reduced profit margins for farms. We wanted to create a surface that would inhibit *C. intestinalis* from attaching to substrates, and protect these farms. *C. intestinalis* larvae select and attach to substrates, so we designed and tested surfaces that could inhibit settlement or metamorphosis of the larvae. Discs of three types of surfaces were tested in static larval assays, and polyvinyl siloxane surfaces inhibited larvae most effectively. Specifically, a leachate from the polyvinyl siloxane discs induced larval mortality within 24 h, and persisted after discs were leached for up to 90 days in lab and 49 days in the ocean. In this initial testing, polyvinyl siloxane shows promise as a long-lasting, surface-based inhibitor of *C. intestinalis* fouling.

Determination of the digestibility of different sources of poultry by-product meal by Atlantic salmon (*Salmo salar*)

Presenting Author: Guo, Yue (Dalhousie University, Faculty of Agriculture)

Poultry by-product meal (PBM) is a promising ingredient for replacing fishmeal especially for the salmonid diets. However, different manufacturers produce PBM from different raw sources, using different processes, which may lead to the variation in quality of PBM. Six hundred and thirty Atlantic salmon smolts (*Salmo salar*) with the initial weight from 50 to 100g were randomly cultured in 21 tanks (30 fish/tank) in flow through fresh water at 11°C for testing the digestibility of six different PBM samples including Lackawanna (L), Griffin (G), Sanimax Splendron (SS), Sanimax Nussey (SN), Rothsay Storage (RS), and Rothsay Moorefield (RM). The apparent digestibility coefficient (ADC) and digestible nutrient content (DNC) of ingredients were evaluated by using 0.5% chromic oxide as fecal marker and feces collected by the sedimentation method. The protein and energy ADC were higher for L, RM, SN and SS, and lower for RS and G ($P \leq 0.05$). Differences in DNC for protein (DP) and for energy (DE) occurred ($P \leq 0.05$). L and RM had highest DP at 59.5% and 58.1%, respectively, followed by SN, RS and SS at 53.9%, 53.3% and 52.8%, respectively. G had lowest DP at 50.4%. L had highest DE at 4774Kcal/kg. RS had lowest DE at 4008 Kcal/kg ($P \leq 0.05$). The variation in DNC within different PBM can be used for feed formulation in the future.

Epidermal cell shedding is an overlooked factor in rockweed (*Ascophyllum nodosum*) harvesting

Presenting Author: Halat, Laryssa (St. Francis Xavier University)

In Nova Scotia there is an industrial harvest of *Ascophyllum nodosum*. Industry considers this sustainable since it has been carried out for about 20 years without decline of the resource. However, in addition to the removal of ca. 20 tons ha⁻¹ of *Ascophyllum* from the natural beds (about 25% of the standing crop), the harvest imposes further biomass removals that would otherwise be committed to the coastal detrital food web. These include 'missing' biomass from reproductive tissue (ca. 100% of harvest biomass), natural losses of fronds that would otherwise be removed by wave action (ca. 10% of harvest biomass), and a loss of biomass based on epidermal shedding that we quantify for the first time. We followed epidermal shedding weekly from May to February using image analysis to quantify changes in epiphyte cover. About 30% of the epidermal layer is shed on a weekly. In spring, summer and fall this cycles on roughly a monthly basis. In winter, the shedding loses synchrony, and declines to 23% of the epidermis per week. Based on geometry of epidermal cells and cross sectional areas of fronds, we estimate that about 1% of thallus biomass is lost in each shedding cycle. This accounts for 10-12% of the summer standing crop. Thus the *Ascophyllum* harvest represents a net loss from the environment of about 2 tons ha⁻¹ of input from harvest beds of particulate organic carbon annually. We conclude that epidermal shedding is an important ecological service that is not accounted for by industry.

Spatial and temporal monitoring of *Hydroides dianthus* in environmental water samples at Eel Lake using a species specific molecular assay

Presenting Author: Hall, Stephanie (Dalhousie University, Faculty of Agriculture)

In 2012, an unidentified calcareous tubeworm began fouling an oyster lease in Eel Lake Nova Scotia. Samples of the calcareous tubeworm were collected and underwent DNA extractions and Polymerase Chain Reaction (PCR) with a universal primer to amplify and sequence 18S rDNA gene and cytochrome oxidase gene (COI). The generated sequences were run in a phylogenetic analysis with all other calcareous tubeworms present in GenBank and the species was tentatively identified as *Hydroides dianthus*. Species-specific primers were designed for the cytochrome oxidase gene and underwent specificity, sensitivity and efficacy testing. Primer COI 4 showed the highest sensitivity, with the lowest detection limit being 0.1ng/L. Spatial and temporal monitoring was also conducted on the lake, to determine if there were spatial or temporal patterns during spawning events. Water samples were collected from Eel Lake at three sites from the months June-August. At each site samples were collected from three depths 1ft, 5ft and 10ft. The samples were analyzed using the designed assay (Primer COI 4) to determine if *H. dianthus* was present. The worms appeared to begin spawning by approximately June 20th and larvae was present for most of July and August. Over the months sampled, a pattern was observed where *H. dianthus* appeared to have a week of spawning, in which all depths and sites tested positive for larvae. This was followed by one or two weeks of reduced larval presence.

Association between graft recipient characteristics and weight/colour of pearls produced by the pearl oyster *Pinctada margaritifera*

Presenting Author: Kindree, Meagan (Dalhousie University)

The cultivation of Tahitian blacklip pearl oyster, *Pinctada margaritifera*, is an important socio-economic activity in French Polynesia. Cultured pearls are created from a piece of mantle tissue of a donor oyster being implanted into the gonad of a recipient oyster. Pearl size and colour are important characteristics in determining pearl value while survival and graft retention of the recipient oysters are important for determining the success of an aquaculture operation. Ten donor families were used in this study to graft 1505 recipient oysters. For each recipient, shell length and area measurements were taken at initial time of graft and at the end of the culture period using Image J software. ANOVA statistical tests were used to find if there were significant associations between the size/growth of the recipient oyster and donor family, survival, graft retention and pearl weight. There was a significant relationship between the donor family, pearl size and growth of the recipient oysters, but not between recipient growth/size and survival or graft retention. The results from this study show recipient oysters as well as the donor family do have an influence on the size of pearl. It may be possible to select for certain traits in the recipient oysters to improve pearl size in a selected breeding program opposed to wild oyster collection for pearl production. Further study will assess the potential relationship between the shell colour of the recipient oyster and the pearl colour they produced.

Stochastic effects of dams on the population persistence of Atlantic salmon (*Salmo salar*)

Presenting Author: Lawrence, Elizabeth (Dalhousie University)

Barriers to migration negatively affect population persistence. This issue is of particular concern for migratory species of importance to fisheries or aquaculture. To investigate this, the effects of migration barriers on population persistence were examined for Atlantic salmon that must pass through dams during their migration downstream. Using empirically based stochastic model simulations, the per capita population growth rate was estimated and the probability of decline was calculated for various dam scenarios. Results indicated that when the number of dams in a river varied from one to four (this is not atypical), then the probability of negative population growth increased from 18% to 73%. The drastic effects that barriers have on migratory species must be taken into account when planning conservation measures for important fished species.

Rate of increase in salinity affects acclimation of rainbow trout, *Oncorhynchus mykiss* to seawater

Presenting Author: Lin, Feng (Dalhousie University, Faculty of Agriculture)

Rainbow trout can suffer high mortality following direct transfer from freshwater to sea-cages in coastal Nova Scotia because the industry lacks reliable acclimation protocols. To address this deficiency, two trials were conducted, each with five treatments (each 40 fish; mean 16.7cm fork length, 58.5g). In trial 1 (duration= 6 days), start Aug. 6, one group was directly transferred into full strength seawater (SW, 30ppt), while the other four groups were held at either 5, 10, 15 or 20ppt for 3 days, then abruptly increased to 30ppt for further 3 days. Trout directly transferred to SW suffered 28% mortality compared to < 7% in the other groups and mean plasma osmolality of survivors was elevated (360 vs. 345-350 mOsm/L). In trial 2 (duration= 24 days), start Aug. 14, one group was directly transferred into full SW. For the other four groups, the salinity was increased in 5ppt increments, reaching SW after 5, 10, 15 or 20 days, respectively. Mortality among trout exposed to full SW either directly or in 6 days was 40% and 37.5%, compared to < 13% in the other three treatments. The 18-day 30ppt group and 24-day 30ppt group both presented the lowest mortality (< 10%), corresponding to a safer level of osmolality (330 ± 6.2 mOsm/L and 331 ± 8.0 mOsm/L, respectively) than other groups. Acclimation to SW was better among larger fish, blood plasma osmolality was inversely related to fork length. Fish over 17.0cm generally exhibited a lower level of osmolality (329 ± 9.6 mOsm/L) and improved survival than smaller fish (361 ± 21.0 mOsm/L). Meanwhile, fish under 17.5cm accounted for over 88.5% of the total mortality in two experiments, indicating a safe acclimation size of > 17.5cm.

Size-at-age of juvenile American lobsters (*Homarus americanus*) inhabiting cobble and mud bottom in Mace Bay, Bay of Fundy

Presenting Author: Minch, Taryn (University of New Brunswick Saint John)

The American lobsters' post-larvae settle on the benthos at the end of their planktonic stage. Post-larvae are known to prefer cobble bottom for settlement and early development, likely due to the presence of a structurally complex habitat that provides protection from predators. However, when cobble substrates are absent, the larvae may settle on different substrates such as mud, which is "less complex in structure". Food availability and protection may vary between the two substrates, which affect the lobster growth. Here we assess the adequacy of mud substrates as nursery habitat for juvenile lobsters in Maces Bay, Bay of Fundy. This was addressed by assessing the size-at-age of juvenile lobsters found on cobble and mud substrates using the new direct age determination technique. The technique relies on counting annual growth bands that are deposited on one of three ossicles (mesocardiac) forming the gastric mill in the stomach. Preliminary results suggest that size-at-age for lobsters on mud and cobble are similar with the exception of 3-year-old individuals who have a larger size-at-age on mud substrate. Our results suggest that mud bottom may represent a more important habitat for young juvenile lobsters than currently appreciated.

Seasonal migration and habitat of the American lobster, *Homarus americanus*, in Minas Passage, Bay of Fundy

Presenting Author: Morrison, Kaycee (Acadia University)

The American lobster (*Homarus americanus*) commercial fishery is Canada's most valuable seafood export, with significant catch sourced from the upper Bay of Fundy. Local lobster fishers report that lobsters undergo seasonal migration (into Minas Basin in spring; outwards in late fall) and use the Fundy Ocean Research Centre for Energy

(FORCE) tidal turbine test area in Minas Passage as a migration corridor. This project examines movement patterns of electronically tagged lobsters and contributes to the assessment of potential impacts of turbine installation on this species. Vemco V13 or V13P acoustic transmitters were fitted to 125 adult lobsters, sourced from commercial catch in Minas Basin - lobster fishing area (LFA) 35. Bottom-mounted Vemco receivers (29 in 2011, 24 in 2012) were deployed in arrays within Minas Passage to detect migration of tagged lobsters. Seafloor video clips, photographs, and grab samples (N = 91, 1183, and 21, respectively) collected aboard the CCGS Hudson in June 2013 were examined quantitatively and qualitatively for macrobiota and substrate composition. In total, 130,217 detections from 38 (30%) lobsters were logged in Minas Passage, at 30 receiver stations, with 71% from the northern third of Minas Passage. Ten lobsters were detected at or near (within 200 m) the FORCE test area. Some outward migration through the passage occurred in late fall in both years. Receivers moored throughout winter months in 2012/2013 indicate lobster presence (including berried females) in the passage as late as February. Undetected lobsters may indicate overwintering of lobsters in Minas Basin and/or dislodged transmitters.

Effects of ploidy and cell size on erythrocyte volume control in brook charr (*Salvelinus fontinalis*)

Presenting author: Nader, Nicole (University of New Brunswick Fredericton)

Diploidy is common in vertebrates, including teleosts, where the majority of individuals possess two complete sets of chromosomes. However, polyploids are found in the wild in different fish species. Triploidy can be induced by thermal or hydrostatic pressure treatment of fertilized eggs. Both treatments interrupt meiotic reduction, preventing the release of one of the maternal chromosome sets. Consequently, the newly formed zygote is left with two maternal and one paternal set of chromosomes. The increase in nuclear material leads to the formation of a bigger nucleus and in some cell types, bigger cells. This study tests the hypothesis that cell size affects regulatory cell volume control during osmotic stress, using diploid and triploid erythrocytes as model cells. I hypothesize that under osmotic stress *in vitro*, triploid cells will have slower regulatory volume increase (RVI) and decrease (RVD). Furthermore, I predict that ploidy affects gene expression of the cell surface exchangers Na⁺/K⁺/2Cl⁻ co-transporter (NKCC co-transporter), βNa⁺/H⁺ exchanger (βNHE), HCO₃⁻/Cl⁻ exchanger (AE1) and Na⁺/K⁺ ATPase, with gene dosage compensation leading to no difference in exchanger mRNA relative abundance and subsequent exchanger density on the cell surface between ploidies. Basic haematology, flow cytometry, immunofluorescence and confocal microscopy allow me to test my hypotheses. Given that the integrity and function of erythrocytes is critical for the survival and function of vertebrates, my experiments will provide some insight into the decreased survival of triploid fish under stress and consequently contribute to the knowledge base concerning the effective use of triploid fish in aquaculture.

Commercial American Lobster Fisheries and Long-Term Environmental Cycles

Presenting Author: Nau, George (Acadia University)

Fisheries management practices have often focused on the effect of fishing mortality and stock-recruitment relationships in order to make predictive models of stock abundance. Such models can ignore natural long-term physical and biological cycles as possible drivers, because the relationship of a resource to these variables is often not apparent. Cross-correlation analyses of long-term data of landings and environmental variables were used to highlight some of these relationships. American Lobster landings for both the Bay of Fundy along a portion of the New Brunswick coast and the Maine coast were compared with the 18.61-year lunar nodal precession cycle which affects tidal intensity and coastal sea surface temperatures. American lobster showed a significant positive correlation with sea surface temperature and a significant negative correlation with tidal intensity for both the Maine coast and the Bay of Fundy. Correlations of tidal activity to both lobster landings and temperature show similar relationships, which may indicate some sort of inter-relationship.

Abundance and Prevalence of the Intestinal Parasite *Polymorphus botulus* in American lobsters (*Homarus americanus*) in Nova Scotia

Presenting Author: Samson, Alexandre (Dalhousie University, Faculty of Agriculture)

The Canadian lobster fishery is the most economically significant commercial fishery in Canada. The lobster fishery takes place throughout Atlantic Canada and Quebec but the largest catches are in LFA 33/34 in Southwestern Nova Scotia. The intestinal acanthocephalan parasite *Polymorphus botulus* has been found in a significant percentage of lobsters from certain geographic areas of Nova Scotia. This incidental finding has prompted the examination of the temporal and geographic distribution of *P. botulus* in Southwestern Nova Scotia. *P. botulus* is normally found in the

Green crab (*Carcinus maenas*) and Common Eider ducks (*Somateria mollissima*). The lobster is not the primary host for this parasite and it is unknown what impact it is having on lobster health. However, there is anecdotal evidence that the presence of this parasite in lobster correlates to negative outcomes in live holding situations. We have found significant differences in *P. botulus* prevalence and abundance in lobsters from different geographic areas of Nova Scotia. Over 75% of the lobsters in one geographic area have *P. botulus* in their intestinal tract while other areas have significantly less.

Modelling of porbeagle shark (*Lamna nasus*) bycatch in the Scotia-Fundy groundfish fishery

Presenting Author: Saunders, Jennifer (Dalhousie University)

The porbeagle shark (*Lamna nasus*) is listed by COSEWIC as an endangered species, a designation given because our Northwest Atlantic population appears to be only 22% to 27% of its size in 1961. While porbeagle shark bycatch in pelagic longline fisheries has been extensively studied, the bycatch associated with groundfish fisheries has not been a focus of research. Scientific observer data show that the haddock bottom longline and bottom trawl fisheries make up a large portion of the average porbeagle bycatch in the Northwest Atlantic, largely due to their high fishing effort. This study analyses the factors responsible for high porbeagle bycatch in those fisheries. The data set was obtained from the Department of Fisheries and Oceans Observer Program and includes 28,851 observations between 1996 and 2010. Ten factors were analyzed for their significance on porbeagle bycatch. Preliminary results indicate that fishing gear type, timing of fishing trips (months and years), and depth of fishing sets are significant factors affecting the amount of porbeagle bycatch observed. Fishing effort, determined by the number of hooks on a line, duration of a set or a tow, or total haddock catch, seem to be factors of less importance. These results will

be confirmed by using generalized linear models. It is clear that there are certain fishing strategies that account for a greater amount of porbeagle bycatch in the haddock fisheries. The findings of this study may help fishermen and managers to limit the bycatch mortality experienced by the endangered porbeagle shark population of the Scotia-Fundy region.

Age and growth of Atlantic sturgeon (*Acipenser Oxyrinchus*) in the Saint John River, New Brunswick

Presenting Author: Stewart, Nathan (Acadia University)

As a long-lived and late maturing species, Atlantic sturgeon are susceptible to overharvest, making knowledge of age and growth essential to their sustainable management. The Saint John River, New Brunswick, supports one of the two remaining fisheries for Atlantic sturgeon in Canada along with the St. Lawrence River, Quebec, however the relationship between age and growth has not previously been modeled for the Saint John River population. The von Bertalanffy growth model (VBGM) has been used to model the relationship between age and growth for several spawning stocks of Atlantic sturgeon. Pectoral fin spines have been the most commonly used structure for age determination of Atlantic sturgeon and other sturgeon species due to accuracy and ease of collection. The VBGM of age and length for Atlantic sturgeon in the Saint John River was determined by the reading of pectoral fin spine sections collected from 233 individuals belonging to that stock. Most of the spine sections (84%) were aged by two of three readers to evaluate possible reader bias. Age-bias plots and coefficient of variation (CV) indicated relatively low precision between readers compared to other studies (readers 1 and 2: CV=6.3%; readers 1 and 3: CV=7.0%). According to VBGM parameters males grow faster than females, but females reach a greater maximum length (males: $K=0.05$, $L_{\infty}=247$; females: $K=0.04$, $L_{\infty}=278$). According to the von Bertalanffy parameters for combined sexes, the Saint John River population is medial in terms of growth rate and maximum length to the Hudson and St. Lawrence Rivers ($K=0.04$, $L_{\infty}=270$).

Effect of maternal geographic origin and size on offspring size and morphology of swimming structures in American lobster (*Homarus americanus*)

Presenting Author: Thurlow, Samantha (University of New Brunswick Saint John)

Maternal effects on offspring phenotype are well-known in many taxa, with for example larger females commonly producing larger offspring. Similarly, local adaptation to differing environmental conditions across a species' range can affect the quality of offspring. The American lobster (*Homarus americanus*) constitutes Canada's most valuable fishery and its management centres on measures to maintain egg production as a proxy for larval supply; yet relatively little is known about maternal effects and local adaptation in this species, thus their impact on larval supply and

subsequent recruitment is poorly understood. Lobster larvae are known to be active swimmers and predators, thus both size at hatch and swimming ability can potentially affect survival and dispersal during the planktonic stage. We therefore investigated effects of maternal origin and size on 1) overall body size and 2) the size of appendages used for swimming in newly hatched larvae. Females of as wide a size range as possible were collected from two warm and two cold water sites in the Gulf of St. Lawrence. Offspring phenotype was then compared among the four maternal origins using ANCOVAs with maternal size as a covariate for larval size, and larval size as the covariate for the length and area of different swimming appendages.

Population Characteristics of Little Skate and Winter Skate in the Minas Basin, Bay of Fundy

Presenting Author: Whidden, Julia (Acadia University)

Little Skate (*Leucoraja erinacea*) and Winter Skate (*Leucoraja ocellata*) are sympatric and morphologically nearly identical species that reside in the western Atlantic Ocean. The IUCN red list designates Little Skate as near threatened and Winter Skate endangered, however no study on either species has ever been conducted within the highly tidal environment of the inner Bay of Fundy which could serve as a nursery or feeding ground. Skates were sampled as non-target catch at a commercial herring weir in the Avon Estuary in 2012-2013 to characterize the population. Skates were tagged with individually-numbered dart tags, measured for length, weight, width, and clasper length in males, and ocelli were counted in Winter Skate. In total, 948 of 2,051 skate were tagged. Tissue samples were taken from 644 skate for molecular analysis. Sequencing of the mtDNA cytochrome oxidase I gene of 46 tissue samples from 2012 identified 8.7% Little Skate; confirmation using increased samples during 2013 is ongoing. Catch abundance of skate was compared to the tidal cycle, and demonstrated that catches increase at low-low tides at night. A preliminary population estimate from 20 recaptures suggests a population of 42,471 (CI 26,758 - 71,165) skate. Further analyses will be presented.

Egg quality in domesticated wild and F1 Atlantic halibut (*Hippoglossus hippoglossus*)

Presenting Author: Zhang, Yangfan (Dalhousie University, Faculty of Agriculture)

During the spawning season each female produces several batches of eggs, the quality of which varies considerably in terms of fertilization and symmetrical cleavage rates. Egg production at Scotian Halibut Ltd. comes from an aging group of large fish (mean wt. 23.3 kg) that have been captive for 17 years, and 'young' 10 year-old F1 fish (mean wt. 10.8 kg). The older and larger 'wild' fish produced larger eggs than the F1 fish (mean SE diameter 3.4 ± 0.4 vs. 3.2 ± 0.3 mm; $P=0.094$) and also a greater volume per batch (mean SE 1.2 ± 0.7 vs. 0.7 ± 0.4 L; $P<0.05$). By contrast, the F1 fish produced better quality eggs; exhibiting a slightly higher mean (SE) fertilization rate (27 ± 25.1 vs. 22 ± 23.7 %; $P=0.485$), and the symmetry of cell cleavage was superior (72 ± 25.7 vs. 60 ± 26.5 %; $P=0.059$). The biggest factor limiting egg production was the high variability in fertilization rate (range 0 to >70%) between batches from both young and old individuals, likely due to over-ripening. This was a consequence of the difficulty of predicting the timing of ovulation between batches, which ranged from 14 to 120 hours. Low arachidonic acid and overall omega-6 fatty acid levels in the eggs may have compromised egg maturation and rate of over-ripening. By contrast, levels of docosahexaenoic acid, eicosapentaenoic acid and linoleic acid did not appear to be limiting factors to egg quality in either groups of broodstock.

Biology Abstracts

Oral Presentations

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

Molecular basis of cell migration inhibition by the dietary phytochemical piperine

Presenting Author: Annan, Henry (Saint Mary's University)

Metastasis, the migration of cells from a primary tumour site to distant tissues, is associated with the degradation of the epithelial basement membrane and extracellular matrix in connective tissue and often leads to poor prognosis in breast cancer. Matrix metalloproteinases (MMPs) are enzymes that are implicated in the destruction of the extracellular matrix and are overexpressed in breast cancer cells. Naturally occurring plant compounds known as phytochemicals are being investigated as possible anti-cancer agents. Piperine, a major alkaloid component of black pepper, is one such phytochemical that has shown chemotherapeutic effects in early experiments on human and mouse tumour cells. The current study investigates the potential of piperine to prevent cancer metastasis. The overall effect of piperine on MB-MDA-231 breast cancer cell migration was examined using a wound-healing assay. A mechanism of drug action was then explored by determining the effect of piperine on the mRNA transcription, production and activation of the gelatinases, MMP-2 and MMP-9, as well as the stromelysin, MMP-3. The wound-healing assay showed that piperine significantly inhibited cancer cell migration at concentrations of 50 μ M. RT-qPCR analysis also showed that piperine significantly inhibited MMP-2 and MMP-9 mRNA expression after 48 hours of treatment. Preliminary results from western blot and gelatin zymography analyses indicated that piperine may also inhibit the translation and activity of MMP-2 and MMP-9. Piperine did not appear to affect MMP-3. These results offer further insight into the anti-metastatic action of piperine and suggest a possible novel treatment for aggressive breast cancers.

Cloning and expression of Ancylostoma-secreted-protein homologues secreted by Parelaphostrongylus tenuis

Presenting Author: Benfey, Nick (University of New Brunswick Fredericton)

Parelaphostrongylus tenuis is a parasitic meningeal worm commonly found in white-tailed deer (*Odocoileus virginianus*). Once a chronic infection is established, the deer host exhibits concomitant immunity, i.e., resistance to reinfection upon secondary exposure to the parasite. This immunity is poorly understood; however, it is thought to be associated with the secretion of modified proteins by the worm into the host environment. The aim of this study was to produce recombinant versions of such proteins. A transcriptome analysis of *P. tenuis* revealed 34 tentative Ancylostoma-secreted-protein homologues which are part of the pathogenesis-related protein superfamily. The cloning and expression of these proteins is of interest for developing a sero-diagnostic test and for future immunohistochemical characterization of the internal structures of *P. tenuis*.

Error prone PCR generated mutants of YvrHa used to determine critical binding amino acid residues in the unusual YvrHa/YvrI two-subunit sigma factor system of Bacillus subtilis

Presenting Author: Bishop, Adam (University of New Brunswick Fredericton)

Sigma factors are reversibly binding subunits of RNA Polymerase (RNAP) that target the complex to gene promoters and help activate the initiation of transcription. The *Bacillus subtilis* proteins YvrI and YvrHa interact to form an unusual two-subunit sigma factor in this bacterium. In order to identify the protein-protein interaction interface between YvrI and YvrHa, we generated random mutations in YvrHa using error-prone PCR and subjected mutants to a screen meant to identify amino acid substitutions that impair its interaction with YvrI. The results suggest that YvrHa residue F67 is a critical amino acid for the binding of YvrHa to YvrI and that mutations at E69, M74 and I71 also reduce the ability of YvrHa to bind YvrI. These residues all lay within a contiguous amino acid segment of YvrHa called region 2.3 suggesting that this region constitutes the interaction interface in this unusual two-subunit sigma factor.

What Goes In Must Come Out: Quantifying Nitrogen Emissions from Crop Residue Degradation

Presenting Author: Carverhill, Jacqueline (Mount Allison University)

The agriculture industry is touted as one of the largest producers of anthropogenic nitrogen emissions. Thus, the importance of quantifying nitrogen losses from farming practices stems from concerns about rapidly increasing greenhouse gas emissions and the need to increase nitrogen use efficiencies. This study utilized ^{15}N -enriched substrates to determine N_2O -N losses from crop residue. Canola, pea, flax, and wheat residues as well as a urea fertilizer treatment were applied to soil, and resultant gas fluxes were measured. N_2O -N and CO_2 -C losses were quantified by gas chromatography. In addition, isotope ratio mass spectrometry and cavity ringdown spectroscopy were used to measure decomposition of the ^{15}N -enriched residues and track the fate of nitrogen present in the residues. This study builds on previous work that used ^{13}C -depleted substrates to quantify crop residue degradation. Results will report carbon and nitrogen emission rates of all four crop residues by comparing net cumulative CO_2 -C and N_2O -N production. This study will further determine N_2O emission factors for all four crop residues that will be directly comparable to that of applied urea fertilizer. In Saskatchewan, the emission factor for N - N_2O is currently set at 0.4-0.8%, with no distinction made between nitrogen from organic sources versus applied fertilizer. The results of this study will have implications for commercial farming operations, including nitrogen accounting and agricultural best management practices. In addition, the results will be particularly relevant for public policy, specifically the Intergovernmental Panel on Climate Change methodology for determining N_2O emission coefficients.

Adsorption of Doxorubicin on Gold Nanoparticle Surfaces: The Feasibility of Gold Nanoparticles as Cancer Drug Delivery Vehicles

Presenting Author: Curry, Dennis (Cape Breton University)

Cancer is a leading cause of death with surgery, radiation therapy, and chemotherapeutic regimens the major treatment options. However, patients undergoing the latter treatments often endure adverse side effects such as hair loss, nausea and mucositis attributable to the non-specific nature of the current anti-cancer therapeutics, which kill both healthy and cancerous cells. Consequently, the development of an effective drug delivering/targeting system with gold nanoparticles (AuNPs) and a widely used cancer drug, doxorubicin (DOX), would be highly desirable. Our research on the adsorption and desorption characteristics of the drug-nanoparticle conjugate will improve our fundamental understanding of the interactions at play. Specific interest areas include the effects of pH, salt concentration, temperature and solvent effects on adsorption and desorption characteristics. Further work incorporates poly(ethylene glycol) (PEG) and single stranded oligo-deoxyribonucleic acid (ssDNA) to stabilize the drug-loaded nanoparticles. The systematic study of surface chemistry interactions and conjugate stabilization will help develop an effective nano-medication to improve the effectiveness of current anti-cancer drugs, while decreasing their side-effects and increasing patient quality of life.

West Nile Virus and the Arboviral Mosquito Community in St. John's, Newfoundland and Labrador

Presenting Author: Fielden, Miles (Memorial University of Newfoundland)

Many Mosquito species are vectors of viruses that have serious consequences for human health. Human activities coupled with human-induced climate change have enabled the range expansion of many mosquito vectors. It has been about ten years since St. John's has had a mosquito community assessment. Mosquito larvae and pupae were sampled from artificial and natural pools in both residential and non-residential areas during August and September, 2013. Immature stages were reared to eclosion and females were identified to species aided by a dissecting microscope and a dichotomous key. *Culex pipiens*, *Aedes canadensis* and *Aedes japonicus* were found in significant numbers. Breeding *Culex pipiens* are new to the city and *Aedes japonicus* is new to the province. *Aedes japonicus* was the most abundant species and significantly more collected in non-residential areas in both August and September. *Aedes canadensis* specimen were collected, exclusively in non-residential areas in August. *Culex pipiens* were collected exclusively in residential areas in the month of September. Choice paradigm were used to determine the relative effectiveness of grass, moose manure, and mushroom in attracting ovipositing mosquitos. Grass traps attracted more *Culex pipiens* than either moose manure or mushroom traps. *Aedes japonicus* was more attracted to mushroom traps than moose manure traps, and more attracted to moose manure traps than grass traps. Choice traps were also more effective in attracting mosquitos than traps with a mixed solution. Range expansion of mosquito species into St. John's supports continuing vector surveillance to properly understand potential viral risks.

Assessing the Risk of Lyme Disease in New Brunswick: Testing Ixodes ticks for the presence of *Borrelia burgdorferi*

Presenting Author: Filiaggi, Corey (Mount Allison University)

Lyme disease is an emerging disease in New Brunswick and is the most common arthropod-vector zoonosis in North America. Ticks feed on a wide range of hosts such as humans, domestic pets, and wildlife, and can transmit pathogens, including *Borrelia burgdorferi* - a spirochete bacteria which is the causative agent of Lyme disease. The goal of this research is to monitor the presence and abundance of *Ixodes scapularis*, *Ixodes cookei*, and *Dermacentor* ticks in New Brunswick and determine the percentage of ticks infected with *Borrelia*. A study by the Public Health Agency of Canada surveyed the infection rate of ticks in Canada from 1990-2003, and they found that the infection rate in New Brunswick was 16%; no more recent data is available. In my work, I found that 1.4X more ticks were collected from New Brunswick in 2013 versus 2012 which indicates that tick populations are increasing. I found that the overall infection rate for ticks collected in 2012 was 44% and in 2013 was 24%. Ticks were found throughout New Brunswick, in 6/7 health regions, and all regions had infected ticks. Moreover, areas deemed non-endemic had higher infection rates than the two identified endemic regions. Ticks were also received from Nova Scotia, and showed similar trends: 1.6X more ticks were collected in 2013 compared to 2012, with infection rates of 49% in 2012 and 19% in 2013. These results show that Lyme disease is a serious public health concern in New Brunswick and Nova Scotia.

Myricetin inhibits T-cell proliferation through the generation of hydrogen peroxide

Presenting Author: Ghassemi Rad, Javad (Dalhousie University)

Activation and proliferation of T-cells is a central feature of the adaptive immune response. Cytokines produced by the activated T-cells stimulate other immune cells and act on the local vasculature to promote recruitment of various immune effector cells to inflamed tissue. Chronic inflammation has been implicated in the development of many diseases; however, recent studies show that a proper diet may reduce chronic inflammation and the risk of certain diseases. Myricetin is a phytochemical found in grapes, walnuts, and green tea. There is evidence that myricetin has anti-inflammatory properties but, to date, there is no information on the effects of myricetin on T-cells. In this study, Oregon Green-488-stained mouse T-cells were activated *in vitro* with anti-CD3/anti-CD28-coated microbeads in the absence or presence of various concentrations of myricetin to determine the effect on T-cell proliferation using flow cytometry. Myricetin caused a dose-dependent reduction of T-cell proliferation. Flow cytometric analysis of Annexin V-FLUOS/propidium iodide-stained T-cells showed that the inhibitory effect of myricetin on T-cell proliferation was due to the induction of apoptosis/necrosis. However, the presence of hydrogen peroxide scavenger, N-acetyl cysteine, reduced the cytotoxic effects of myricetin on T-cells. In addition, an Amplex Red colorimetric assay showed that myricetin caused hydrogen peroxide to be produced in culture medium that did not contain T-cells. Furthermore, T-cell activation in the presence of dendritic cells (DC) was not affected by myricetin, most likely due to DC production of anti-oxidant molecules. This is the first study to show that myricetin inhibits the proliferation of T-cells through generation of hydrogen peroxide, thereby contributing to the anti-inflammatory actions of this phytochemical.

Investigation of possible non-thermal effects on $U^{k'_{37}}$ values from Atlantic and Western Equatorial Pacific suspended particulate samples: Implications for $U^{k'_{37}}$ Paleothermometry

Presenting Author: Gould, Jessica (Dalhousie University)

The investigation of past sea surface temperatures (SSTs) significantly contributes to the understanding of current and projected ocean and atmospheric characteristics. The $U^{k'_{37}}$ index, which describes the proportion of alkenone molecules present in a phytoplankton sample, is one of the main proxies utilized to reconstruct SSTs. An observation that the degree of alkenone unsaturation in prymnesiophytes is strongly correlated with growth temperature makes possible the reliable reconstruction of SSTs. Although the $U^{k'_{37}}$ index is a reliable proxy, uncertainties concerning the relationship between measurable $U^{k'_{37}}$ values and growth temperatures remain. To explore possible non-thermal effects on the $U^{k'_{37}}$, this study analyzed suspended particulate samples from transects of the Atlantic and Pacific Oceans. In agreement with published calibrations, regressions of the data display a strong statistical correlation between $U^{k'_{37}}$ values from surface suspended samples and World Ocean Atlas (WOA) SSTs. The non-thermal effects of salinity and nutrient concentrations on $U^{k'_{37}}$ values were explored using only the Atlantic samples. No relationships between residual SST values and either monthly or annual average Sea Surface Salinity or Nutrients were observed. Analysis of a combined Atlantic Ocean dataset, consisting of both this study's as well as previously published $U^{k'_{37}}$ values, results in a statistically stronger relationship between $U^{k'_{37}}$ and WOA average *monthly* SSTs than that found between $U^{k'_{37}}$

and WOA average *annual* SSTs. In summary, the data analyzed in this study suggest that suspended particulate alkenone samples may record SSTs on finer temporal and spatial scales, affected by both seasonal temperature influences and dynamic regional characteristics.

A comparative shape analysis of the oral jaws of the Mexican tetra (*Astyanax mexicanus*) and the zebrafish (*Danio rerio*)

Presenting Author: Hammer, Christine (Mount Saint Vincent University)

Vertebrate jaw bones undergo growth and remodeling with age, resulting in morphological changes. Two teleost species, the Mexican tetra (*Astyanax mexicanus*) and zebrafish (*Danio rerio*), have similar shaped jaws at hatching, which become very different by adulthood. The Mexican tetra jaws are large and toothed, while the smaller zebrafish has no oral teeth. The goal of this project is to analyze the differences in shape occurring in the occluding upper (premaxilla) and lower (mandible) jaw bones of these species throughout growth, to compare the changes occurring within and between the species. Previous attempts to compare the jaws of these species have focused only on the mandible, and relied purely on observations or measurements that do not account for the overall shape of the bone. For this project, a growth series for each species was obtained, ranging from 4 mm in standard length to adulthood (i.e. over 2 cm standard length). The samples were stained using the acid free double stain (in which Alcian Blue stains cartilage and Alizarin Red stains calcified bone), and the jaws removed through dissection. To accurately quantify the differences in shape of both the upper and lower jaws, morphometrics analyses were conducted using SHAPE, a computer program that statistically measures the outline of a shape in an image. The results from this study will have important implications in assessing the potential influences of factors such as jaw size and dentition on jaw bone shape, which could in turn be applied to other vertebrates.

Effect of flavonoid-rich apple peel extract (FAE) on biomarkers of blood pressure in spontaneously hypertensive rats

Presenting Author: McPhee, Iain (University of Prince Edward Island)

The kidneys are known to play a role in blood pressure (BP) regulation. Production of reactive oxygen species (ROS), like hydrogen peroxide, can damage the kidney and cause oxidative stress that contributes to the development of hypertension, a serious condition of elevated BP. Recently, our group fed an antioxidant diet containing flavonoid-rich apple peel extract (FAE) to spontaneously-hypertensive rats (SHR) for 8 weeks, and found that BP was lower than in SHR that ate control diets. The present study examined mechanisms for the antihypertensive effect of FAE by measuring biomarkers of oxidative stress in the kidney. We hypothesized that the activity of antioxidant enzymes and the content of endogenous antioxidant glutathione (GSH) would be higher in rats fed FAE. In order to test this, assays for GSH and 8-Isoprostane content, and activity of glutathione peroxidase (GPX), glutathione reductase (GR), superoxide dismutase (SOD), and catalase (CAT) were performed. Unpaired t-tests showed that the activity of CAT was elevated by 13.7% in kidneys after FAE feeding compared to control ($p=0.0314$; 0.1012 ± 0.0049 nmol/min/g, $n=12$ vs. 0.0873 ± 0.0037 nmol/min/g, $n=11$). However, GR activity was 67% lower in FAE fed rats ($p=0.0049$; 84.7 ± 22.7 nmol/min/g, $n=12$, vs. 262.1 ± 53.6 nmol/min/g, $n=11$). 8-Isoprostanes, GPX and SOD were not significantly changed by FAE feeding. CAT catalyzes the conversion of hydrogen peroxide to water, removing harmful ROS. These results suggest that feeding FAE enhances endogenous antioxidant protection in the kidneys, which would lower oxidative stress damage and limit the progression of hypertension.

Factors affecting duck brood rearing in small wetlands in the Annapolis Valley, Nova Scotia

Presenting Author: Millet, Lee (Acadia University)

The creation and restoration/enhancement of wetlands has been prioritized by non-government organizations (NGOs) for decades. Wetlands have been disappearing at alarming rates around the world and by as much as 75% in urban areas of Canada since European settlement. Wetlands are important land features as they mitigate effects of flooding, purify water, replenish groundwater and are rich in biodiversity. The Nova Scotia Eastern Habitat Joint Venture (NS-EHJV) establishes the base for wetland conservation in Nova Scotia, under the mandate of the North American Waterfowl Management Plan (NAWMP). It was determined that guidelines regarding implementation of these wetlands would be useful, increasing ecological potential, especially for ducks. A study to investigate the use by ducks of existing wetlands in the Annapolis Valley was initiated in 2009. This study has broadened its scope to incorporate land use influences adjacent to wetlands. Waterfowl breeding pair and brood surveys were conducted to discover which wetland sites were being used and the intensity of the usage. Adjacent land use surveys were completed ranging

up to 100 m around a site. It was found that the number of breeding pairs and broods detected were parallel between the 2012 and 2013 field seasons. Adjacent land use types such as rivers and riparian zones positively influenced brood production. Findings suggest that breeding hens may prefer wetlands with nearby water bodies, which could serve as corridor for duckling travel. Results from this study will help to better guide management decisions regarding construction of new wetlands on a diverse, agricultural landscape.

A comparative analysis of leaf development in two species of *Cecropia* with contrasting leaf morphology

Presenting Author: Ogden, Mike (University of Prince Edward Island)

Two closely related plants with contrasting leaf morphologies, *Cecropia obtusa* and *Cecropia sciadophylla*, were investigated from a developmental perspective. Although the leaves of both species appear to be very similar in shape, one species bears palmately-lobed simple leaves, whereas the other bears palmately-compound leaves. By investigating the developmental sequence of leaves in each species, further knowledge can be gained on the evolution of leaf types, and specific developmental stages could be identified for future studies investigating the role of specific genes in leaf shape establishment. To discern whether leaves of each species share similar ontogenies, shoot tips were dissected to reveal the primordial stages of leaf initiation and morphogenesis at the level of the shoot apical meristem (SAM). The dissected samples were viewed under a scanning electron microscope, and high-resolution micrographs were captured for analysis. A quantitative comparison of the two species was achieved by calculating: (1) leaf insertion angles, representing the size of a primordium in relation to the SAM; (2) plastochrone ratios, a measure of the relative distance of two successive leaves from the SAM; and (3) divergence angles, the angles between successive leaf primordia in relation to the SAM. The two species showed no significant differences in these quantitative parameters, suggesting that divergence in leaf morphology is not linked to alterations in phyllotaxy (leaf arrangement) during early stages of leaf development. It was also observed that divergence in overall morphology occurs after primordia form distinct projections which ultimately develop into lobes or leaflets, depending on the species.

Epidemiological study of dogs with otitis externa in Cape Breton, Nova Scotia

Presenting Author: Perry, Laura (Cape Breton University)

Otitis externa is inflammation of the external auditory canal, which is often caused by yeast, parasites or bacteria. It occurs in ten to twenty percent of dogs seen in small animal practice. The purpose of this study was to determine the prevailing species of bacteria that cause otitis externa in dogs in Cape Breton and examine the effectiveness of antibiotic treatment. Ear swabs were collected from 60 dogs exhibiting symptoms of otitis externa from Celtic Creatures Veterinary Clinic (Sydney), between May and November of 2013. API strips were used for species identification and antibiotic susceptibility tests were run using three commonly-used antibiotics. Data from Celtic Creatures Veterinary Clinic were also gathered retrospectively from the past six years (2008 – 2013) to discover any annual/seasonal patterns and predispositions to this disease (breed, ear type, past infection). Of 60 dogs swabbed, 32 had yeast infections, and 28 had bacterial or mixed infections. From these, 19 species of bacteria were identified, of which *Staphylococcus* species was the most common (35% of cases). The retrospective analysis revealed that, the prevalence of infection has increased from 2008 to 2013, as has the reoccurrence of infection. Of the 443 cases of otitis externa reported, yeast was identified as the most common infecting agent over that time (38% of cases). Dogs with hairless ears and those with long canals were more likely to exhibit otitis externa. The results from this study will be used to create a more effective treatment protocol for local veterinarians.

Determining if ex situ, in situ or one month captive-reared *Blanding's* turtle (*Emydoidea blandingii*) hatchlings are more robust

Presenting author: Pitts, Wesley (Acadia University)

Blanding's turtles (*Emydoidea blandingii*) are an endangered species of turtle in Nova Scotia. One of the approaches to conservation and management in this population has been headstarting. Headstarting is the process of raising neonatal turtles in captivity to further growth, whether from incubated eggs, or wild individuals. This process is both time consuming and expensive. This experiment tests whether there is a benefit from ex situ incubation alone, without raising the hatchlings in captivity. Eggs were collected from 12 randomly selected nests and evenly distributed between incubators at 29.5°C and 27.5°C. An additional 14 nests were protected with wire mesh covered wooden frames in the wild. After hatching or emerging from the nest, hatchlings were measured and weighed. A self-righting test was performed by flipping hatchlings onto their carapace and timing how long it took them to return to an upright

position. A predator-response test was performed by placing the hatchlings in a 2m long plastic trough with 6cm of water, and recording how long it took individuals to swim 1m while initiating a flight response by tapping behind them. Half of the incubated hatchlings were released immediately after testing, and half were captive-reared for approximately one month, then re-measured and tested before being released. Ex situ incubated hatchlings were significantly slower in both the self-righting and predator response tests. These results suggest that there is no fitness benefit to ex situ incubation alone.

Hips don't lie: Understanding Huntington Disease through interactions of Hip1, Hip1, htt and deltex In Drosophila melanogaster

Presenting Author: Slade, Frankie (Memorial University of Newfoundland)

Huntington disease is a progressive neurodegenerative disorder, with impaired cognition, dementia, and motor deficiencies, plus other symptoms. Treatments exist for this disease; however there is no cure. Huntington disease is associated with a number of cellular proteins, including Huntingtin (htt), Huntingtin interacting protein 1 (Hip1) and (Huntingtin interacting protein 1 protein interactor (Hippi). The disease arises from an expanded stretch of glutamine residues in the htt protein. *Drosophila melanogaster* has been used to model neuronal disease due to similar, albeit less complex, nervous system structure. Hip1 is involved in the regulation of neurogenesis in *D. melanogaster*, and is sequestered by the Hippi protein when binding to htt is disrupted due to expansion. This Hippi-Hip1 complex appears to function in apoptosis and abnormal activity leads to Huntington disease phenotypes. Deltex is involved in the Notch-signalling pathway, and interacts with Hip1, affecting microchaetae (small mechanosensory bristle) development. To investigate the role of Hip1 in neuronal development, overexpression and inhibition of Hip1 was induced, in the neuron rich *Drosophila* eye and in the notum. The consequences of the interference of Hippi expression were examined as well. Overexpression (Hip1^{L2}) and reduced expression (Hip1^{MB}) of Hip1 reduced lifespan, while expression of Hip1^{L2} in the presence of Hip1^{MB} rescued the phenotype. Subtle effects were observed in development of the *Drosophila* eye upon over expression, loss of function and replacement of Hip1. The interactions between the htt, Hip1, Hippi and deltex proteins in *Drosophila* give insight into the biological basis that underlies the pathogenesis of Huntington disease.

Effectiveness of several class of anthelmintics for the control of Haemonchus contortus in sheep

Presenting Author: van den Heuvel, Connie (Dalhousie University, Faculty of Agriculture)

Over the past ten years gastrointestinal nematode parasites have become a major issue for sheep producers worldwide. *Haemonchus contortus* is considered to be the most prevalent and pathogenic blood-sucking parasite. Many sheep farmers worldwide use anthelmintic drugs to control these parasites; however, this is resulting in the development of anthelmintic resistance. There have been very few studies conducted in Canada to determine the anthelmintic resistance status, especially in Atlantic Canada. This study was conducted to determine the effectiveness of several classes of anthelmintics on six local sheep farms in Nova Scotia, Canada. Fecal egg count reduction tests were conducted on each farm, using fecal samples to determine fecal egg counts from at least 10 grazing lambs per farm. Anthelmintic resistance occurs when there is less than 95% fecal egg count reduction. All of the six farms showed resistance towards at least one anthelmintic. Resistance to benzimidazoles, macrocyclic lactones and imidazothiazoles was demonstrated on 100% (4/4), 100% (4/4) and 40% (2/5) of the farms tested respectively, with considerable variability in resistance levels among farms. Closantel was effective, but only against *Haemonchus contortus*. Amongst the farms tested, resistance to benzimidazoles and macrocyclic lactones was very common. The results of this study show that resistance to commonly used anthelmintics is a serious problem on Nova Scotia sheep farms. This means that sheep producers should implement possible solutions such as smart drenching and sustainable integrated pasture management to reduce the development of anthelmintic resistance.

Effect of Exposure to Individual Ration Components on Feed Sorting Behaviour of Dairy Heifers

Presenting Author: Vogel, Jakob (Dalhousie University, Faculty of Agriculture)

This study investigated the effect of exposure to individual ration components on sorting behaviour of dairy heifers upon transition to a novel ration. Twelve Holstein heifers consuming a familiar forage-based ration ad libitum, were transitioned to a novel total mixed ration (TMR) (NTMR; 41.6% haylage, 36.5% corn silage, 14.6% high-moisture corn, and 7.3% protein supplement, DM basis) according to 1 of 2 treatments: direct transition to the NTMR (DIR) or gradual transition with exposure to individual components (COMP). Feed intake and feeding activity were determined

daily and fresh feed and individualorts were sampled every 2 d for particle size and NDF analysis. The particle separator consisted of 3 screens (18, 9, and 1.18 mm) and a bottom pan resulting in 4 fractions (long, medium, short, and fine). Sorting activity for each fraction was calculated as the actual intake expressed as a percentage of the predicted intake. There was no effect of treatment on intake (10.6 kg DM/d, SE=0.58, P=0.46) or feeding time (172.3 min/d, SE=4.2, P=0.75). After transition to NTMR, COMP heifers sorted against long particles (95.4 vs. 98.7 % SE=0.5, P<0.001) and for short particles (101.7 vs. 100.6, SE=0.4, P=0.04) to a greater extent than DIR. The COMP heifers also tended to sort for fine particles (102.4 vs. 100.7 %, SE=1.0, P=0.09) and consumed less NDF than predicted compared to DIR (98.9 vs. 100.5 %, SE=0.6, P=0.07). These results suggest that feed sorting behaviour may be influenced by previous experiences with feed components.

Plant Cell Death Morphology in *Aponogeton madagascariensis*: A Comparison Between Developmental and Induced PCD

Presenting Author: Warner, Trevor (Dalhousie University)

A major component in cell death classification systems (CDCS) is the appearance of intracellular components, referred to as morphology. In animals, a conventionally accepted CDCS, is established; unfortunately one has not been established for plants, due to a lack of data. It is the authors objective to gather data which will contribute to the formation of a CDCS in plants. Traditionally, cell death has been delineated into two major categories: an accidental, passive, necrotic cell death, or a regulated, active, programmed cell death (PCD). PCD can be developmentally regulated or environmentally induced. The Madagascar lace plant is a model organism for studying developmental PCD due to: the predictable timing and location of leaf perforations, and its thin, transparent leaves which are ideal for live-cell imaging. Using two cell death inducers salt (100mM, 150mM and 400mM), and heat (45°C, 55°C, and 65°C) in the lace plant, induced cell death morphology can be compared to developmental PCD. Morphological characteristics of lace plant leaf perforation PCD are: loss of pigmentation, perinuclear chloroplast formation, cytoplasm condensation, tonoplast collapse, and plasma membrane (PM) retraction. The induced treatments which showed PCD-like characteristics were 55°C and 150mM, respectively. Morphology of the 55°C treatment showed: loss of anthocyanin, cytoplasm condensation, vacuolar swelling, and PM retraction. The 150mM treatment showed vesicle formation, changes in chloroplast appearance, and no PM retraction. There are both similarities and differences between developmental and induced PCD morphology. Morphological data collected should be coupled with biochemical, and molecular data before a plant CDCS is established.

Investigations into the development of the conjunctival papillae using fluorescent dye labeling

Presenting Author: Wilson, Kaitlyn (Mount Saint Vincent University)

The conjunctival papillae are outgrowths of the epithelium which surround the cornea in the embryonic chick eye. They are transient structures which induce bone (scleral ossicles) immediately below them in a sequential pattern. The purpose of this study is to further understand the origin of the tissue that gives rise to the conjunctival papillae. Although, the literature is clear that the origin of these cells is the neural crest, the goal here was to follow the path after neural crest cell migration from the neural tube. To do this, a fluorescent dye (DiI) was injected into the mesenchyme of the chick (*Gallus gallus*) head at 3 days post fertilization (dpf; HH stage 17). Dye was injected into two locations: between the nasal pit and the optic cup, and adjacent to the eye in the temporal region. Results show that only the accessory membranes (i.e. nictitating membrane) are labeled with the first injection. The second injection labeled a group of conjunctival papillae demonstrating that cells in the mesenchyme migrate to this region by HH stage 34 (8 dpf). This data clearly demonstrates the region from which one group of the conjunctival papillae arise and further research is needed in order to understand the migration pathway of cells contributing to the other papillae in the chicken eye. This research will ultimately enhance our understanding of the origin of eye tissues in the vertebrate eye.

Burrowing behaviours of juvenile soft-shell clams (*Mya arenaria*) in response to intertidal sediment acidification

Presenting Author: Woodard, Krystal (University of New Brunswick Saint John)

Ocean acidification (OA) is expected to result in negative implications for a myriad of organisms under future projected conditions. As OA persists and worsens in the future, the calcium carbonate shells of organisms, such as molluscs, could dissolve, leading to increased vulnerability, changes in behaviour and subsequent mortality for these organisms. In general, coastal areas are known to have a lower pH than the open ocean, with surface sediments currently being even more acidic than projected future OA conditions. Often, coastal surface sediments have a reduced

aragonite saturation state (Ω_A), inhibiting many molluscs from adequately maintaining their shells. The objective of this study was to observe how Ω_A within surface sediments affects the burrowing behaviour of juvenile soft-shell clams (*Mya arenaria*). Natural sediment cores from the field were sampled to determine if juvenile soft-shell clams use burrowing depth as a mechanism to avoid undersaturated ($\Omega_A < 1$) sediment, and whether or not a relationship between shell length and burrowing depth existed. These results were then compared with those of a laboratory experiment, which allowed clams to burrow into sediment manipulated with varying amounts of CO₂ (yielding varying levels of pH/ Ω_A). This study will enhance our understanding of how sediment acidification impacts the burrowing behavior of juvenile bivalves, such as *M. arenaria*, and will add to the growing body of literature outlining the behavioural implications of ocean acidification.

The relationship between condition and measures of stress in nestling European starlings

Presenting Author: Yuill, Hillary (Saint Mary's University)

Maintaining an effective immune system is energetically costly. During times of stress, the immune system and an individual's physical condition can become compromised. Elevated white blood cell (WBC) counts, and high heterophil/lymphocyte (H/L; types of WBCs) ratios are two reliable indicators of stress in birds. The objective of this study was to determine whether nestling condition was negatively correlated with stress in European starlings (*Sturnus vulgaris*). I predicted that nestlings in poor condition would have higher stress and therefore higher overall WBC counts and H/L ratios than nestlings in good condition. Two nestlings were chosen from each nest when 14 -15 days of age ($n = 16$ nests); one was in the best condition, as measured by regressing mass against tarsus length, and one was in the worst condition. Blood samples were taken for blood smears, which were then fixed in methanol, and stained using Hema III. Smears were examined with microscopy to estimate WBC count and H/L ratio per 10,000 erythrocytes. Condition differed significantly between the two nestling groups (best and worst condition). WBC counts were positively correlated with H/L ratios. However, counter to my prediction, nestling condition tended to be positively correlated with H/L ratio, while no correlation existed between condition and WBC counts. The slight positive relationship between condition and H/L ratio contrasts with results from another study done on adult starlings in this same population. Nestlings at this age may still be developing their immune response, and so WBC and H/L ratios do not indicate condition.

Biology Abstracts Poster Presentations

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

Expression of Class III Alcohol Dehydrogenase: Glutathione Dependent NADP(H) Linked, as a Possible Pathway Used by Microorganisms in the Detoxification of Formaldehyde Resins

Presenting Author: Bachar, Roudi (Saint Mary's University)

Urea-Formaldehyde polymers undergo hydrolysis to break into their toxic components, one of which is formaldehyde. When resin containing wood chips are put into anaerobic bioreactors it is suspected that formaldehyde will disproportionate into carbon dioxide (CO₂) and methane (CH₄), by the microorganisms present in the system resulting in a mixed Alco-fermentation reaction. Using real time gene expression tracking, it is possible to see which enzymes and pathways are responsible. Alcohol dehydrogenase III; otherwise known as S-(hydroxymethyl) glutathione dehydrogenase (S-GdH), is a key intermediate enzyme in the Glutathione Dependent NAD(P)⁺ linked catabolic pathway of aldehydes into alcohols. Polymerase chain reactions (PCR) with a created set of primers were used to determine gene presence in the system, cloning was used to create standards and determine efficiency of PCR products. The tracking of gene quantity (GQ) and gene expression (GE) over time was determined through the use of real-time PCR (qPCR) and reverse transcriptase PCR (rtPCR). A comparison of the overall trend of GQ and GE with respect to gas production trends are used to determine if there is a significant correlation between the two trends. Results are still being analysed.

Status of Native and Non-Native Lady Beetles (Coleoptera: Coccinellidae: Coccinellinae) on Cape Breton Island, Nova Scotia with a special focus on *Coccinella transversoguttata richardsoni* as a species at risk

Presenting Author: Bonnar, Colin (Cape Breton University)

Two native lady beetle species, *Coccinella transversoguttata richardsoni* and *Coccinella novemnotata*, have declined dramatically across North America since the late 1970s. One, *Coccinella transversoguttata*, was common on Cape Breton Island; however, it has not been found on Cape Breton Island since the 1980s. The Committee on the Status of Endangered Wildlife in Canada (COSEWIC) is reviewing the status of these two lady beetles as species at risk. I sampled 12 sites that had the appropriate open edge habitat, shrubby with diverse herbaceous vegetation, for *Coccinella transversoguttata*, across industrial Cape Breton. No *Coccinella transversoguttata* were collected in 2014 indicating a dramatic decline, but not fitting easily into COSEWIC categories of species at risk. Non-native species, which were introduced around the same time that the abundant native *Coccinella transversoguttata* started to decline, represented 97% of the lady beetles collected in 2014. As there has not been any record for more than 25 years in Cape Breton of *Coccinella transversoguttata*, I will consider whether this fits the COSEWIC criteria for Extirpated or Endangered or Threatened species.

Effects of nesting location on stress metrics in blood in American Eiders

Presenting Author: Boyd, Ellen (Acadia University)

The Common Eider, *Somateria mollissima* population in Nova Scotia is in decline. There have been several factors that have been proposed as contributing to this decline, and some of these may manifest themselves in the birds through increased physiological stress, which in turn might reduce reproductive success. Comparing heterophil: lymphocyte (H:L) ratios is a common method of evaluating long-term stress levels in avian species. During the breeding period female Common Eiders remain on their nests for the duration of the season, leaving them susceptible to predation. My project contrasted stress levels, as indicated by H:L ratios, of eiders nesting in exposed habitats with eiders nesting in sheltered. If increased susceptibility to avian predation increased breeding stress, we expected to see higher H:L ratios for eiders nesting in exposed habitat than those in sheltered habitat. We extracted blood from breeding females on Eastern Shore Islands (sheltered), Bon Portage Island (exposed), and John's Island (exposed). Mean H:L ratios of eiders from John's Island were higher than those from either Bon Portage Island or the Eastern Shore Islands, but these differences were not quite statistically significant. To determine if stress levels are a factor in the declining populations these ratios should be compared to other American Eider populations that are not under decline. Comparing my data to values established internationally, Canadian Arctic eiders had significantly higher

baseline H:L ratios than those from Nova Scotia, which in turn were higher than those of breeding birds in Iceland. These differences may be related to varying annual environments.

Light- and temperature-dependent changes in the photophysiology of a marine diatom

Presenting Author: Burriss, Tyson (Mount Allison University)

The diatom *Thalassiosira pseudonana* was cultured at two different temperatures (13 and 23°C). At each temperature cultures were grown at two different light levels (40 and 90 $\mu\text{mol photons m}^{-2} \text{s}^{-1}$), on a 12:12 h light:dark cycle. Rates of growth and respiration were higher in cultures grown at higher light, but respiration rate was not higher in cultures grown at higher temperatures whereas growth rate was. Chlorophyll a (chl a) content was highest in the culture grown at the higher temperature and lower light and lowest in the culture grown at lower temperature and higher light. Active photosystem II (PSII) content was measured by oxygen flash yields and compared to the content of the PSII subunit PsbA measured by immunoblotting. Both measurements were normalized to chl assays taken at approximately the same time. Oxygen data produced a greater estimate of PSII than immunoblots, but both were within the expected range. The number of chl a molecules per PSII averaged about 790 chl/PSII for oxygen flash yields and 1560 chl/PSII for immunoblots. The ratio of chl a to PSII did not differ greatly between the four treatments when measured by oxygen flash yields, but the ratio found using the PsbA quantification as an estimate of PSII content was higher in cultures grown at higher light. Rubisco content (RbcL/chl a, measured by immunoblotting) was higher in lower light treatments but no effect of temperature was detected. In general, the level of irradiance had a greater effect than temperature on the photosynthetic apparatus.

Seasonality of eelgrass (*Zostera marina*) and associated community in Nova Scotia, Canada

Presenting Author: Cullain, Nakia (Dalhousie University)

Seagrasses are among the most productive ecosystems on the planet and form extensive beds in estuaries and along coastlines around the world. These beds provide key ecological services, including nutrient cycling, carbon sequestration, and adult and juvenile habitat for many ecologically and economically important species. The seasonality of our local seagrass species, eelgrass (*Zostera marina*) has yet to be studied in Atlantic Canada, thus this study aims to examine the seasonal changes in canopy structure, carbon storage, nitrogen retention and habitat services of eelgrass in Nova Scotia. Four sites along the Atlantic coast of Nova Scotia were sampled during the spring, summer and fall of 2007. Visual surveys were used to estimate the eelgrass canopy structure (shoot density and height), abundance of mobile fauna and percent cover of sessile and epiphytic organisms. Eelgrass above-and-below-ground biomass and infauna abundance were also collected using three sediment cores. To date, results show that the mobile benthic fauna at Taylor Head and Musquodoboit Harbour displayed seasonality. Franks George had differences between all seasons except for fall and summer and Cable Island was the only site to not display any seasonality in mobile benthic fauna. Interestingly, in most cases there was evidence that the changes in species abundance were related to the seasonality of the eelgrass itself. These are encouraging results however, this is only a small portion of the eelgrass community. There will be a more complete picture of the seasonal changes in eelgrass communities in Nova Scotia once all of the analyses are completed.

Applying Traits-Based Analyses to Bioassessment of Streams on Cape Breton Island

Presenting Author: Davis, Jessica (Cape Breton University)

Bioassessment studies focus on measuring the impact of humans on an environment by studying the organisms living within that environment. The most common organisms used within bioassessment research are benthic macroinvertebrates. Traits based analyses is a new form of bioassessment that uses the traits of the organisms within the ecosystem, opposed to more prevalent methods that only use the abundances of the organisms found. This project uses benthic macroinvertebrates, identified to family, collected from forty streams on Cape Breton Island. A traits data base focused on feeding type, locomotion capabilities and biotic index number for each family found was created and statistical analyses was performed to demonstrate that traits based analyses gives more insight into the condition of a freshwater ecosystem compared to just using benthic macroinvertebrate abundances.

Assessing potential hybridization between *Ixodes cookei* and *Ixodes scapularis* as a factor in the spread of Lyme disease in New Brunswick

Presenting Author: Duncan, Anna (Mount Allison University)

Lyme disease is caused by the spirochete bacterium *Borrelia burgdorferi* introduced by a tick bite. In New Brunswick, *Ixodes scapularis* alone is considered as a vector for Lyme disease and is tested for *Borrelia* in national passive surveillance. However, some recent estimates of Lyme prevalence are unexpectedly high, prompting the hypothesis of more than one vector propagating the disease. Samples of the closely related *Ixodes cookei* collected by passive surveillance from 2012-2013 throughout New Brunswick show that it is capable of carrying *Borrelia* and readily feeding from humans. This study aimed to determine whether the close phylogenetic relationship and environmental proximity have given rise to hybridization between these two species, prompting reassessment of *I. cookei* as a Lyme vector. A morphological survey of intact specimens compared the two species as well as specimens with ambiguous morphology. *I. scapularis* and *I. cookei* differed significantly in palp and scutum descriptors ($p > 0.05$). Potential hybrids palps differed significantly from *I. cookei* and scutum shape differed significantly from *I. scapularis* ($p > 0.05$). To determine if these morphological ambiguities represent hybridization, we assess maternal lineage via CO1 barcoding, and hybridization by sequencing the nuclear 28S gene. CO1 sequences were different enough for species delineation and analysis of 28S also showed only two species and no evidence of hybridization, although there may be evidence of introgression or geographical differentiation in both species. This work shows that these species show more phenotypic plasticity than previously appreciated, potentially resulting in an underestimation of vectorial capacity and under-testing of Lyme-competent ticks.

Strategic Environmental Assessment of Changes in Bill C-45 to the Navigable Waters Protection Act and Potential Effects on Environmental Protection in Canada

Presenting Author: Foster, David (Dalhousie University)

The *Jobs and Growth Act 2012 (Bill C-45)*, received Royal Assent in December, 2012. It makes changes in many existing Canadian laws, including the *Navigable Waters Protection Act (NWPA)*, with more emphasis on economic prosperity via the creation of infrastructure and less on environmental protection by deemphasizing environmental considerations. The purpose of this study is to evaluate how the level of environmental protection will change for Canadian waterways that provide critical ecosystem goods and services such as habitat for biodiversity. A Strategic Environmental Assessment (SEA) investigated the strengths and weaknesses of the new legislation based upon a literature review, interviews with experts & stakeholders, and comparative case studies. An SEA is an evidence-based tool for analyzing the environmental impacts and sustainability of policy changes, and can be used proactively to emphasize the importance of environmental issues in proposed and new legislation. The reduction of regulatory requirements for smaller works and works in now federally-unregulated bodies of water, suggests future infrastructure approvals will be much faster with less analysis of environmental issues. The onus of protecting the navigability and environmental health of these important bodies of water will fall to private citizens who have the ability to litigate only after damage has occurred. This violates the Precautionary Principle. Results from the literature review and interviews document environmental protection will indeed be weakened. Those stakeholders whose interest lies in environmental protection oppose the legislative change, while those involved in industry are generally positive about the less rigorous and faster approval process.

Comparative Effects of Ocean Acidification on Two Northern Teleost Fish: *Fundulus heteroclitus*, and *Gasterosteus aculeatus*

Presenting Author: Heustis, Allyson (St. Francis Xavier University)

Ocean acidification is the product of rising anthropogenic carbon dioxide emissions and increasing oceanic surface temperatures. The negative effects of ocean acidification have been readily studied in tropical regions, however research is lacking in temperate zones. *Fundulus heteroclitus* and *Gasterosteus aculeatus*, temperate Northern Euryhaline minnows, were acclimated to projected atmospheric conditions for the year 2100 to examine olfactory-based behavioural changes when exposed to Schreckstoff, a naturally occurring alarm substance found in epithelial club cells of both species. From obtained results, we were able to conclude that there were significant changes in fish weight; however, due to a bacterial infection, and declining health of the fish, the experiment was terminated prematurely. In future research, stabilizing stress levels of fish populations before beginning the experiment would be beneficial to overall fish health. During trials, fish were allowed one minute to make a selection, after which, fish were

nudged with a net to induce swimming. This external anthropogenic stimulus significantly affected directional selection; therefore, modified future experimental design should eliminate nudge-induced swimming, as nudging significantly affected our results.

Nest-feathering by tree swallows (*Tachycineta bicolor*) in response to artificial warming of their nests

Presenting Author: Holland, Erika (Acadia University)

Bird nests protect eggs, developing young, and incubating adults from inclement weather and predation. Tree Swallow (*Tachycineta bicolor*) females are solely responsible for incubating eggs. Prior to and while females are incubating, males compete with rivals for feathers that they use to line nests for their incubating partner. Feathers could offer protection against abrasion from rough nesting material, be an indicator of mate quality, or protect against ectoparasite attack, but I tested the thermal benefits hypothesis that predicts that feathers are used to keep eggs and chicks warm. I hypothesized that artificially heating Tree Swallow nests would result in addition of fewer feathers. At my study site in the Annapolis Valley, nesting started the first week of May and continued into mid June. Nests were randomly assigned to control or experimental treatments. Wire platforms were added under nests early in nest-building so that later manipulations would cause reduced disturbance. Both treatments had heating pads (spent pads for controls) placed under them that were replaced daily until culmination of incubation. In nests that successfully fledged young, contrary to the thermal benefits hypothesis, there was no statistically significant difference in feather numbers between controls and experimentals. Ongoing analyses are testing whether these results were affected by female age, box size, or time of nest initiation.

Serotonergic regulation of aggressive behaviours in the gymnotiform fish *Brachyhypopomus gauderio*

Presenting Author: Kooka, Carl (Cape Breton University)

Aggressive behaviours allow for social animals to resolve conflicts over limited resources and are mediated by hormones and neuromodulators, such as androgens, cortisol, and serotonin. Although serotonin (5-HT) has a well characterized inhibitory effect on aggressive behaviours, via activation of the 5-HT 1A receptor, how the 5-HT 1A receptor regulates aggressive behaviours via activation of the stress axis is not well understood. As such, this study investigated how serotonin, via its 5-HT 1A receptor, regulates aggressive behaviours. The gymnotiform electric fish *Brachyhypopomus gauderio* served as a model species in this respect, since serotonin has been shown to alter its electric organ discharge (EOD) in a manner that mimics changes related to aggressive behaviour. Subjects were injected with the 5-HT 1AR postsynaptic antagonist MM-77 dihydrochloride to determine how inhibition of the stress axis via the 5-HT 1A receptor affects the EODs, physical behaviours, and cortisol levels. It is expected that fish injected with MM-77 dihydrochloride would exhibit increases in EOD amplitude and duration, dominance, and cortisol levels. Preliminary behavioural results suggest that when compared to fish injected with saline, those that were injected with MM-77 dihydrochloride display more dominant behaviours. Additional analyses will focus on the effect of MM-77 dihydrochloride on the fish's EOD and cortisol levels.

Hunting Down a Connection: Investigating a potential Interaction between minibrain and Hip1

Presenting Author: Lamond, Allison (Memorial University of Newfoundland)

Down syndrome is a human neurodevelopmental disorder that arises from an additional complete or partial copy of chromosome 21. Located in the Down syndrome critical region (DSCR) of chromosome 21 is the Dual specificity serine/threonine kinase 1A (*Dyrk1a*) gene. The overexpression of this gene is thought to play a key role in the generation of the Down syndrome phenotypes. The minibrain (*mnb*) gene is the *Drosophila melanogaster* homologue of *Dyrk1a*. Huntington's disease is a neurodegenerative disease caused by the inclusion of extra "CAG" repeats in the huntingtin (*htt*) gene located on chromosome 4. Huntingtin interacting protein 1 (*Hip1*) is a protein that interacts with the expanded *htt* and a *D. melanogaster* *Hip1* homologue was discovered by our laboratory group. To evaluate potential interaction between these genes, *mnb* and two versions of *Hip1* were overexpressed in the neurons of *D. melanogaster* using the neural transgene *GawB^{L(3)31-1}*, where it was expected that a decrease in both life expectancy and motor abilities would occur. As well, RNA interference (RNAi) is used to silence these genes to better understand the effect of effectively silencing *mnb* and *Hip1* individually and in combination in the eye via the transgene *GMR-Gal4*. Similar experiments were conducted with the co-expression in the eye of the transcription factor *foxo*. These results show interesting and dramatic results with virtually no bristles being produced in the eyes. Valuable insights

into the activities of mnb and Hip1 will be presented and the implications to Down syndrome and Huntington's disease will be discussed.

Maternal environmental effects of temperature and exogenous gibberellic acid application on evening primrose (*Oenothera biennis*) seed characteristics

Presenting Author: LeFait, Britanie (Mount Saint Vincent University)

Evening primrose (*Oenothera biennis*), a biennial species, is found across North America. Earlier studies have considered the effects of individual environmental factors on this species. However, the interactive effects of temperature and gibberellic acid on multiple populations of evening primrose have received little attention. We investigated the effects of two temperature regimes (24/20°C and 28/24°C; day/night) and two gibberellic acid treatments (100 µL everyday and 100 µL every other day) on the subsequent germinability of seeds from four local populations of evening primrose in Halifax (Baseball Field, Radcliffe, Willet Street and Farnham Gate). From each population under each temperature regime, ten plants were grown from June 2013 to January 2014 with plants receiving gibberellic acid treatments on their respective days for the first two weeks of experimental conditions. Matured seeds were harvested and germinated, within three days of collection, under the two temperature regimes for at least 30 days or until no germination was observed for five consecutive days. Also, seedling vigour was tested under the two temperature regimes for three weeks. We measured various parameters, including germination percentage and rate of seeds, seed characteristics (total sound seed number and weight, total aborted seed number and weight, seed weight per capsule, individual seed weight), capsule characteristics (weight, length, width), seedling physical characteristics (seedling vigour index, dry matter accumulation, moisture content) and seedling physiological characteristics (chlorophyll content, chlorophyll fluorescence, ethylene). Preliminary results suggested that, in evening primrose, higher maturation temperature decreases capsule size but increases seed germinability, regardless of germination temperature.

Determining potential mediators of mast cell activation for the production of the cytokine interleukin-10

Presenting Author: Legere, Stephanie (Dalhousie University, Department of Microbiology and Immunology)

Mast cells produce many cytokines that operate in the immune system, including interleukin-10 (IL-10). IL-10 typically induces an anti-inflammatory immune reaction, promoting responses that decrease inflammation in cellular environments. In recent studies this cytokine has been found to inhibit fibrosis in a rat model of hypertension. Therefore, we investigated compounds that could potentially activate mast cells to up-regulate IL-10 gene expression and protein production. In this study it was hypothesized that vitamin D₃ and platelet-activating factor could act as mediators for the activation of mast cells to produce the cytokine IL-10, as previous studies had implicated these two compounds as mediators with which IL-10 production could be up-regulated. The experimental procedure involved activating human mast cell lines and primary human cord blood-derived mast cells with vitamin D₃ or platelet-activating factor. The level of IL-10 gene expression was determined by qPCR, while production of IL-10 protein was assayed with a specific enzyme-linked immunosorbent assay (ELISA). Overall, it was determined that both vitamin D₃ and platelet-activating factor did not induce IL-10 gene transcription or protein production in primary human mast cells or the human mast cell lines analyzed. We are currently investigating additional mediators in order to identify molecules that are able to induce IL-10 production by human mast cells and thereby potentially initiate an anti-inflammatory immune response.

Is plant re-colonization age-dependent in limestone quarries?

Presenting Author: Mason, Agnes (Memorial University of Newfoundland)

Quarrying of limestone habitat is a global threat to limestone ecosystems. On the Great Northern Peninsula of Newfoundland (Sandy Cove; 51.348627N, 56.665034W) extensive limestone quarrying has damaged a unique biodiversity hotspot. The Sandy Cove limestone barrens are home to many rare arctic-alpine plants, including the endangered endemic *Braya longii* (Long's Braya). I investigated the rate of vegetative re-colonization of formerly quarried limestone barrens across three age gradients: oldest (1968) (N=1), an intermediate site (1979) (N= 4) and the youngest (1989) (N=2) with natural sites (N=2) acting as controls. Across all natural and quarried sites, vegetation surveys (species counts and percent cover) were conducted from edge to centre to observe the effect edges have on species abundance and composition. Results for quarried sites show low vegetation cover for native and non-native species (to the limestone barrens). For the oldest disturbed site (1968) the average total percent cover was 43% ± 4.13,

the intermediate sites (1979) had an average total percent cover of $19\% \pm 1.46$, and the youngest sites had an average total percent cover of $16\% \pm 1.39$. The natural sites had an average total percent cover of $75\% \pm 2.65$. Based on the slow recovery rate and low vegetation cover of native species, future restoration efforts need to consider an active restoration strategy including replanting native species and the addition of substrate suitable for plant growth. This study underscores the importance of mitigation and management strategies to help restore this valuable biodiversity hotspot.

Methylene Blue Therapy in Experimental Septic Shock

Presenting Author: Maxan, Alexander (Dalhousie University, Department of Microbiology and Immunology)

Sepsis and septic shock are amongst the most common cause of mortality for intensive-care patients. In sepsis microvascular function is impaired and vasoplegia and inflammation-induced capillary leakage leads to refractory hypotension. The purpose of this study was to investigate the effects of methylene blue (MB) on capillary perfusion and immune cell activation within the intestinal microcirculation during experimental septic shock induced by lipopolysaccharide (LPS). Five groups of Lewis rats ($n=5$ in each group) were studied: control, endotoxemia (20 mg LPS/kg), LPS + norepinephrine (NE), LPS + MB, and LPS + NE and MB. All drug treatments were timed to be concurrent with LPS administration IV. Heart rate, mean arterial pressure and body temperature were monitored. Intravital microscopy (IVM) was used to observe the intestinal microcirculation two hours after sepsis was induced. In comparison to the control group, animals in the untreated LPS group had a significant decrease in mucosal capillary perfusion and showed an increase in leukocyte adhesion in intestinal submucosal venules 2 hours after induction of endotoxemia. Administration of both MB and NE improved mucosal capillary density and decreased leukocyte adhesion. Experimental administration of another vasoconstricting therapy (MB) additionally to the clinical standard therapy for septic shock (NE) did not further deteriorate the intestinal microcirculation but reduced immune cell activation.

Canine scent detection of larval *Tetropium fuscum* in winter field conditions: a potential application for forest pest management

Presenting Author: Montgomery, Fielding (Dalhousie University)

Tetropium fuscum (brown spruce longhorn beetle) is an invasive wood boring beetle that has infested 11 counties in Nova Scotia. In North America it is known to infest spruce trees *Picea* spp. *T. fuscum* is a potentially significant threat to the ecological function of infested forests, and the economic value and marketability of lumber, pulp and paper industries in NS. Human visual inspections of signs and symptoms of BSLB infestation lead to high rates of false alarms and misses during ground surveys. Thus, we propose the inclusion of scent detection canines. Dogs previously trained on detection of *T. fuscum* in lab conditions, with a percent correct >80 , will complete detection surveys of 30 preselected trees (33-67% with visual signs and symptoms of *T. fuscum* attack), in three site locations. Each tree identified as "infested" by the dog, and an equivalent number identified as "healthy", will be cut and bolts reared to analyze the presence of *T. fuscum*. Signal Detection Theory will be used for data analysis. It is predicted that dogs will have a lower false alarm rate in BLSB surveys than their human counterparts, and can be used as an efficient method of forest pest management. It is also expected that this project can serve as a model for the mitigation of other invasive forest pests (i.e. Emerald Ash Borer, Asian Longhorn Beetle, and European Gypsy Moths).

Marine Macrophyte Detritus: Effects of Substratum Type

Presenting Author: Penney, Alicia (Cape Breton University)

Marine macrophyte detritus (wrack) is important to shoreline ecosystems and may represent a pathway for marine-derived nutrients to enter terrestrial systems. However, little is known about the mechanisms of wrack deposition. I investigated physical patterns of deposition on different beach substratum types (cobble, gravel & sand). Collections on different beach types in Bamfield, British Columbia (summer 2002 and autumn 2013), and Gabarus, Nova Scotia (summer 2013) were compared for total wrack dry mass and functional group composition. A flume experiment examined forces required to transport already detached wrack pieces. Cobble beaches were expected to have the highest deposition amount; however, there was no significant difference found between dry mass amounts on different beach types. There was a significant difference in the amount of wrack by year and season sampled in Bamfield. Differences in functional group composition were observed between sampling periods and beach types. The lack of significant difference between beach types may be due to the large amount of variance in wrack deposition amounts.

The difference in functional group composition on different substrata may be due to hydrodynamic forces characterizing each beach type, as well as the physical characteristics of the substrata. Since a very large amount of wrack (140 tonnes dry mass / Km shoreline in summer) may be deposited yearly, knowledge of patterns and mechanisms of wrack deposition may help ecologists to predict wrack inputs in different geographical locations. This knowledge may be the stepping stone for further studies quantifying marine-derived nutrients from a macroalgal wrack source.

Development of a Tracking and Guidance App for Long-term Thyroid Hormone Management for use by Thyroid Cancer Patients

Presenting Author: Rajaraman, Drew (Saint Mary's University)

An important part of treatment for differentiated thyroid cancer requires the patient to take daily thyroid hormone replacement in the form of levothyroxine or T4 (e.g. Synthroid). This is done not only to replace thyroid hormones, but also to help prevent thyroid cancer recurrence by suppressing serum thyroid stimulating hormone (TSH) to below normal range. For most patients TSH suppression is a life-long therapy, although the target range of TSH suppression will vary over time as their recurrence risk changes. Regular blood-work and communication with the primary care physician is required to make adjustments in the dosage of levothyroxine in order to maintain the appropriate level of TSH suppression and reduce thyroid cancer recurrence risk. With the rising use of smartphone Apps in the healthcare system, the use of mobile technologies to facilitate participation of thyroid cancer patients in their health care has significant potential to improve adherence to management recommendations, optimize clinical outcomes and reduce costs. The goal of this study is to design and develop a beneficial mobile application (App) for use by thyroid cancer patients to record and monitor blood test results and recommended T4 dose changes in conjunction with their local primary care physicians. A mobile App was successfully developed using HTML5. Alpha testing of the App was performed on multiple devices to identify and eliminate errors. The completed App enables the user to input TSH test results, review records in table and graphical format, and identify TSH levels outside of the user's Target TSH Range.

Laboratory assay testing green crab as an alternative bait for lobster fishing

Presenting Authors: Ryan, Shauna; Livingstone, Sara (St. Francis Xavier University)

The American lobster (*Homarus americanus*) fishing industry in Nova Scotia is an important part of the economy, though there are large struggles that come with the practice. Obtaining baits needed for lobster fishing are extremely expensive for the fisherman; some spend up to \$10,000 annually on bait for a two-three month fishing season. An alternative bait type that could be considered to lower these costs is the invasive green crab (*Carcinus maenas*). We compared lobster behavioral responses to green crab and traditional baits (mackerel, flounder) as well as to an inert control. The results showed no significant difference amongst the biological bait types. These findings lead to the conclusion that green crab should be tested in the field as bait for lobster trapping. If successful, it could lead to a more cost effective and sustainable bait for the industry, with potential additional benefits from reducing population sizes of an invasive species.

A transgenic zebrafish model of NUP98-HOXA9 induced myeloid disease reveals a stem cell origin and dependence on Meis1

Presenting Author: Wagner, Gretchen (Dalhousie University)

Acute Myeloid Leukemia (AML) is identified by the hyperproliferation of myeloid cells with impaired differentiation and apoptosis. AML is the most common leukemia in adults and accounts for 20% of pediatric leukemia, but survival remains below 60% despite aggressive therapy. HOXA9 is crucial for myeloid cell differentiation and is upregulated in 80% of AML cases. The NUP98-HOXA9 (NHA9) fusion oncogene results in HOXA9 overexpression and is associated with high risk AML. While the hematopoietic stem cell (HSC) appears to be the likely cell-of-origin and Meis1 a key collaborating gene in non-fusion HOXA9-induced AML, much less has been determined in the case of NHA9-induced disease. We previously generated a transgenic zebrafish with inducible NHA9 expression under the zebrafish pu.1 promoter. NHA9 expression produced a myeloproliferative neoplasm (MPN) in 23% of adults and increased myeloid cells and decreased erythrocytes in 28 hours post-fertilization (hpf) embryos. Using transgenic zebrafish reporter lines, cd41::egfp and runx1::egfp, we observed and quantified by fluorescence-activated cell sorting (FACS), a two-fold expansion in HSCs in 48 hpf embryos, suggesting a stem cell origin in this disease. meis1 morpholino knockdown in NHA9 embryos restored both primitive and definitive hematopoiesis demonstrating a contributing role in the myeloproliferative phenotype observed. Employing NHA9 and meis1 mRNA injections into

these HSC reporter lines together with subsequent knockdown and recovery experiments, we will further elucidate the contribution of Meis1 and HSCs to NHA9-induced AML. These studies are likely to provide new insights in the development of targeted therapies for this high risk leukemia.

How coral species *Porites astreoides* responds to effects of Ocean Acidification

Presenting Author: White, Kascia (Saint Mary's University)

Ocean acidification poses an extreme threat to coral colony survival. The rise of carbon dioxide in atmospheric pressure decreases the seawater carbonate ion concentration resulting in lower rates of calcium carbonate deposition in coral skeletons. If this rise continues, rates of coral erosion will exceed coral accretion, causing coral reef systems to significantly decline. Coral calcification rates could decline by 20% to 80% of modern values by the end of this century. *Porites astreoides* from Bermuda's Rim Reef release larger planulae than *P. astreoides* from Bermuda's Patch reefs, so adult *P. astreoides* colonies were collected from two Patch Reef sites and two Rim Reef sites in Bermuda. Planulae were settled in three target pCO₂ levels (420, 1200, and 1670 ppmv) and reared in experimental conditions for two weeks. My objective was to determine whether there is a species-specific differential response to CO₂. I am focusing on answering whether 1) larval sizes across the north lagoon differ, and 2) larvae differ in their response to CO₂ variations. I predict that if Rim Reef larvae are larger than Patch reef larvae of the same species, they will be more resistant to ocean acidification effects. Rim and Patch corals differed significantly for both total calcification and settlement proportions, with higher rates of calcification under ambient CO₂ conditions, but no significant difference between CO₂ conditions in settlement proportions. This study provides suggestive evidence to support the hypothesis that increased larval size leads to increased resistance to enriched CO₂ in *P. astreoides* recruits.

Applying Traits-Based Analyses to Bioassessment of Streams in the Yukon

Presenting Author: Wroblewski, Julie-Anne (Cape Breton University)

Bioassessment is a method for measuring the impact of human activity on the environment by looking at organisms in the ecosystem. The most commonly used organisms for this method are benthic macroinvertebrates which tend to be beneficial for several reasons. This includes, but is not limited to, the fact that they are mainly sedentary, so they are exposed to any stressors at the site. For this research project, I looked at data collected from 290 streams in the Yukon regarding the relative abundance of 81 different benthic invertebrate families. I performed traits-based analysis on these data with a focus on locomotion, feeding behaviour, and the biotic index for each of these families. This was followed by performing statistical analysis to see whether the traits-based analysis will give more insight to the condition of the freshwater streams of the Yukon River Basin.

~Biology Poster Presenter Index~

<i>Presenting Author(s)</i>	<i>Poster #</i>
Bachar, Roudi (Saint Mary's University)	17
Bonnar, Colin (Cape Breton University)	13
Boyd, Ellen (Acadia University)	21
Burris, Tyson (Mount Allison University)	1
Cullain, Nakia (Dalhousie University)	20
Davis, Jessica (Cape Breton University)	3
Duncan, Anna (Mount Allison University)	14
Foster, David (Dalhousie University)	9
Heustis, Allyson (St. Francis Xavier University)	2
Holland, Erika (Acadia University)	11
Kooka, Carl (Cape Breton University)	22
Lamond, Allison (Memorial University of Newfoundland)	5
LeFait, Britanie (Mount Saint Vincent University)	19
Legere, Stephanie (Dalhousie University, DMI)	12
Mason, Agnes (Memorial University of Newfoundland)	18
Maxan, Alexander (Dalhousie University, DMI)	6
Montgomery, Fielding (Dalhousie University)	10
Penney, Alicia (Cape Breton University)	15
Rajaraman, Drew (Saint Mary's University)	8
Ryan, Shauna; Livingstone, Sara (St. Francis Xavier University)	7
Wagner, Gretchen (Dalhousie University)	16
White, Kascia (Saint Mary's University)	23
Wrobleski, Julie-Anne (Cape Breton University)	4

Poster session	Saturday, March 15th	Author Presence
1	7:30am – 8:30am	No authors at posters
2	12:15pm – 12:45pm	Authors at odd # posters
	12:45pm – 1:15pm	Authors at even # posters
3	1:15pm – 2:15pm	Authors at all posters
4	7:15pm – 8:45pm	Authors at all posters

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