CENTRE FOR FISHERIES ECOSYSTEMS RESEARCH























progress report 2010-2015





MEMORIAL TO DR. ARTHUR MAY

Dr. Arthur May's vibrant career led him from rural Newfoundland to the study of the Labrador cod grounds and a series of influential positions in Canadian federal scientific institutions and academia. His accomplishments in these areas are well known. What may not be so well known was his long-standing commitment to the development of fisheries science at Memorial University. Early initiatives to establish a Federal-University fisheries lab at MUN were thwarted, but in the turbulent early 1990s, with fish stocks collapsing and the fishery in turmoil, Art (now Memorial's President) remained convinced that the University must increase it's capacities in fisheries science. Art was instrumental in the creation of the NSERC Chair in Fisheries Conservation that brought me to the Marine Institute and Memorial in the mid-1990s. A decade and a half later, although long retired, Art's support for the evolution to CFER,

and enthusiastic leadership of the advisory committee, was key to early research strategies and successes. For me, his counsel and advice were always required reading. But even more, I had the pleasure of learning from him, especially about the destructive fishing era of the late 1960s - when cod and other species were decimated by foreign fleets. His was a firsthand and long-term scientific knowledge. Art was generous with that knowledge, and critical of what we sometimes called short-term "hit and run" science. He was invariably constructive, no matter differing viewpoints, and often-times very humorous. His interest in fisheries science never abated. Just prior to his illness, after discussions about the fisheries of the Hamilton Bank of his graduate school days, and indications that in 2015 CFER might renew research there, he expressed interest in accompanying the research voyage. Although his cabin will be empty, his spirit and knowledge remains...

MESSAGE FROM GLENN BLACKWOOD

Since John Cabot lowered his basket into the waters off Newfoundland and Labrador some 500 years ago, fisheries have been a source of food and employment and have defined the culture of Newfoundland and Labrador.

Since its creation in 1964, the Fisheries and Marine Institute of Memorial University has played a significant role in the development of the fishery in Newfoundland and Labrador. When the Institute became a part of Memorial University in 1992 it expanded its interaction with the fishing industry to include industrial training, diplomas, degrees, graduate programs and applied research. The Institute's continued its role in fisheries development with the creation of the Centre for Fisheries Ecosystems Research (CFER) on July 2, 2010 with the support of the Government of Newfoundland and Labrador. This new centre within our School of Fisheries. combined with the Institute's existing research capacity in our Centre for Aquaculture and Seafood Development and the Centre for Sustainable Aquatic Resources, gave the Institute a research capability in fisheries that does not exist anywhere else in Canada.

CFER has had an incredible impact in the five years since its creation. In my view, the research that has been undertaken at CFER has transformed our understanding of the fisheries ecosystems in our waters. The centre is also transforming the fisheries of the future through the development of graduate students that will be the next generation of leaders in fisheries science. However, the fishing industry in Newfoundland and Labrador is facing many challenges, and continuing innovative research, such as is being undertaken at CFER, is critical to maintaining a sustainable and economically viable fishing industry. In 1949, the Memorial University Act made fisheries research a key part of Memorial's mandate to serve the needs of Newfoundland and Labrador. With the creation of CFER I now believe that we have finally developed the research capacity in fisheries at Memorial that was envisioned some 66 years ago.

I would like to thank the Government of Newfoundland and Labrador, through the Department of Fisheries and Aquaculture and the Research and Development Corporation for their continued support of CFER. Our thanks also goes out to our other partners in the Newfoundland and Labrador fishing industry, for supporting our research initiatives through collaborations and partnerships, our collaborators at the Department of Fisheries and Oceans and our colleagues throughout Memorial University who have supported us in the development of the centre.

Glenn Blackwood

Vice-President of Memorial University (Marine Institute)





MESSAGE FROM THE DIRECTOR

As the founding Director of the Centre for Fisheries Ecosystems Research, it has been a privilege to nurture its growth over the past five years. CFER is now involved in a wide variety of fisheries research that bears directly on the future of the fisheries and fishing communities of Newfoundland and Labrador and, indeed, those worldwide. Of vital importance, CFER has continued the tradition of active sea-going research, response to the needs of the fisheries, and strength in graduate students and science — ingredients that led to its creation. I retire this year confident that I leave CFER in a strong position for continued success.

Dr. George Rose

Director,

Centre for Fisheries Ecosystems Research, Fisheries and Marine Institute of Memorial University of Newfoundland



AN INTRODUCTION TO THE CENTRE FOR FISHERIES ECOSYSTEMS RESEARCH

As the Administrative Director of the Centre for Fisheries Ecosystems Research, or CFER as we like to call it, I have a unique perspective on how CFER has grown since its creation on July 2nd, 2010.

CFER has a mandate to conduct research on the ecosystems that provide the base for fisheries in the waters of Newfoundland and Labrador. In addition, our mandate focuses on training students, who are the next generation of leading fisheries scientists that will study fish and fisheries, not only in the waters around our province, but around the world.

In its efforts to meet this mandate, CFER has grown significantly both in its number of employees and in its research activities since July 2010 and has developed into a comprehensive unit of research scientists, biologists, technicians, administrative personnel, post-doctoral fellows and graduate students. We are now the largest university-based seagoing research centre that studies fisheries in Canada — this is a significant accomplishment in five short years, and we take pride in that. But just as significantly, our research is having an impact. Our student numbers reached a peak of 22 and our outreach and engagement activities — from helping a local Brownie group earn their Science and Technology badges to presenting our research and collaborations at international conferences — are letting the people of Newfoundland and Labrador and the world know what CFER is doing and how important our research has become.

The future of CFER is bright — we have hired the best and brightest, our research is world class, and our students are our legacy.

The document that follows is an overview of our employees, students and research since our creation, with particular emphasis on ongoing projects in 2014. I hope you find this progress report interesting and informative, and share my appreciation for the hard work of the CFER team.

Thomas Brown Administrative Director, CFER

If you would like more information on CFER please visit our website: www.mi.mun.ca/cfer







THE FIRST FIVE YEARS





To look back over the last five years it is amazing to see how much CFER has evolved. Growing from a group of two technicians and seven graduate students, led by Director Dr. George Rose in 2010, CFER's research is now bolstered by five research scientists, four of which are based at the Marine Institute and one in Happy Valley-Goose Bay in partnership with the Labrador Institute. These scientists supervise graduate students and post-doctoral fellows, and are supported by a team of five fisheries biologists and technicians. Since inception, CFER has had five post-doctoral fellows hold positions with CFER and have reached a high of 22 graduate students.

Graduate students form the base of CFER. The Institute hosts students from around the world who are pursuing both masters and doctoral degrees in biology, environmental sciences and statistics. Their research stretches across taxa, includes freshwater and marine environments, and ranges from a micro scale to wholeecosystem views. In addition, undergraduate students are employed at CFER for research placements and internships, summer student positions in Labrador provide training to Nunatsiavut beneficiaries, and staff act as mentors for high school science students. With this, CFER is helping to build the foundation for the next generation of fisheries scientists.

The Centre's research initiatives were launched in February 2011 with the arrival of the RV Celtic Explorer, from the Marine Institute in Ireland, in St. John's to complete an acoustic and biological survey of overwintering Atlantic cod. The Celtic Explorer has returned each year, with surveys spanning an area ranging from the Southern Grand Banks to Hamilton Bank off the coast of Labrador. Onboard, CFER personnel collect data on oceanographic conditions and sample a variety of fish, including (but not limited to): cod, capelin, haddock, pollock, shrimp, silver hake, and turbot. This annual survey also provides a platform for the training of graduate students, giving them opportunity to gain firsthand experience working offshore and taking a



hands-on approach to fisheries research. To date, these offshore surveys have estimated fish abundances; provided input into stock assessments; detected more southern species moving into Newfoundland and Labrador waters; provided a platform for satellite tagging studies; and collected samples for student projects on diet, stock structure and movement of fishes.

CFER's research focus stretches far beyond these offshore voyages. Inshore, research is examining lobster population dynamics, juvenile fish are being collected to provide insight on the movements of cod, and sampling of early life stages of forage fishes such as capelin and herring are giving insights into early feeding of these species. CFER's 10m vessel, the Gecho II, is fully equipped to collect data on inshore fish populations, such as capelin in Trinity Bay and cod off Petty Harbour, NL. Stretching inland, acoustic methods are being applied to assess the productivity of freshwater fishes, and work continues examining Atlantic salmon around Lake Melville in Labrador. In the face of changing ocean temperatures, CFER researchers are investigating shifts in fish assemblages and distributions in and around the province. The Centre is also contributing to fisheries research outside of Newfoundland and Labrador with international collaborations, such as partnerships with Irish scientists allowing for studies of the pelagic ecosystem across the north Atlantic, and projects in Canada's North. CFER has also established a great working relationship with the Fisheries and Oceans Canada and has many ongoing partnerships and collaborations.

In addition to working towards improving the fundamental understanding of functioning and dynamics of the ecosystems in the waters surrounding Newfoundland and Labrador, CFER's aim is to complete industry-relevant research, answering questions important to Newfoundland and Labrador's fishers and fisheries. Through collaborations with industry partners, CFER scientists are undertaking projects on stock assessments, fish movements, by-catch, marine protected areas, sustainability certifications, trophic interactions, and emerging species around Newfoundland and Labrador. Students have worked directly with harvesters to collect samples from lobster, salmon and cod caught during commercial and subsistence fisheries. These partnerships with fishers provide valuable insights into the organisms and ecosystems we study.

Sharing this research is vital to CFER's continued success. In order to achieve this, members of CFER have organized and chaired sessions and workshops at national and international meetings. Students and researchers also travel to conferences in order to share findings and meet with collaborators to further develop research projects. Since 2011, individuals from CFER have contributed to publications in primary scientific literature, books, and government documents. Beyond academia, CFER, like the Institute, is active in public outreach activities for all ages, engaging Newfoundland and Labrador youth in fisheries science and introducing them to the diversity of life in the ocean.

Both researchers and students have been successful in winning prestigious research grants through the Natural Sciences and Engineering Research Council (NSERC), the Research and Development Corporation of Newfoundland and Labrador (RDC), the Marine Environmental Observation Prediction and Response Network (MEOPAR), the Institute for Biodiversity, Ecosystem Science and Sustainability (IBES), and from the Newfoundland and Labrador Department of Fisheries and Aquaculture (DFA). These grants recognize the importance of the work CFER does and why it must continue well into the future.

Looking ahead, CFER is poised to remain a leader in fisheries research. With the recruitment of additional researchers and students, we look to further growth and continue to address research questions important to the people of Newfoundland and Labrador.



WHERE WE'RE FROM AND WHAT WE'VE ACCOMPLISHED



Rize City, Turkey





WHERE ARE CFER ALUMNI NOW?

Shaoxing, China

Genevieve D'Avignon, MSc 2013 International Development Intern, Quebec without Borders

Laura Wheeland, MSc 2014 Fisheries Technologist, Centre for Fisheries Ecosystems Research

Kyle Krumsick, MSc 2014 PhD Candidate (Biology), Memorial University with CFER

Brian Pentz, MMS 2014 Statistics Canada, Halifax NS

Anna Ólafsdóttir, PhD 2013 Research Scientist at the Pelagic Division, Faroe Marine Research Institute

Craig Knickle, PhD 2014 Biologist, PEI Department of Fisheries and Aquaculture

Erin Carruthers, Post-doctoral Fellow Fisheries Scientist, Fish, Food and Allied Workers (FFAW) Union/Unifor

Jennifer Doucette, Post-doctoral Fellow Senior Aquatic Biologist, Canada North Environmental Services

MILESTONES



JULY 2

CFER is created with a five-year mandate through \$11.75 million in funding from the Newfoundland and Labrador Department of Fisheries and Aquaculture and the Research & Development Corporation

Dr. George Rose is appointed Director





AUGUST Dr. Jonathan Fisher is hired on as CFER's first Research Scientist



SEPTEMBER

Dr. Sherrylynn Rowe joins CFER as a Research Scientist

2011

FEBRUARY 7

The RV Celtic Explorer arrives in St. John's to undertake CFER's first survey of NL fish stocks. This vessel has since returned each year



NOVEMBER 28

CFER holds its first Advisory Committee meeting, chaired by Dr. Arthur May

JANUARY

CFER welcomes

as a Quantitative

Fisheries Scientist

Dr. Noel Cadigan





MAY 9 – JUNE 2

Multispecies survey was conducted in NAFO Division 3Ps, Northern Cod research in Bonavista Corridor



JUNE

Dr. Marie Clement joins CFER as an Aquatic Research Scientist in partnership with the Labrador Institute

SEPTEMBER

is hired as CFER

Research Scientist

Dr. Dominique Robert

APRIL 25 - MAY 23

Northern Cod Survey in NAFO Divisions 2J3KL, Multispecies Survey in 3Ps



OCTOBER

2013

A team led by Drs. Robert and Fisher begin a tagging program on Atlantic Halibut in the Gulf of St. Lawrence

AUGUST

Dr. Clément's students complete a successful first field season sampling Atlantic Salmon around Lake Melville ahead of schedule

2012

MAY

The first satellite tagged Atlantic Cod

are released by

Drs. Rose and Rowe

SEPTEMBER 26

CFER launches its public seminar series at the Marine Institute



APRIL 24 – MAY 22

Northern Cod Survey in NAFO Divisions 2J3KL, Multispecies Survey in Southern 3Ps



2014

2015

NOVEMBER

Dr. Noel Cadigan presents an integrated state-space stock assessment model for northern cod



APRIL 7

\$4.95 million in funding over 2 years to continue CFER research activities is announced by the Minister of Fisheries and Aquaculture, the Honorable Keith Hutchings





Dr. George Rose

Doctor of Philosophy McGill University

Master of Science, Biology Laurentian University

Bachelor of Science Fisheries & Wildlife Management University of Guelph

Dr. George Rose has worked in the Newfoundland and Labrador fisheries for over 30 years. A Newfoundlander by birth, he obtained a bachelor of science in fisheries and wildlife management from the University of Guelph, a master of science from Laurentian University in biology, and a doctor of philosophy from McGill University focusing on the Labrador fisheries.

Dr. Rose has worked for provincial, federal and international fisheries organizations. He was awarded the Natural Sciences and Engineering Research Council of Canada Chair in Fisheries Conservation at the Fisheries and Marine Institute in 1996 prior to becoming the first director of CFER in 2010. He has published more than 125 scientific papers primarily on the North Atlantic fisheries, many popular articles and an award winning book on the Newfoundland and Labrador fisheries ecosystems. He was a contributor to the Nobel Prize winning International Panel on Climate Change report in 2007. Dr. Rose is currently Editor-in-Chief of the international journal, *Fisheries Research*. At CFER, his research focuses on the conservation and sustainability of fisheries, examining distribution and population dynamics using hydroacoustics, tagging, and geochemical lab techniques.



Dr. Rose's Highlights in 2014





PhD Students

MSc Student





Dr. Jonathan Fisher

Doctor of Philosophy University of Pennsylvania

Master of Science, Biology Dalhousie University

Bachelor of Science (Honours), Biology Queen's University

Dr. Jonathan Fisher joined the Marine Institute as a research scientist with CFER in 2011. Prior to this, Dr. Fisher was a post-doctoral fellow concurrently in the Department of Biology at Queen's University and in the Ocean Sciences Division at the Bedford Institute of Oceanography.

Dr. Fisher's research interests include the structure, function and dynamics of marine ecosystems. He has research experience in population, community and ecosystem ecology of exploited and unexploited systems in the Northwest Atlantic. His primary research goal within CFER is understanding and quantifying how exploitation and climate forcing are changing characteristics and productivity of temperate and sub-Arctic marine ecosystems, especially Newfoundland and Labrador's fisheries resources. Dr. Fisher's current research projects address shifting spatial distributions of marine species in response to climate change; the movements and dynamics of Atlantic halibut in the Gulf of St. Lawrence; trophic interactions; and quantifying large scale productivity differences within and among North Atlantic ecosystems.

Dr. Fisher has ongoing collaborations within CFER, with the Department of Fisheries and Oceans (DFO), the Fish, Food and Allied Workers (FFAW), and the Department of Fisheries and Aquaculture (DFA). Three of his graduate students are currently supported by Research & Development Corporation (RDC) Ocean Industry Student Research Awards.

Dr. Fisher, with Post-doctoral fellow Dr. Hannah Murphy and DFO Scientist Martin Castonguay, handle an Atlantic halibut (Hippoglossus hippoglossus) during tagging operations in the northern Gulf of St. Lawrence.

Dr. Fisher's Highlights in 2014



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MSc Students





Dr. Sherrylynn Rowe

Doctor of Philosophy Dalhousie University

Master of Science, Biology Memorial University

Bachelor of Science (Honours), Biology Memorial University

Dr. Sherrylynn Rowe joined CFER in 2011, returning home to Newfoundland and Labrador after working as a research scientist with Fisheries and Oceans Canada at the Bedford Institute of Oceanography for six years.

Dr. Rowe's research interests relate to behaviour and life history, particularly their implications for population dynamics and sustainable management strategies. Her work has centered on Northwest Atlantic ecosystems spanning from the coast of Labrador to the Gulf of Maine and has involved a variety of taxonomic groups. Her early studies examined reproductive and foraging ecology of seabirds, lobster demography, and linkages between spawning behaviour and population dynamics of Atlantic cod. More recent scientific efforts have focused on resource assessment and population biology of commercially important marine fish and invertebrates (e.g., groundfish, scallops); species-at-risk (e.g., wolffish, skate); and nontraditional target species subjected to new fisheries (e.g., hagfish, sea cucumber, whelk).

As a research scientist with CFER, Dr. Rowe's current focus is on abundance, behaviour, and life history of northern cod in order to better understand and predict recovery dynamics in a changing ecosystem. Some of her additional projects include examining the role of marine protected areas in enhancing lobster populations and fisheries, incidence and impacts of parasites in Atlantic cod, and population biology of haddock in southern Newfoundland waters. Dr. Rowe's research philosophy has always involved engagement with local stakeholders and she routinely collaborates with local fish harvesters and processors, government agencies, as well as other scientists based regionally, nationally and internationally.

Large Atlantic cod outfitted with the pop-up satellite tags that record latitude and longitude, depth, and temperature for a year or more. Drs. Rose and Rowe are working on this multi-year project which aims to unravel some of the mysteries surrounding the distribution and movement patterns of cod in waters off Newfoundland and Labrador.

Dr. Rowe's Highlights in 2014









MSc Students





Dr. Noel Cadigan

Doctor of Philosophy University of Waterloo

Master of Applied Statistics Memorial University

Bachelor of Science (Honours) Memorial University

Dr. Cadigan is a quantitative fisheries scientist specializing in statistical methods for fish stock assessment and sustainable fisheries. He has extensive experience in the assessment of Newfoundland fish stocks, and experience with other Canadian, American and European stocks.

Prior to joining the Marine Institute, Dr. Cadigan worked with Fisheries and Oceans Canada at the Northwest Atlantic Fisheries Centre in Newfoundland and Labrador from 1990–2011 and focused on the assessment of Atlantic cod and other groundfish stocks.

As a research scientist within CFER, Dr. Cadigan is focusing on stock assessment and sustainable harvest advice for Newfoundland and Labrador fisheries. He is leading a project to develop a state-of-the-art stock assessment model for northern cod that integrates much of the scientific information on the productivity of this fish. The purpose of the model is to provide harvest advice for the future, which involves a "state-space" modelling approach and advanced computational software.

Dr. Cadigan is also leading a project to develop an integrated spatial stock assessment model for Newfoundland snow crab. In addition, he is researching improved statistical methods for working with survey data, as both of these projects rely on data collected from scientific surveys. Dr. Cadigan is also looking at how to define and calculate fisheries management reference points (i.e. targets and limits) in stochastic environments where various aspects of stock productivity are changing.

Dr. Cadigan analyzing fisheries data in order to develop models that will contribute to management advice for Newfoundland and Labrador fisheries.

Dr. Cadigan's Highlights in 2014







MSc Students





Dr. Marie Clément

Doctor of Philosophy University of Guelph

Master of Science, Biology University of New Bru<u>nswick</u>

Bachelor of Science (Honours), Biology Université de Moncton

Dr. Marie Clément is an Aquatic Ecologist stationed at the Labrador Institute (Happy Valley-Goose Bay). She was recruited by CFER — in conjunction with the Labrador Institute and with funding from ACOA — in June 2012, to develop a community-based aquatic research program. Marie worked for Fisheries and Oceans Canada from 2001 to 2012.

The overall objective of Dr. Clément's research program is to generate scientific information to assist in conservation, fisheries management and food security in Labrador. Current research projects are aiming at determining whether salmon stocks in the Lake Melville watershed are genetically distinct and should be managed as a separate designable unit; determining whether the salmon fisheries in Lake Melville are exploiting a single stock or represent a mixed stock harvest; identifying important rivers contributing to salmon production; and developing analytical methods for quantifying contaminant levels and identifying chemical tracers in Atlantic salmon.

Dr. Clément's research is aiming to create training opportunities for aboriginal beneficiaries and to develop community-based collaborations and research networks. All projects are being conducted in partnership with various agencies such as Fisheries and Oceans Canada (DFO); Dalhousie University; Université du Québec à Rimouski; Memorial University; the Nunatsiavut Government; the Innu Nation; the Labrador Hunting and Fishing Association; and the Torngat Wildlife, Plants and Fisheries Secretariat.

Dr. Clément, along with students, sample juvenile Atlantic salmon in Caroline Brook, Labrador during the 2014 field season as a part of ongoing research on Lake Melville salmon populations.

Dr. Clément's Highlights in 2014



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Dr. Dominique Robert

Doctor of Philosophy, Oceanography Université Laval

Bachelor of Science (Honours), Biology Université Laval

Dr. Dominique Robert is a research scientist with interests in pelagic ecology and marine fish recruitment dynamics. He joined CFER in the Fall 2012 after a post-doctoral stay with the ArcticNet Network of Centres of Excellence, where he investigated climate change impacts on the pelagic fish assemblage in the southeast Beaufort Sea, Canadian Arctic. Prior to that, Dr. Robert researched mechanisms driving predation mortality in larval Japanese anchovy as a postdoctoral fellow of the Japanese Society for the Promotion of Science at Kyoto University.

Dr. Robert's current research focuses on recruitment and production variability of key forage fish in Newfoundland and Labrador marine ecosystems, such as capelin, Atlantic herring and Atlantic mackerel. One main objective of this research is to quantify the role zooplankton prey supply in regulating condition and survival rates throughout their life cycles. This research relies primarily on field-based sampling of larval and adult forage fish, but also includes a laboratory component targeted at describing the dynamics of feeding and growth in larval capelin. He is also leading a project aimed at understanding the distribution, seasonal migrations and habitat use of Atlantic halibut in the Gulf of St. Lawrence by using pop-up satellite archival tags. These tags record depth and temperature at high resolution over predetermined periods.

Dr. Robert's research projects are conducted in collaboration with Fisheries and Oceans Canada (DFO), Fish, Food and Allied Workers (FFAW/Unifor), and the Department of Fisheries and Aquaculture (DFA).

Dr. Robert and MSc candidate Carissa Currie work in the lab assessing diet composition of larval Atlantic herring to reveal links between changes in the dynamics of Newfoundland herring stocks and long-term trends in plankton prey production.

Dr. Robert's Highlights in 2014

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PhD Student

MSc Students



POST-DOCTORAL FELLOWS

The Marine Institute's Centre for Fisheries Ecosystems Research provides opportunities for post-doctoral fellows from around the world to continue their research following the completion of their PhDs. From collecting and analyzing data, completing laboratory experiments, and working on statistical models, they undertake research projects that further their expertise, add to their publication records, and prepare them for future careers as research scientists.



DR. HANNAH MURPHY

Dr. Murphy holds a Bachelor of Science from the University of British Columbia, a Bachelor of Science (Honours) and Doctor of Philosophy from the University of Melbourne, Australia. During her doctoral research, Dr. Murphy investigated how zooplankton availability (bottom-up processes) affected larval survival and recruitment of snapper, a temperate marine fish. Hannah's research focuses on fish larval trophodynamics (food-web dynamics). At CFER, she is investigating how larval growth affects capelin survival and recruitment, as well as participating in a satellite tagging project on halibut in the Gulf of St. Lawrence.



DR. CHRISTOPH KONRAD

Dr. Konrad was awarded a Bachelor of Science (Honours) in zoology and a Doctor of Philosophy in theoretical ecology at the University of Aberdeen. In between, he received a Masters of Research at the University of St. Andrews. Dr. Konrad's doctoral thesis looked at the development and application of random-walk models. Prior to his appointment at CFER, he worked on the *EcoFishMan Project* at the University of Aberdeen linking the ecological impact and economic revenue of fisheries in the North Sea. At CFER, Dr. Konrad is analyzing cod-tag data from multiple regions around Newfoundland and Labrador to enhance the understanding of cod stock dynamics, including growth rates, migration patterns and, especially, the selectivity of effective gear.



DR. STÉPHANIE LELIEVRE

During her doctoral research at the IFREMER Institute (France), Dr. Lelievre identified spawning grounds in the Eastern English Channel and the southern part of the North Sea using cartography and habitat modelling. Dr. Lelievre also worked as a researcher at IFREMER on the CHARM project which aims to improve knowledge of the English Channel sea area in order to preserve the fragile environment and help establish sustainable management of resources. At CFER, Dr. Lelievre's research focuses on snow crab productivity and management targets under changing ocean conditions.



DR. ILHAN YANDI

Dr. Yandi holds a Doctor of Philosophy in marine ecology, specializing in marine fish larvae, from Karadeniz Technical University, Turkey. During his doctoral research, he examined RNA, DNA and protein content of larval horse mackerel and anchovy hatched from field-captured eyed eggs. Before coming to Newfoundland and Labrador, Dr. Yandi was a Maritime Faculty scientist at Recep Tayyip Erdogan University, Turkey. At CFER, Dr. Yandi is working on developing a technique for rearing larval capelin, a forage fish of high economic and ecological importance in Northwest Atlantic marine ecosystems. Results of this study will uncover factors that control growth and survival, and will validate otolith usage in estimating age and growth history of early larvae.

GRADUATE STUDENTS

CFER houses numerous students from Memorial University's School of Graduate Studies. Students complete Masters and PhD programs in Biology, Environmental Sciences, and Mathematics and Statistics under the supervision of Marine Institute research scientists.

PhD Candidates



BRYNN DEVINE Shifting distributions of deep water fishes



DAIGO KAMADA

Feeding ecology of Newfoundland capelin



KATE KINCAID (BARLEY)

Fishery closures and marine reserves in ecosystem based management



KYLE KRUMSICK

Species interactions and food web modelling in Newfoundland and Labrador



DARRELL MULLOWNEY

Cod and crab interactions along the Newfoundland and Labrador shelf



VICTORIA NEVILLE

Cod otolith geochemistry

Masters Candidates



LAURA CARMANICO Parasite infection levels in Atlantic cod



HILARY ROCKWOOD Diet and spatial overlap in cod and non-cod gadids



CARISSA CURRIE Feeding ecology and recruitment in larval Atlantic herring



BOB ROGERS Life history and abundance of haddock in Newfoundland



TIMOTHEE GOVARE Feeding ecology of first-feeding capelin larvae



FRED TULK Assessing recruitment patterns and mixing of NL cod stocks



VICTORIA HOWSE Impact of the Eastport MPA on lobster populations



SHIJIA WANG Fisheries management reference points



ZAKIYAH MOHAMMED Statistical modelling of fish growth



DAVE WOODLAND Northern cod feeding ecology



RILEY POLLOM Hydroacoustics assessments of freshwater fishes

STAFF ADMINISTRATIVE, RESEARCH & TECHNICAL PERSONNEL

The Marine Institute staff at CFER come from diverse backgrounds in academia, education, non-profit groups and the fishing industry. These individuals support the research of CFER's scientists and graduate students by coordinating and assisting in field research, organizing outreach activities, processing samples in the lab, analyzing and managing datasets and helping to develop research projects.



CLARA PENNY Administrative Assistant



GORDON ADAMS Fisheries Technologist



SUSAN FUDGE Fisheries Biologist



KILEY BEST Fisheries Technologist



WADE HISCOCK Fisheries Biologist



LAURA WHEELAND Fisheries Technologist

ADVISORY COMMITTEE

Glenn Blackwood Acting Chair	VP, Memorial University of Newfoundland (Marine Institute)
Mark Abrahams	Memorial University, Dean of Science
Carey Bonnell	Fisheries and Marine Institute, Head of the School of Fisheries
Derek Butler	Association of Seafood Producers
Erin Carruthers	FFAW
Gerard Chidley	Fish Harvester
Paula Clarke	Research & Development Corporation of NL
David Decker	FFAW
Tom Dooley	NL Department of Fisheries and Aquaculture
Kevin Hardy	Fish Harvester
David Lewis	NL Department of Fisheries and Aquaculture
Barry McCallum	Department of Fisheries and Oceans Canada
Brian McNamara	Newfound Resources Ltd.
Winston Pitcher	Fish Harvester
Nancy Pond	NL Department of Fisheries and Aquaculture
Jamie Snook	Torngat Secretariat
Martin Sullivan	Ocean Choice International
Robert Verge	Canadian Centre for Fisheries Innovation
Alberto Wareham	Icewater Seafoods Inc.
Brad Watkins	Fish Harvester



RESEARCH PROJECTS



Fisheries and the ecosystems in which they operate are inherently connected. CFER is attempting to better understand these linkages. The work stretches across Newfoundland and Labrador, in waters inshore, offshore and inland. As well, CFER collaborates with industry and academic partners to undertake research throughout Canada and internationally. True to the Centre's name, the research takes an ecosystem view, from examining large scale regime shifts to identifying the smallest of plankton.

The following pages highlight many of the research projects that have been undertaken since 2010, with a particular focus on those active in 2014. This work covers six overarching research themes:

- Movements and Distributions
- Fisheries Acoustics
- Diet and Food Supply
- Supporting Management and Assessment
- Fish in a Changing Ocean
- Population Dynamics and Life History

Results from this research enhance the current understanding of the structure and function of marine ecosystems. This information also feeds into the stock assessment process, providing insight into movements and abundances of fish, and through the development of improved assessment models. CFER's aim is to complete research that is relevant to both industry and academia; studies are focused around gaps identified in scientific literature, questions posed by fishers and communities around Newfoundland and Labrador, and requirements for stock management. With changing ocean conditions comes a potential shift in the Northwest Atlantic ecosystem and its fisheries. With the Institute's current CFER research team, the Centre is well-positioned to evaluate these changes for the benefit of the people of Newfoundland and Labrador.





PROJECT HIGHLIGHTS **MOVEMENTS AND DISTRIBUTIONS**

Atlantic halibut distribution, migrations and habitat use in the Gulf of St. Lawrence

There is a need for new baseline biological information for developing stock assessment tools and improving management strategies for Atlantic halibut in the Gulf of St. Lawrence. Dr. Robert is leading a satellite tagging project with CFER scientists Dr. Fisher and Dr. Murphy, DFO Science and FFAW scientists and harvesters, to provide new insight on this valuable fish. By collecting tracks of temperature and depth at high resolution, satellite tags record important behavioural traits and facilitate the reconstruction of seasonal migrations of individual fish over a full year.

Satellite tagging to examine cod distribution and movement

Many mysteries remain surrounding where cod travel and how they behave. Drs. Rose and Rowe are deploying the latest generation of pop-up satellite archival tags on large cod captured during Celtic Explorer surveys to gain insight into cod movements and behaviour. Pop-up tags store latitude and longitude data, depth, and temperature for a year or more, measured every two minutes, then release themselves from the fish and transmit their data via satellite back to the research station. Since 2012, CFER has deployed more than 100 of these tags on cod throughout Newfoundland waters and aims to also tag cod off Labrador during 2015. This research is providing fine-scale information on distribution and movement of individual fish that will be instrumental in elucidating migration pathways, critical habitat, timing and location of spawning, and stock structure - elements of tremendous importance for interpreting and predicting fluctuations in associated fisheries and assessing stock status.





Rivers of origin and baseline contaminant levels in Lake Melville's Atlantic salmon

Labrador is currently experiencing rapid economic development (e.g., Lower Churchill hydroelectric development, road construction and mining). Although Atlantic salmon is an important food source for aboriginal communities, salmon populations in Lake Melville remain largely unknown. Dr. Clément and her research partners developed a project aimed at determining the rivers that are contributing to salmon production. Other goals are to establish baseline contaminant levels in the salmon food, social and ceremonial fisheries, and determining whether the next generation Microwave Plasma-Atomic Emission Spectrometer (MP-AES), recently acquired by the Labrador Institute, can detect levels of contaminants observed in fish.

A habitat template approach to the identification of areas of differential fisheries productivity in Newfoundland and Labrador waters

Quantifying relationships between ocean habitat features and fisheries productivity is one way to advance ecosystem approaches within fisheries ecology. This project, led by Dr. Fisher and PhD candidate Brynn Devine, is testing the ability of a spatial habitat model to predict areas of differing fisheries productivity, species' life history traits, and fish species numbers around Newfoundland and Labrador. Model predictions are made by incorporating spatially resolved chemical, biological, geological, and physical oceanographic data. This collaboration with DFO Science (Newfoundland, Maritimes and Pacific regions) and National Resources Canada, grew from the ICES Working Group on the Northwest Atlantic Regional Sea and provides support for the model's predictions of both areas of apparent high and low fisheries productivity and species' differential responses to exploitation within those areas.

- Using fishery dependent landings data to examine fish distributions, environmental influences and bycatch avoidance
- Examining the dynamics of oceanographic conditions and associated fauna across the North Atlantic
- Analyzing the structure of Northwest Atlantic pelagic ecosystem across a strong temperature gradient between the island of Newfoundland and the Flemish Cap
- Using chemical signatures in otoliths to track the migration, stock structure and behaviour of cod in Newfoundland and Labrador waters



PROJECT HIGHLIGHTS FISHERIES ACOUSTICS

Hydroacoustic surveys of spawning "northern" Atlantic cod

The northern cod stock was the backbone of the Newfoundland and Labrador fishery for hundreds of years, and may be once again as it rebuilds. A team of CFER scientists, including Drs. Rose and Rowe, MSc candidate Dave Woodland, and PhD candidate Kyle Krumsick are working to gain more information on this important stock. Spawning fish and late juveniles aggregate in certain areas of the offshore shelf in springtime, offering an ideal opportunity to acoustically survey this portion of the stock in an efficient manner. Modern echo sounders enable the detection of individual and aggregated fish providing distribution, abundance and biomass estimates at high resolution. New methods are being researched to measure the acoustic characteristics and size of individual cod (and their main prey capelin, with DFO collaboration) at multiple acoustic frequencies. As part of these acoustic-trawl surveys, CFER has been sampling northern cod throughout the stock area providing detailed information on diet and productivity that will be key to predicting cod recovery dynamics, sustainable rates of harvest, and potential impacts on other stocks and fisheries, including shrimp and snow crab.

- Developing acoustic methods to monitor the productivity of freshwater ecosystems as a part of the NSERC HydroNet research network
- Evaluating multi-frequency acoustic responses of species-sizes of the deep scattering layer and pelagic fishes (capelin)
- Using acoustics to examine sizebased individual variation in susceptibility of Atlantic cod to capture by survey gear
- Testing the feasibility of quantifying fish abundance in Lower Churchill River and Upper Lake Melville using acoustic surveys
- Studying capelin spawning and larval emergence in Trinity Bay using acoustics and plankton hauls



PROJECT HIGHLIGHTS DIET AND FOOD SUPPLY

Influence of preferred prey availability on condition and survival of Newfoundland capelin

Capelin is a key species of Newfoundland and Labrador marine ecosystems, transferring a large proportion of the energy from lower trophic levels to top predators such as groundfish. After collapsing in the early 1990s, Newfoundland and Labrador capelin have remained at low levels, preventing the recovery of valuable groundfish resources. Dr. Robert is leading a research program with MSc candidate Timothée Govare and PhD candidate Daigo Kamada, in collaboration with Fisheries and Oceans Canada, targeted at identifying the main drivers of capelin productivity with a focus on preferred prey supply during key periods of the life cycle.

- Examining trophic interactions among cod, shrimp, snow crab and capelin, and productivity in Newfoundland and Labrador waters
- Studying the population dynamics of herring in relation to the production of their preferred prey during the larval stage
- Linking feeding success, growth and survival during the larval stage of marine and freshwater fish
- Modelling marine food webs from Southern Labrador to the Northern Grand Banks
- Northern cod diet and productivity under changing environmental conditions and stock status







PROJECT HIGHLIGHTS SUPPORTING MANAGEMENT AND ASSESSMENT

Effects of fisheries closures on stocks, ecosystems, fisheries and communities

Fisheries closures are one of the oldest management tools, yet their impacts on stocks, ecosystems, fisheries, and communities are often not well documented. CFER is currently undertaking two projects looking at the impacts of closed areas on fish and fisheries. Dr. Rose and PhD candidate Kate Kincaid, are investigating closures worldwide as a part of the Canadian Capture Fisheries Network, with two case studies in diverse habitats and climates: a closure in the tropical Indian Ocean at the Mafia Island Marine Park in Tanzania and the Hawke Channel closure off Labrador. A multi-disciplinary approach is being used to examine impacts of these closures using local knowledge of harvesters and communities, in addition to ecological impacts on fish stocks and the fisheries. A second project involving Dr. Rowe and MSc candidate Victoria Howse, works closely with local harvesters to examine productivity of American lobster inside and outside of the Eastport Marine Protected Areas to help quantify the role of MPAs in enhancing lobster populations and fisheries.

ADDITIONAL PROJECTS

- Conducting spatial analyses of demersal fish communities to support ecosystem based management
- Creating an improved stock assessment model for 3LNO American plaice
- Estimating regression parameters from highly stratified survey count data

Maximum sustainable yield (MSY) and Marine Stewardship Council certification of Newfoundland and Labrador fish stocks.

Increasingly, consumers want to buy fish that are caught sustainably — meaning that the fishery is not affecting the health of future fisheries. Dr. Noel Cadigan is leading a project focused on measuring the sustainability of a fishery using standards established by Marine Stewardship Council (MSC). Current approaches for measuring sustainability rely on the concept of MSY, assuming that stock productivity is constant. The Newfoundland and Labrador experience of the last 20-30 years shows that many aspects of stock productivity can vary substantially; this project focuses on defining and computing MSY reference points for Newfoundland and Labrador cod stocks, taking into account these changes. The aim is to provide realistic reference points for fisheries management to help get some Newfoundland and Labrador cod fisheries certified as sustainable in the future, which will lead to better market access, improved prices to harvesters, and more profitable fisheries in the short- and long-term.

- Implementing a Gulf-wide conventional tagging survey to estimate exploitation rate in the 4RST halibut stock
- Providing acoustic survey abundance and biomass estimates of northern cod
- Cod spawning and the use of spawning closures as a tool for the management of fish stocks



PROJECT HIGHLIGHTS FISH IN A CHANGING OCEAN

Southern Newfoundland under changing ocean conditions: diets and spatial distributions of emerging and re-emerging gadoids

In response to changing ocean conditions, the spatial distributions of fishes and other marine organisms are also shifting. These effects may be most noticeable near the edges of marine species' ranges. Researchers at CFER, including Dr. Fisher and MSc candidate Hilary Rockwood, are examining interactions where species overlap. Changing distributions can impact the rates at which species interact and population or ecosystem rebuilding occurs. The relatively warm waters of southern Newfoundland contain the northern range endpoints for haddock, silver hake and pollock. This project incorporates longterm monitoring of changing ocean conditions with fish sampling from acoustic-directed bottom trawls aboard the RV Celtic Explorer. This research aims to quantify the spatial overlap and food web interactions among these 'southern' non-cod gadoids and their functional relationships with the resident Atlantic cod population in this ecosystem.

Invertebrate productivity and management targets under changing ocean conditions

With recent annual landings valued at over \$200 million, snow crab remains a dominant component of Newfoundland and Labrador fisheries. These snow crab stocks have recently been certified by the MSC as an initiative of the Association of Seafood Producers (ASP). This project, led by Dr. Cadigan in collaboration with Dr. Fisher, is aimed at fulfilling some of the MSC research needs of industry partners by providing snow crab biomass and harvest rate estimates, and forecasting how environmental conditions affect the productivity of Newfoundland and Labrador snow crab stocks. MSC certification increases market value and access by the fishery; however, it also prescribes research and management milestones aimed at sustainability that must be met within five years of accreditation. This project aims to help ensure that the Newfoundland and Labrador snow crab industry maximizes its economic potential for years to come by contributing new knowledge to the MSC certification process and aiding in management decisions.

- Examining the impact of changing ocean conditions on the distribution of deep water fish and fisheries
- Detecting responses of Northwest Atlantic marine ecosystems to warm conditions: changes in groundfish distributions and communities
- Fisheries ecology at a large scale: predicting predator-prey interactions and understanding the spatial structure of regime shifts
- Ecosystem surveys in Arctic waters: assessing plankton communities and oceanographic conditions, and expanding knowledge of fish distributions during exploratory fisheries



PROJECT HIGHLIGHTS POPULATION DYNAMICS AND LIFE HISTORY

Determining the genetic structure of Atlantic salmon in Lake Melville

Atlantic salmon in Lake Melville support an important Food, Social and Ceremonial (FSC) fishery. A better understanding of these salmon populations is needed for fisheries management, conservation and food security. This project, by Dr. Clément and her research partners, aims at determining whether Atlantic salmon in Lake Melville are genetically distinct and should be managed independently, and whether the FSC fisheries in Lake Melville come from a single stock or represent a mixed stock harvest. During a successful field season in 2014, salmon juveniles were sampled from 11 isolated rivers flowing into Lake Melville and adult salmon were sampled from the FSC fisheries in the communities of North West River and Rigolet, with laboratory analyses currently being conducted by student Judith Savoie.

Life history and population ecology of haddock in southern Newfoundland waters

Haddock supported a substantial Newfoundland fishery during the 1950s and 1960s but has been at low abundance in recent decades. Research by Dr. Rowe and MSc candidate Bob Rogers, aims to better understand haddock population ecology off the south coast of Newfoundland and Labrador. Observations from CFER's 2012 acoustic-trawl survey conducted off the south coast included notable catches of haddock. Not only did the data suggest that haddock abundance might have improved in that specific area, but that there was a significant proportion of large fish measuring over 50 centimetres. Haddock recruitment is highly variable and might be favoured during warm periods in Newfoundland waters which represent the northern edge of its distribution. This research will provide information critical to the management of the haddock fishery in the future.

- Relating capelin larval growth dynamics to year-class strength
- Incidence and impacts of parasitic worms in Atlantic cod stocks surrounding Newfoundland and Labrador
- Modelling variability in growth and maturation rates of fishes
- Assessing variability in the dynamics of year-class strengths among Atlantic cod stocks around Newfoundland and Labrador











PUBLIC OUTREACH AND ENGAGEMENT

Engaging others in the work of the Centre, whether in academia, politics, industry or the general public, is key to ensuring CFER's success. Memorial University's Public Engagement Framework recognizes the importance of strong sustained partnerships with members of the public of Newfoundland and Labrador and beyond. This exchange of knowledge and ideas helps to build collaborations and shape research questions. We are able to share knowledge of the oceans with a wide audience, and promote the Centre's goal of fisheries sustainability. The Marine Institute, through CFER, takes part in activities aimed at communicating science with youth in our province. It is these future generations ---the budding scientists, managers and champions of our oceans — that must take an interest in our marine ecosystem and its resources at an early age.

Since its inception, CFER has been involved in numerous activities to share awareness about research, fisheries, and oceans to Newfoundlanders and Labradorians:

- Marine Institute scientists, students and staff have participated in over 50 conferences and workshops since CFER's creation (provincially, nationally and internationally), regularly deliver public presentations, and radio and television interviews.
- CFER takes an active role in engaging secondary school students in fisheries research though job shadowing, Women in Science and Engineering (WISE-NL) Summer Student Employment Program placements and participation in regional science fairs as judges.
- Undergraduate students are recruited for positions as summer research assistants, and CFER participates in annual Memorial University and Marine Institute career fairs.
- CFER provides training opportunities by hosting workshops, and inviting students and researchers from around Newfoundland and Labrador to participate.
- CFER hosts visiting academics, prospective students, industry partners and collaborators.
- CFER participates in family-fun events such as Holyrood Squid Festival's MI Marine Base Open House and World Oceans Day to engage youth in oceans activities.













In the coming years, the Marine Institute's Centre for Fisheries Ecosystems Research is poised to remain a leader in fisheries research. We will continue to focus research on questions surrounding fisheries productivity and sustainability to better inform fisheries management, locally and globally. The Centre remains committed to pursuing research that is important to the Newfoundland and Labrador fishing industry through the continuation of multi-year projects and expansion into new opportunities. CFER will continue to provide opportunities for graduate students and postdoctoral fellows, both on land and at-sea, training them as the next generation of fisheries scientists. With great support from the Province of Newfoundland and Labrador, Memorial University and of all it's collaborators, the future is bright for CFER at the Fisheries and Marine Institute.

PUBLICATIONS (2014)

CFER's most recent publications are presented here. For a full list of publications please visit **www.mi.mun.ca/cfer**

Barley Kincaid, K., & Rose, G.A. (2014). Why fishers want a closed area in their fishing grounds: Exploring perceptions and attitudes to sustainable fisheries and conservation 10 years post closure in Labrador. Canada. Marine Policy, 46, 84-90. doi:10.1016/j.marpol.2014.01.007

Barley Kincaid, K., Rose, G., & Mahudi, H. (2014). Fishers' perception of a multiple-use marine protected area: Why communities and gear users differ at Mafia Island, Tanzania. Marine Policy, 43, 226-235. doi:10.1016/j.marpol.2013.06.005

Bouchard, C., Mollard, S., Suzuki, K., Robert, D. & Fortier, L. (2014). Comparison of the early life history of sympatric Arctic gadids Boreogadus saida and Arctogadus glacialis in the Canadian Beaufort Sea. Polar Biology. doi:10.1007/s00300-014-1617-4.

Best, K., McKenzie, C.H., & Couturier, C. (2014). Investigating mitigation of juvenile European green crab Carcinus maenas from seed mussels to prevent transfer during Newfoundland mussel aquaculture operations. Management of Biological Invasions, 5(3), 255-262. doi:10.3391/mbi.2014.5.3.09

Cadigan, N. G., Morgan, M. J., & Brattey, J. (2014). Improved estimation and forecasts of stock maturities using generalized linear mixed models with auto-correlated random effects. Fisheries Management and Ecology, 21(5), 343-356. doi:10.1111/fme.12080

Clément, M., A. Chiasson, A., Veinott, G., & Cairns, D.K. (2014). What otolith microchemistry and stable isotope analysis reveal and conceal about anguillid eel movements across salinity boundaries. Oecologia, 175, 1143-153. doi:10.1007/ s00442-014-2969-8

Devine, B.M., & Fisher, J.A.D. (2014). First records of the blue runner Caranx crysos (Perciformes: Carangidae) in Newfoundland waters. Journal of Fish Biology, 85, 540-545. doi:10.1111/jfb.12438

Ellis, J.E., Rowe, S., & Lotze, H.K. (2015). Expansion of hagfish fisheries in Atlantic Canada and worldwide. Fisheries Research, 161, 24-33. doi:10.1016/j.fishres.2014.06.011

Fisher, J.A.D., Casini, M., Frank, K. T., Möllmann, C., Leggett, W. C., & Daskalov, G. (2014). The importance of within-system spatial variation in drivers of marine ecosystem regime shifts. Philosophical Transactions of the Royal Society, Series B., 370, 20130271. doi:10.1098/rstb.2013.0271.

Fisher, J.A.D., Frank, K.T., & Belgrano, A. (2014). Global aquatic ecosystem services provided and impacted by fisheries: a macroecological perspective. In A. Belgrano, G. Woodward, and U. Jacob, (Eds.), Aquatic Functional Biodiversity: An Eco-Evolutionary Approach. Oxford, England: Oxford University Press (In press).

Fisher, J.A.D., Frank, K.T., Petrie, B., & Leggett. W.C. (2014). Life on the edge: environmental determinants of tilefish (Lopholatilus chamaeleonticeps) abundance since its virtual extinction in 1882. ICES Journal of Marine Science, 71(9), 2371-2378. doi:10.1093/icesjms/fsu053

Fisher, J.A.D., & Robert, D. (2014). Les poissons du Groenland. In V. Masson-Delmotte, E. Gauthier, D. Gremillet, J.-M. Huctin, and D. Swingedouw (Eds.), Le Groenland à Découvert. Paris, France: CNRS Éditions. (In press.)

Frank, K.T., Fisher, J.A.D. & Leggett, W.C. (2014). The spatio-temporal dynamics of trophic control in large marine ecosystems. Pages 31-54 in T. Hanley and K. La Pierre (Eds.), Trophic Ecology: bottom-up and top-down interactions across aquatic and terrestrial systems. Cambridge, Massachusetts: Cambridge University Press. (In press.) Knickle, D.C., & Rose, G.A. (2014). Examination of finescale spatial-temporal overlap and segregation between two closely related congeners Gadus morhua and Gadus ogac in coastal Newfoundland. Journal of Fish Biology, 85(3), 713-735. doi:10.1111/jfb.12454

Knickle, D.C., & Rose, G.A. (2014). Microhabitat use and vertical habitat partitioning of juvenile Atlantic (Gadus morhua) and Greenland (Gadus ogac) cod in coastal Newfoundland. The Open Fish Science Journal, 7, 32-31. doi:10.2174/1874401x20140416001

Mullowney, D., Dawe, E., Colbourne, E., & Rose, G.A. (2014). A review of factors contributing to the decline of Newfoundland and Labrador Snow Crab (Chionoecetes opilio). Reviews in Fish Biology and Fisheries, 24(2), 639-657. doi:10.1007/s11160-014-9349-7

Mullowney, D., & Rose, G.A. (2014). Is recovery of northern cod limited by poor feeding: the capelin hypothesis revisited. ICES Journal of Marine Science, 71(4), 784-793. doi:10.1093/ icesjms/fst188

Murphy, H. M., Bungay, T., Stern, E. W., Winger, P. D., Robert, D. (2015). Measurement of warp loads of bongo samplers. Fisheries Research, 162, 43-46. doi:10.1016/j. fishres.2014.09.012

Murphy, H.M., Warren-Myers, F.W., Jenkins, G.P., Hamer, P.A., & Swearer, S.E. (2014). Variability in size-selective mortality obscures the importance of larval traits to recruitment success in a temperate marine fish. Oecologia, 175(4), 1201-1210. doi:10.1007/s00442-014-2968-9

Obradovich, S., E. Carruthers, & Rose, G.A. (2014). Bottom-up limits to Newfoundland capelin (Mallotus villosus) rebuilding: the euphausiid hypothesis. ICES Journal of Marine Science, 71(4), 775-783. doi:10.1093/icesjms/fst184

Pepin, P., Robert, D., Bouchard, C., Dower, J.F., Falardeau, M., Fortier, L., Jenkins, G.P., Leclerc, V., Levesque, K., Llopiz, J.K., Meekan, M.G., Murphy, H.M., Ringuette, M., Sirois, P. & Sponaugle, S. (2014). Once upon a larva: Revisiting the relationship between feeding success and growth in fish larvae. ICES Journal of Marine Science (Editor's Choice paper). doi:10.1093/icesjms/fsu201

Robert, D., Murphy, H.M., Jenkins, G.P. & Fortier, L. (2014). Poor taxonomical knowledge of larval fish diet composition is impeding our ability to assess the existence of a 'critical period' driving year-class strength. ICES Journal of Marine Science, 71, 2042-2052. doi:10.1093/icesjms/fst198

Robert, D., Pepin, P., Dower, J. F., & Fortier, L. (2014). Individual growth history of larval Atlantic mackerel is reflected in daily condition indices. ICES Journal of Marine Science, 71(4), 1001-1009. doi:10.1093/icesjms/fst011

Wheeland, L. J. & Rose, G.A. (2015). Quantifying fish avoidance of small acoustic survey vessels in boreal lakes and reservoirs. Ecology of Freshwater Fish. 24(1), 67-76. doi:10.1111/ eff.12126.

Yandi, I., & Altinok, I. (2014). Defining the starvation potential and the influence on RNA/DNA ratios in horse mackerel (Trachurus mediterraneus) larvae. Helgoland Marine Research. doi:10.1007/s10152-014-0414-3.

Falardeau M., Robert D., Fortier L. (2014). Could the planktonic stages of polar cod and Pacific sand lance compete for food in the warming Beaufort Sea? ICES Journal of Marine Science 71: 1956-1965. doi:10.1093/icesjms/fst221

PRESENTATIONS (2014)

Clément, M (January 2014). New aquatic research program in Labrador. Torngat Wildlife Plants and Fisheries Secretariat, Happy Valley - Goose Bay, Labrador

Rowe, S. & Rogers, R. (January 2014). Life history and population ecology of 3Ps haddock - 2012 and 2013. Newfoundland and Labrador Regional Advisory Process on 3Ps and 3LNO Haddock, 3Ps Pollock, and 3Ps American Plaice Stock Assessment, St. John's, NL

Best, K., McKenzie, C. & Couturier, C. (February 2014). Early life stage biology of a new population of Green Crab Carcinus maenas in Placentia Bay and implications for mussel aquaculture in Newfoundland. Newfoundland Aquaculture Industry Association (NAIA) Conference, Gander, NL

Fisher, J.A.D. (February 2014). Habitat template approaches identify large-scale patterns of Northwest Atlantic fisheries productivity. ICES Working Group on the Northwest Atlantic Regional Sea, Falmouth, MA

Rose, G.A. & Fennell, S. (February 2014). Acoustic deep scattering layer spans the North Atlantic: "stovepipe" eddies, fronts and bio-transport. Ocean Sciences Meeting, Honolulu, HI

Carmanico, L., Rowe, S. & Brattey, J. (March 2014). Abundance and prevalence of two ascaridoid nematodes (Anisakis simplex and Pseudoterranova decipiens) in Atlantic cod (Gadus morhua) stocks surrounding Newfoundland. Ecology and evolution of marine parasites & diseases, Texel, The Netherlands

Clément, M., Pearce, J., Veinott, G., Broomfield, T., Bentzen, P. & Bradbury, I. (March 2014). Sustaining an Atlantic salmon fishery in Lake Melville. North West River Field Station, North West River, Labrador

Devine, B. (March 2014). Impacts of rising carbon dioxide on habitat associations of coral reef fishes. CFER Seminar Series, St. John's, NL

Fisher, J.A.D. (March 2014). Oceanographic influences on marine fish dynamics: insights from geographical range limits. Department of Fisheries and Oceans Science Seminar Series. St. John's, NL

Kamada, D. (March 2014). Response of zooplankton community of Lake Winnipeg to environmental changes. CFER Seminar Series, St. John's, NL

Konrad, C. (March 2014). Randomly walking amongst eagles, fishers and red deer. CFER Seminar Series, St. John's, NL

Neville, V. (March 2014). Insights into movement and structure of Newfoundland Atlantic Cod (Gadus morhua) groups through otolith geochemical analysis. CFER Seminar Series, St. John's, NL

Robert, D. (March 2014). Succès d'alimentation et survie larvaire chez le maquereau bleu: évidence d'une période critique dans la régulation du recrutement? Department of Fisheries and Oceans Science Seminar Series. Mont-Joli, QC. (Invited) Rogers, R., Rowe, S. & Morgan, J. (March 2014). Life history and abundance of 3Ps haddock. MUN Biology Graduate Student Symposium, St. John's, NL

Murphy, H. M., Archambault, D. & Miller, R. (April 2014). Some information about the Gulf of St. Lawrence Atlantic halibut (NAFO Divisions 4RST) and a summary of the tagrecapture database. Planning Workshop on the Design of a Comprehensive Tagging Program to Assist Management of the Gulf of St. Lawrence (4RST) Atlantic halibut Stock, Montreal, QC

Clément, M. (June 2014). Aquatic research in Labrador. Poster, Expo Labrador, Happy Valley – Goose Bay, NL

Cadigan, N., Lelièvre, S. & Fisher, J.A.D. (August 2014). Biomass and harvest rates for coastal Newfoundland and Labrador snow crab (Chionoecetes opilio) from 1990-2012. Poster, American Fisheries Society 144th Annual Meeting, Québec City, QC

Currie, C., Bourne, C. Pepin, P. & Robert, D. (August 2014). Spatial temporal variability in herring larvae diet off the coasts of Newfoundland. Poster, American Fisheries Society 144th Annual Meeting, Québec City, QC

Fisher, J.A.D. (August 2014). Downscaling a macroecological relationship involving marine fish predator-prey dynamics. American Fisheries Society 144th Annual Meeting, Québec City, QC

Govare, T., Pepin, P. & Robert, D. (August 2014). Contribution of unicellular eukaryotes to the diet of firstfeeding Capelin larvae. Poster, American Fisheries Society 144th Annual Meeting, Québec City, QC

Howse, V.J., Konrad, C. & Rowe, S. (August 2014). Indicators for success: Influence of MPAs on the growth rate of American lobster (Homarus americanus). American Fisheries Society 144th Annual Meeting, Québec City, QC

Kamada, D., Mowbray, F. & Robert, D. (August 2014). Feeding ecology of Capelin in the Northern Grand Banks. Poster, American Fisheries Society 144th Annual Meeting, Québec City, QC

Lelièvre, S., Fisher, J.A.D. & Cadigan, N. (August 2014). Do changes in the spatial distributions of the NL snow crab fleets affect CPUE estimates? American Fisheries Society 144th Annual Meeting, Québec City, QC

Murphy, H. M., Fisher, J.A.D., Castonguay, M. & Robert, D. (August 2014). Habitat preferences of Gulf of St. Lawrence Atlantic halibut revealed from pop-up satellite archival tags. American Fisheries Society 144th Annual Meeting, Québec City, QC

Murphy, H. M., Warren-Myers, F. W., Jenkins, G. P., Hamer, P. A. & Swearer, S.E. (August 2014). Variability in size-selective mortality obscures the importance of larval traits to recruitment success in a temperate marine fish. Larval Fish Conference, Quebec City, QC Pearce, J., Savoie, J., Clément, M., Veinott, G., Bradbury, I., Saint-Louis, R. & Broomfield, T. (August 2014). Atlantic salmon 2014. Labrador Institute Research Station, North West River

Rockwood, H. & Fisher, J.A.D. (August 2014). Southern Newfoundland waters under changing ocean conditions: dietary analysis of emerging and re-emerging gadoids within Northwest Atlantic Fisheries Organization (NAFO) Division 3Ps. American Fisheries Society 144th Annual Meeting, Québec City, QC

Rogers, R., Rowe, S. & Morgan, J. (August 2014). Life history and population ecology of haddock in southern Newfoundland waters. American Fisheries Society 144th Annual Meeting, Québec City, QC

Wheeland, L., & Rose, G.A. (August 2014). Hydroacoustic measurements of fish community size spectra in a boreal reservoir. Special session on Size-Based Models of Aquatic Ecosystems, American Fisheries Society 144th Annual Meeting, Québec City, QC

Currie, C. & Jones, D. (September 2014). Hormone profiles of captive Harp Seals (Phagophilus groenlandicus) in relation to puberty, reproduction and senescence. Poster, Association of Zoos and Aquariums/ International Marine Animal Training Association Annual Conference, Orlando, Florida.

Howse V.J. (September 2014). Sea Security: lobster protection. Influences of the Eastport Marine Protected Area on American Lobster. Petty Harbour Mini Aquarium and BGSA Graduate Lecture Series, St. John's, NL

Rose, G.A. (September 2014). The future fisheries of Newfoundland and Labrador. Future of our Fisheries Workshop, St. John's, NL

Best, K., McKenzie, C. & Couturier, C. (February 2014). Early life stage biology of a new population of Green Crab Carcinus maenas in Placentia Bay and implications for mussel aquaculture in Newfoundland. Invited seminar for the Advanced Diploma in Sustainable Aquaculture program, Marine Institute, St. John's, NL

Neville, V., Rowe, S. & Rose, G.A. (October 2014). Migrating Atlantic cod otoliths reflect movement through water masses: linking data storage tag data with high resolution trace element and isotope geochemical signatures. 5th International Otolith Symposium, Mallorca, Spain

Rockwood, H., & Fisher, J.A.D. (October 2014). Comparative diets among gadoids in NAFO subdivision 3Ps. Canadian Science Advisory Secretariat Regional Advisory Process (RAP) for Cod and Witch Flounder in NAFO Subdivision 3Ps, St. John's, NL

Cadigan, N. (November 2014). An integrated state-space stock assessment model for northern cod and short-term prospects for the fishery. CFER Seminar Series, St. John's, NL

Cadigan, N. (November 2014). Modelling the uncertain stock dynamics and noisy catch and survey data for northern cod, with emphasis on short-term projections for catch advice. Johan Hjort Symposium on Recruitment Dynamics and Stock Variability, Bergen, Norway

Clément, M. (November 2014). Atlantic salmon research in Lake Melville: Summary of field season 2014. Labrador Hunting and Fishing Association, Happy Valley - Goose Bay, Labrador

Fisher, J.A.D., Tubrett, V. and G. Thorbjornsson (November 2014). Fishery dependent flatfish landings data: spatial distributions, environmental influences and bycatch avoidance. Ninth International Flatfish Symposium. Cle Elum, WA

Robert, D., Murphy, H.M., Fisher, J.A.D., Castonguay, M. & Loher, T. (November 2014). Distribution and habitat preferences of adult Atlantic halibut (Hippoglossus hippoglossus) in the northern Gulf of St. Lawrence. Ninth International Flatfish Symposium. Cle Elum, WA

Robert, D., Pepin, P., Bouchard, C., Dower, J.F., Falardeau, M., Fortier, L., Jenkins, G.P., Levesque, K., Llopiz, J.K., Meekan, M.G., Murphy, H.M., Ringuette, M., Sirois, P. & Sponaugle, S. (November 2014). A multi-species analysis of variability in the link between feeding success and growth during the larval stage of fish: implications for the existence of a critical period. Johan Hjort Symposium on Recruitment Dynamics and Stock Variability, Bergen, Norway

Rowe, S. (November 2014). Consequences of behaviour and life history for stock productivity and sustainable fisheries. Fish, Food, and Allied Workers (FFAW) Union Lunch and Learn Seminar Series, St. John's, NL

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