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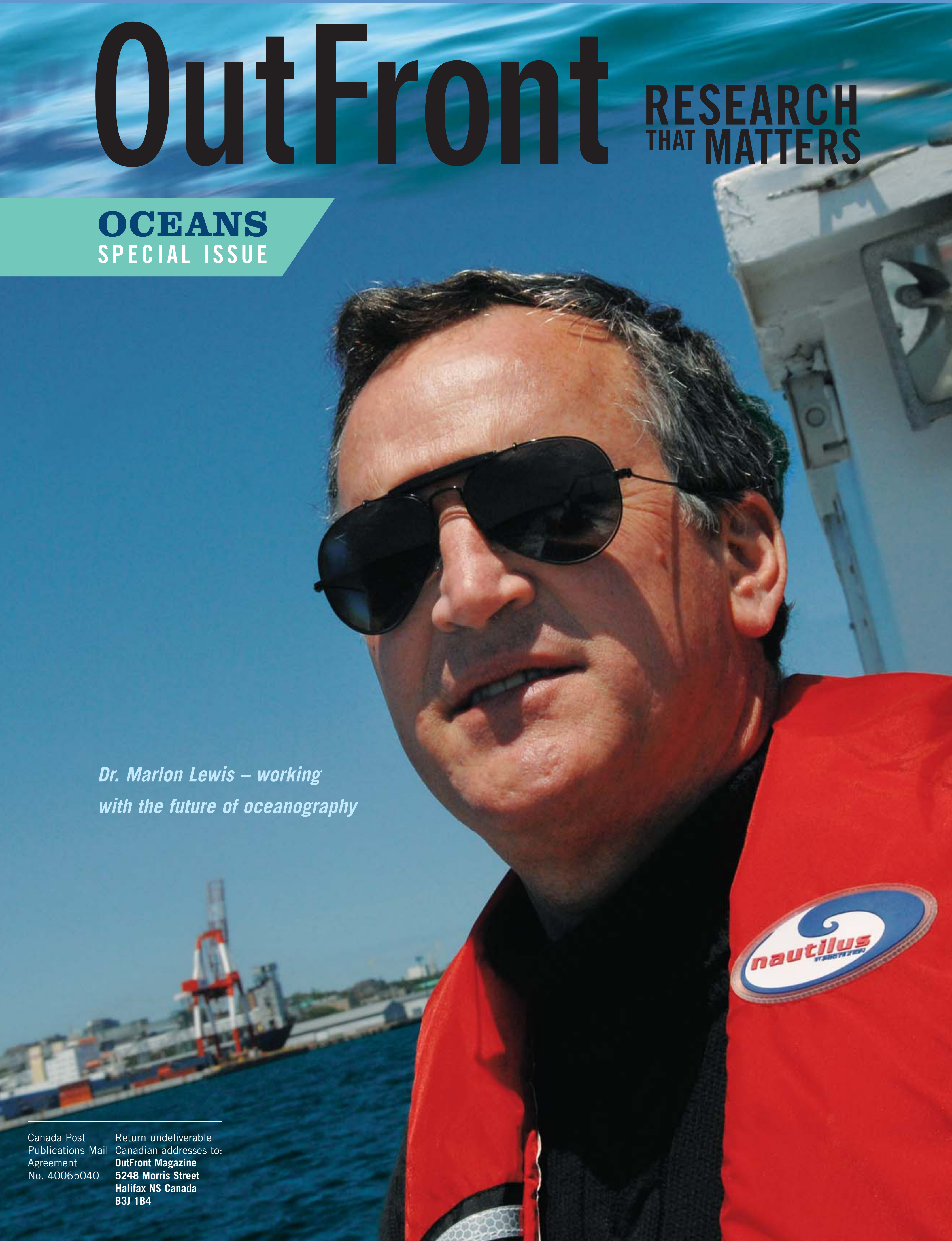
OutFront

RESEARCH THAT MATTERS

OCEANS
SPECIAL ISSUE



Dr. Marlon Lewis – working with the future of oceanography

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DALHOUSIE UNIVERSITY RESEARCH PROJECTS: KEY FUNDING RESOURCES

While Dalhousie University receives research funding from more than 500 agencies and private sector companies, it is also the recipient of substantial support from the public sector. Below are some of the key government groups that have provided funding:

AIF – ATLANTIC INNOVATION FUND, managed by the Atlantic Canada Opportunities Agency, is designed to strengthen Atlantic Canada's economy by accelerating the development of a knowledge-based industry. www.acoa.ca/e/financial/aif/

NSERC – NATURAL SCIENCES AND ENGINEERING RESEARCH COUNCIL OF CANADA makes strategic investments in Canada's capability in science and technology. www.nserc-crsng.gc.ca

SSHRC – SOCIAL SCIENCES AND HUMANITIES RESEARCH COUNCIL OF CANADA promotes and supports university-based research and training in the social sciences and humanities. www.sshrc-crsh.gc.ca

CIHR – CANADIAN INSTITUTE OF HEALTH RESEARCH funds more than 8,500 researchers in universities, teaching hospitals and research institutes across Canada. www.cihr-irsc.gc.ca

CFI – CANADA FOUNDATION FOR INNOVATION provides 40 per cent of infrastructure costs for quality research projects; research institutions must then secure the remaining funds from other government sources and the private sector. www.innovation.ca

NSRIT – NOVA SCOTIA RESEARCH AND INNOVATION TRUST helps the province's researchers pursue projects with social and economic benefits in virtually any sector. The fund helps Nova Scotia's research institutions to secure grants from the Canada Foundation for Innovation. www.gov.ns.ca/econ/

CRC – CANADA RESEARCH CHAIRS invests $300 million a year to attract and retain some of the world's most accomplished and promising minds, in an effort to make Canada one of the world's top five countries for research and development. www.chairs.gc.ca

NSHRF – NOVA SCOTIA HEALTH RESEARCH FOUNDATION works with the health research community and other stakeholders to invest the province's health research resources in a manner that will best serve to improve the health of Nova Scotians. www.nshrf.ca

CFCAS – CANADIAN FOUNDATION FOR CLIMATE AND ATMOSPHERIC SCIENCES provides focused support for excellent University-based research on weather and climate. www.cfcas.org

OUR OCEAN STORIES

Oceans research is central to Dalhousie University, to Halifax, to Nova Scotia, to Canada and to the world. Oceans cover 70 per cent of the Earth's surface. Their waters and resources know no international borders. Canada is surrounded by three of them. And the scientific impact of Dalhousie's research publications in Marine Biology and Oceanography ranks 3rd and 4th in the world after international institutions with many more scientists. To say we punch above our weight is an understatement. Our work makes Canada one of the global leaders in oceans research.

As you will see from these stories, oceans are crucial to human nutrition, energy, defence, transport, climate change prediction and risk assessment. It is imperative that their biodiversity and physical characteristics be understood and, through understanding, be sustained.

Dalhousie scientists, with federal laboratory scientists in Halifax and their national and international colleagues, are providing the world with remarkable, cutting-edge information on oceans not only as they relate to animal and plant life but also to the people whose lives, coastal environments, economic and social well-being depend on them. Dalhousie's law professors have been key contributors to crafting critical international regulatory frameworks including the law of the sea.

By partnering with local industries and multinational companies, our scientists' and scholars' discoveries can produce sunrise economic opportunities for Canadians within a framework of sound sustainable environmental policy and practice.

I hope you enjoy discovering the outstanding work of our ocean and marine researchers as much as I have during my first year at Dalhousie.

Martha Crago

Martha Crago, PhD
Vice-President, Research
Dalhousie University

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A DIVERSE MAKEUP

Marine invertebrates that live on the ocean bottom are organisms that have complex life cycles. They spend their adult life moving, at best, only very small distances. Many reproduce by releasing sperm and eggs into the water where fertilization occurs and embryos are produced. As the microscopic larvae develop, they get carried by currents and eventually (if they don't starve, get eaten, or transported away from suitable areas) return to the ocean bottom and attach themselves in the parental habitat.

A bit of a biology lesson, but one with great importance, especially when considering the overall health of the world's oceans. Biodiversity is important to the ocean's overall balance. Because the marine environment and its components are interconnected, loss of a species can have far-reaching and long-lasting impacts.

Dalhousie's Dr. Anna Metaxas is one of about 65 researchers (Dalhousie has 10 in all) from 15 universities who makeup the Canadian Healthy Ocean Network (CHONe). The network addresses a pressing need for scientific data to ensure proper conservation and the sustainable use of Canada's ocean resources.

Metaxas leads the "Population Connectivity" theme which examines the role of dispersal of early life stages in diversity patterns and in population resilience to disturbances. She is specifically considering the role of larval dispersal in maintaining existing populations of marine invertebrates and repopulating extirpated ones.

"We are removing species at a far faster rate than natural selection would. We have a role to protect marine species, not drive them to extinction."

"We are removing species at a far faster rate than natural selection would. We have a role to protect marine species, not drive them to extinction," says Metaxas, who also earned her PhD from Dalhousie's Biology Department. "In order to protect them, we must first understand how these organisms maintain their populations."

For example, marine protected areas may prove ineffective if the life cycle complexity of the invertebrate species is not taken into consideration. "You might close a certain area to fishing, but in fact it may not be an area that serves as a source of recruits."

Studying invertebrate dispersal and connectivity will provide baseline information against which future changes in the oceans can be monitored and understood. This is critical to the sustainable management of the country's ocean biodiversity resources. ■

Dr. Anna Metaxas

Abriel Photo

PREPARING FOR OPEN WATER

Abriel Photo

Dr. David VanderZwaag

The ice in the Arctic is melting. Climate change is taking its toll. That's without dispute. However, as the icecap shrinks and open water becomes more prevalent, a very debatable issue evolves. How do we deal with the access it affords – to new marine species, to shorter shipping routes, to oil exploration, to scientific research?

The Northwest Passage promises to be a marine highway for transporting valuable cargo such as minerals to world ports. A navigable route through the Arctic Ocean could serve as a shortcut for ships travelling from Europe to Asia.

Dr. David VanderZwaag, Dalhousie's Canada Research Chair in Ocean Law and Governance, has been studying the law of the sea for many years and advising policy-makers internationally for the past decade. He thinks the inevitable change in Arctic waters provides an opportunity to "get governance right."

"One of the greatest looming challenges surrounds the future management of high seas in the Arctic beyond national jurisdiction," muses VanderZwaag. "Do countries wish to eventually commercialize the doughnut hole or to protect it in a largely pristine state?"

"If the intent is to establish the central Arctic Ocean as a marine protected area (MPA), various avenues might be followed including negotiation of a new multilateral agreement for the Arctic or establishment of a new global framework agreement for establishing MPAs on the high seas," adds VanderZwaag.

Co-leading a group of over 12 researchers, VanderZwaag has helped chart a course for future shipping regulation in the Arctic. The Governance of Arctic Marine Shipping Report, prepared at the request of the Arctic Council as part of the 2009 Arctic Marine Shipping Assessment, suggests numerous ways forward.

"One of the greatest looming challenges surrounds the future management of high seas in the Arctic beyond national jurisdiction."

But getting a firm grip on the future of Arctic governance is not easy. VanderZwaag notes the present hesitancy of Arctic states to further legalize transboundary arrangements. He expects future regional cooperation to develop slowly and incrementally. "New cross-border experiments in ecosystem-based management seem likely next steps for areas like the Beaufort and Barents Seas."

His recent co-authored national report for Canada on ecosystem-based management in the Arctic, published by the Norwegian Polar Institute, shines new light on the limited nature of existing bilateral and regional agreements. "Canada has to move from a security fixation towards a leadership vision ensuring vibrant northern communities and healthy ecosystems. Canada is still tinkering with addressing climate change while the Arctic marine environment totters!"

PREDICTING THE FUTURE

Phytoplankton is minute, too small to be seen by the naked eye. Even so, it is a vastly important ocean plant – the primary food source, directly or indirectly, of all sea organisms. Being at the bottom of the ocean's food chain makes it integral to supporting the ocean's delicate ecosystem. And, like land vegetation, phytoplankton takes in carbon dioxide and releases oxygen. It also converts minerals to a form that animals can use.

Too small and too weak to swim effectively against a current, these microscopic floating plants drift effortlessly with the ocean current. If ocean currents shift, so do the location and the availability of the phytoplankton. If once-plentiful phytoplankton becomes scarce in an area, it could have a disastrous effect on marine life and the ocean's ecological system.

One of Dalhousie's newest scientists, Dr. Katja Fennel, studies and makes predictions about the locale of phytoplankton through detailed ocean modelling. She uses her knowledge as an oceanographer to develop accurate models, but it's her first love – mathematics – that makes her work so useful and meaningful.

"There is a real sense of urgency over the last 10 years to try to understand the implication of global change on the oceans."

"Math is so important to addressing problems in oceanography," explains Fennel. "I create realistic computer models by using a mathematical equation written in numerical code. By solving the equation, it allows me to observe the oceans in many different ways." When applying her models to practical problems, predictions can be made about the future of phytoplankton in response to such things as greenhouse gases, ocean warming, changing circulation patterns as the Arctic continues to melt and change in salinity levels.

"It's impossible to physically manipulate the ocean," says Fennel, "but we can simulate changes through computer modelling, meaning that we can answer a lot of 'what if' questions." And the answers to these "what if" questions could help direct public policy in such areas as fisheries management, environment and ecosystem management and marine protection.

As a Canada Research Chair in Marine Prediction, Fennel's primary area of focus is along the Scotian shelf. She studies the waters from the Labrador Sea to the Gulf of Maine, an area where there is now an abundance of phytoplankton yet great potential for an oceanic shift due to changing coastal currents and an increased mixing of cold and fresh water.

"There is a real sense of urgency over the last 10 years to try to understand the implication of global change on the oceans," says Fennel. "The oceans are one of our greatest resources for food, transportation and recreation. It only makes sense that we should be concerned about protecting them."

Abriel Photo

Dr. Katja Fennel

CHASING CORAL EGGS

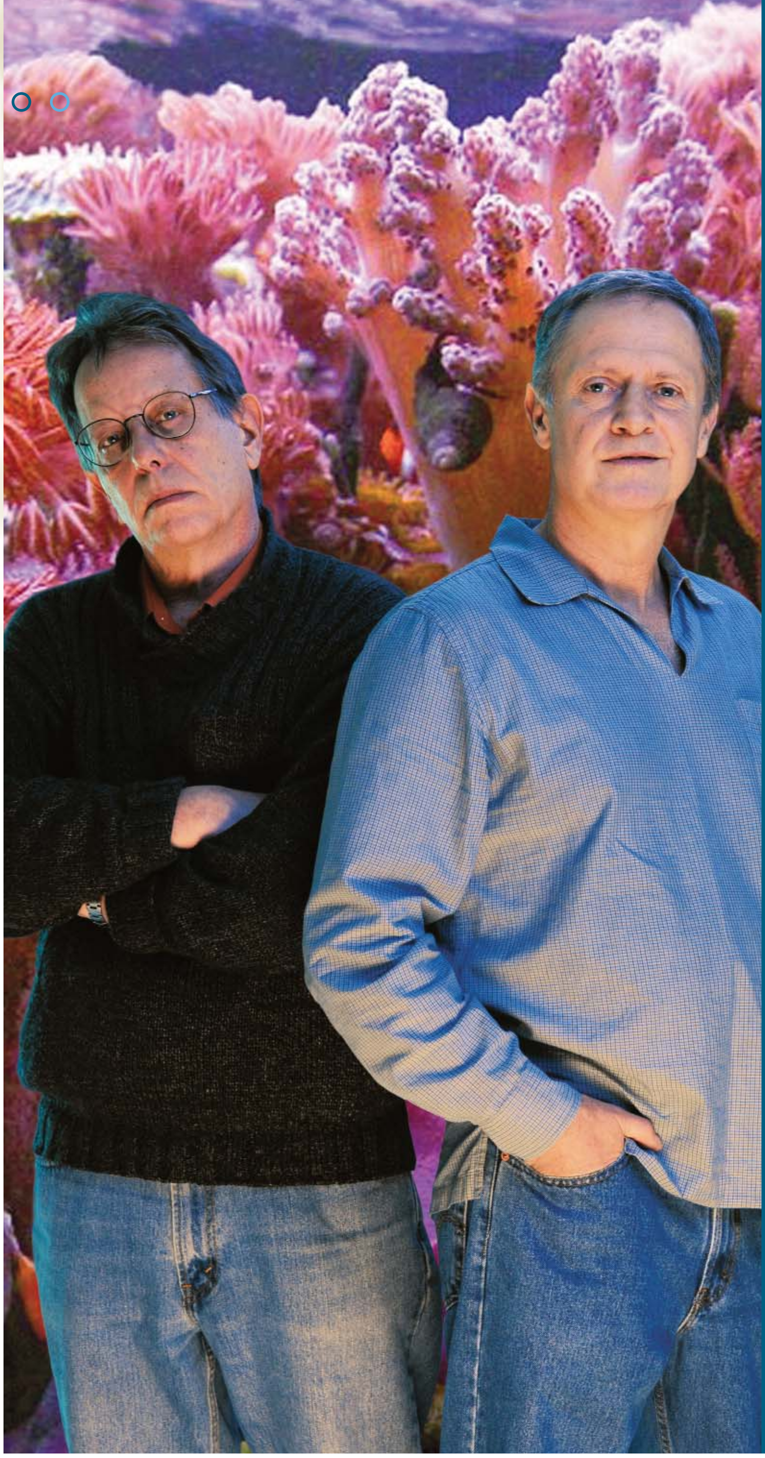
Dying coral was the initial impetus for Drs. Christopher Taggart and Barry Ruddick's research. To find out whether it could be "reestablished" was contingent first upon understanding how far coral eggs and larvae could be dispersed.

They developed the technique whereby tiny particles that mimic coral eggs and larvae were set free in the ocean. Magnetic collectors were placed within a 100-kilometre radius to attract the floating particles, made up of silica-glass and magnetite.

"It is a remarkably simple, inexpensive solution to a very important problem," says Ruddick.

The scientists simply count the number of particles caught to determine dispersion patterns. Their method has proven effective even in rough ocean conditions. "We tested it off the Florida coast, in the midst of hurricane season," Ruddick explains. "The collectors performed as expected and didn't suffer from the bad weather. It's the simplicity of the technique that makes it so robust."

Their findings showed that coral eggs and larvae can travel fair distances – at least 10 kilometres – which holds great promise for rebuilding the coral population. "Coral is particularly interesting because it is both an animal and a plant. It's made up of two different organisms that need each other to live," explains Taggart. "When the ocean temperature rises, it can bleach the coral, meaning the plant part is expelled from the animal part. Now that we have shown that the coral eggs can disperse, it will be up to the coral reef ecologists to determine if the larvae can effectively recolonize a new population."

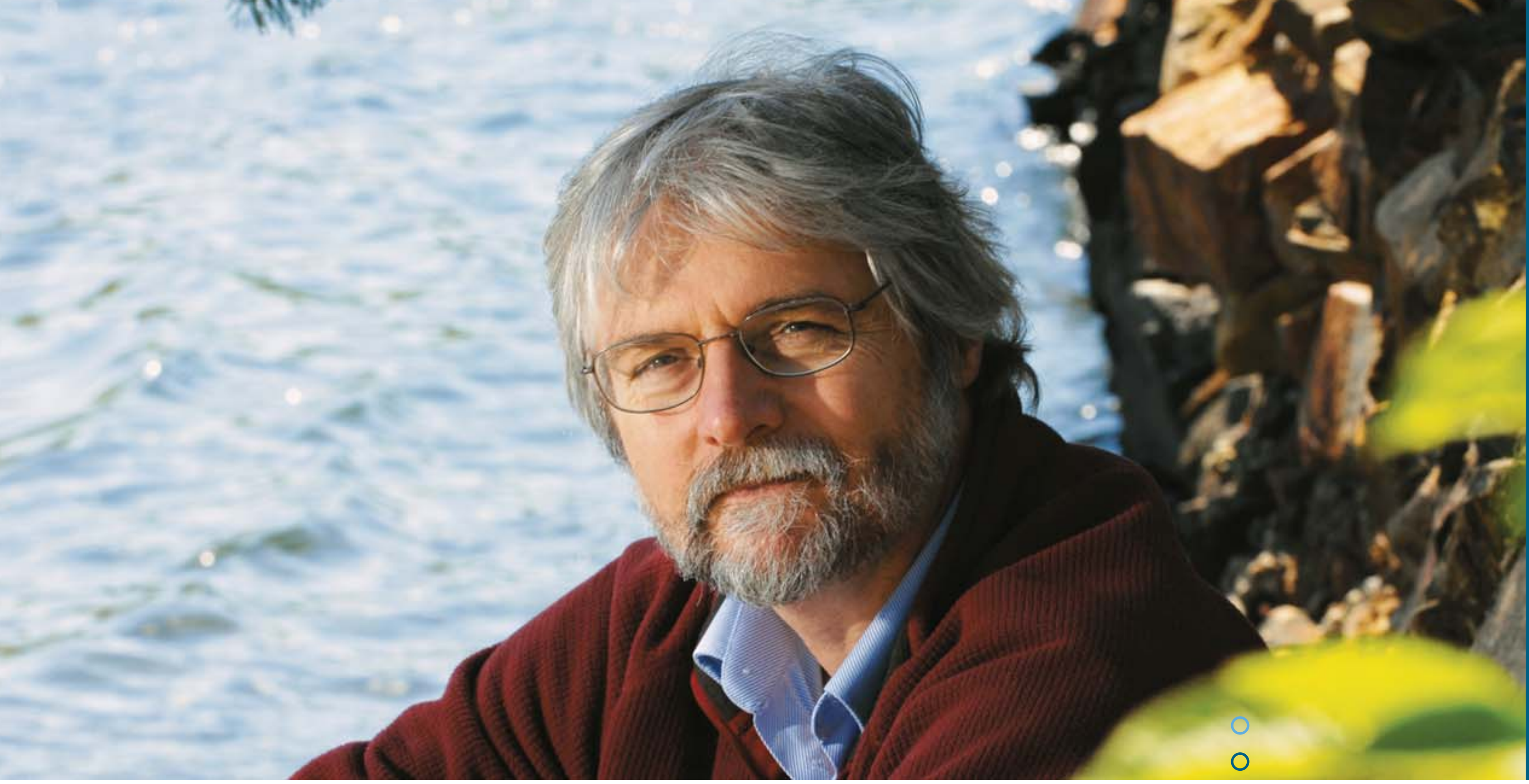


Abriel Photo

"The collectors performed as expected and didn't suffer from the bad weather. It's the simplicity of the technique that makes it so robust."

While this will be instrumental in answering the coral "connectivity" question, the application is broad. It can help figure out the 'how far' questions about the potential impact of invasive species, or where the residual heavy metals from oil drilling end up.

"It's a pragmatic method with many applications," says Ruddick. "As long as we can shape the particle to mimic what is being studied, we can pretty much study the dispersion ability of anything in water." ■



Abriel Photo

Dr. Keith Thompson

STORMY FORECASTS

Storm surge can be the most devastating part of a hurricane. Just ask residents of New Orleans who on August 29, 2005, witnessed 80 per cent of their city become submerged because of 53 different levee breaches caused by Hurricane Katrina. The storm surge also devastated the coasts of Mississippi and Alabama, making Katrina the most destructive and costly natural disaster in the history of the United States, and the deadliest hurricane since 1928.

Defined, storm surge is the difference between the observed water level and the predicted level of the astronomical tides. Dr. Keith Thompson's interest revolves around understanding the dynamics that control storm surges and currents along the eastern seaboard of Atlantic Canada. Developing mathematical models that predict surge and where the flooding will occur is an important part of his research as Dalhousie's Canada Research Chair in Marine Prediction and Environmental Statistics.

"This is the practical side of my research. My team works closely with Environment Canada, National Defence and the Department of Fisheries and Oceans on issuing warnings about floods or ocean storms that may affect sea travel or search and rescue operations," says Thompson.

His longer-term goal is to "bridge the gap" between weather forecasting and ocean forecasting, since they are intricately linked.

"If we could sharpen our prediction models so as to accurately forecast [ocean weather] 10 or 15 days out, we would be much further ahead in preventing lost lives and mitigating destruction."

"The ocean has a major impact on atmospheric weather. Right now, we can make reliable ocean predictions two days out, but if we could sharpen our prediction models so as to accurately forecast 10 or 15 days out, we would be much further ahead in preventing lost lives and mitigating destruction," Thompson explains.

And there is indication that this gap could bridged in the not-too-distant future. With more quality data available from satellites, Argo floats and enhanced statistical techniques, it will be easier to make accurate, longer-term predictions.

"This is an exciting time for oceanographers. The data streams are more robust than ever before. There is great potential for developing models that predict further and more accurately."

GENETICALLY SPEAKING

Dr. Daniel Ruzzante's research focus is one of fish conservation, not just in pure numbers but diversity preservation. Commercial exploitation poses a threat to biodiversity, not by purposeful overfishing but because of a lack of understanding of genetic diversity patterns.

Ruzzante, Dalhousie's Canada Research Chair in Marine Conservation Genetics, is using DNA to investigate the current and past patterns of changing fish populations. By combining the molecular information with ecological and oceanographic information, one can begin to understand what factors influence the distribution of genetic diversity in space and time and what roles are played by the environment, by neutral evolutionary processes and the demography and life history characteristics of the species under study.

"We look at environmental influences such as currents, salinity and temperature versus random neutral genetic processes where the population simply evolves over time without the influence of natural selection," says Ruzzante. "By studying the diversity patterns, and what factors affect these patterns, we can better understand the dynamics of fish populations."

When dealing with commercialized migratory marine species, an accurate estimation of the catch's genetic composition can lead to prevention of overexploitation of less productive population components. This also means that conservation strategies can be adapted for a specific area, making it more effective than the "one size fits all" model.

"Once we have a clearer understanding of the spatial structure and patterns of connectivity in commercially exploited species and of how these patterns might change over time as a response to environmental changes (for instance climate change), then we can better predict, and thus control the impact of human activity on these patterns," explains Ruzzante.

"By studying the diversity patterns, and what factors affect these patterns, we can better understand the dynamics of fish populations."

Abriel Photo

In his efforts to identify the extent of species connectivity, Ruzzante collaborates with researchers from Europe and South America as well as with the private sector, and supervises the work of many students.

"We are laying the groundwork for a sophisticated type of conservation management that doesn't treat an area as one with a homogenous population," he says. "This is an important step in protecting the biodiversity of the fish populations worldwide."

ADAPTING TO CHANGE

Each year, Dalhousie's Dr. Sara Iverson packs her duffle bags and heads to the field – perhaps to Sable Island to study the increasing North Atlantic grey seal population, or to the Pribilof Islands in the Bering Sea to study the declining northern fur seal population.

Iverson studies how marine mammals, polar bears and seabirds adapt to changing environments. Because they are long-living and wide-ranging, all of these top predators can tell us much about marine ecosystem features that are otherwise difficult to study. Newly developed tools, such as tracking technology and biochemical tracers, have allowed Iverson and her colleagues to better understand animal populations as well as diverse ecosystem processes.

"Tracking studies of grey seals have shown that adult males and females feed in different places in the ocean and on different prey, and that this reflects differences in body size (males are twice the size of females), reproductive strategies and changing prey availability," says Iverson.

Across the Arctic, her research shows a complex relationship between sea ice conditions, prey (seal) population dynamics and polar bear diets. In the Bering Sea, studies of the declining northern fur seal population (now listed as 'threatened') have shown that food variability for lactating females has large consequences for the growth and survival rates of their pups.

"We can get invaluable information relevant to understanding changes in marine ecosystems at both regional and continental scales."

"Female seals give birth on land or ice, but feed at sea away from their pup, so acquiring enough food to support milk production is critical to the pup's survival," says Iverson.

Diet is an important way to study animals, ecosystems and adaptations to changing environments. Iverson has developed a scientific model – Quantitative Fatty Acid Signature Analysis (QFASA) – that enables her to determine exactly what a marine mammal has eaten in the ocean or on sea ice, just by analyzing a minuscule amount of the animal's stored fat and that of its potential prey.

"This is a humane and extremely informative way to examine diet, avoiding traditional practices that require killing an animal to study the contents of its stomach," says Iverson, who has been conducting field studies on marine mammals for 25 years. Other scientists involved in similar research have adopted her QFASA model.

Long-term changes in climate and ecosystems are occurring. Perhaps nowhere is this more apparent than in the Arctic and sub-Arctic ecosystems. "With the tools we have developed and our long-term studies of top predator populations and their habitats, in combination with data on other environmental variables, we can get invaluable information relevant to understanding changes in marine ecosystems at both regional and continental scales."

Contributed

Dr. Sara Iverson

ON OCEAN PATROL

We all have our own personal built-in risk analysis system. Using data we've collected over time and experiences from the past, we intuitively assess the scenarios that could happen and their likelihood. Then we make our decisions based on our risk tolerance. Sometimes we do this without even knowing it, but it's the thought process used whether we're ordering dinner, choosing a university or setting up a mortgage.

In 1996, the Canadian Coast Guard in Nova Scotia wanted to establish a similar risk analysis system so it could make better strategic plans for search-and-rescue decisions on the water. The goal was to capture a comprehensive set of data that included marine activity, the number of incidents (i.e. fires, sinkings, collisions) among this traffic and the incident outcomes.

Quite surprisingly, this type of comprehensive traffic modeling on the water was ahead of its time. "Aside from related projects by militaries around the world, no one else in general marine management was doing this type of data collection and analysis 10 years ago," says Dr. Ron Pelot, a professional engineer from Dalhousie who created this system. "The Coast Guard was definitely in front of the curve with its thinking. Of course, that has changed since September 11th and now this type of increased attention to marine traffic has become a trend."

The team created software called MARIS (Marine Activity and Risk Investigation System) which could be put on every Coast Guard manager's desk, allowing them to view traffic levels at various locations, accident rates based on vessel type and time of year, and other data. "MARIS helps the Coast Guard translate information into the best decisions – decisions that can mean the difference between life and death."

With MARIS, the Coast Guard can pick any grid on the water and quickly determine the expected travel time for the nearest rescue ship to get there.

"Now they had the ability to consider whether their response rate would be better if they stationed an additional search and rescue crew in St. John's or Halifax, for example," says Pelot. "MARIS is a GIS program, but it's one we developed on our own so it would be affordable enough to be of practical use."

Abriel Photo

While still very involved in marine activity information, Pelot has taken on a new risk management challenge. He serves as the Director, RBC Centre for Risk Management in the Faculty of Management, mandated to coordinate risk analysis at the university. "Risk management is very much in vogue around the world today and for good reason. I think that it will be a trend well into the future."

"MARIS helps the Coast Guard translate information into the best decisions – decisions that can mean the difference between life and death."

Abriel Photo

Dr. Heike Lotze

"When you evoke changes to the bottom of the food chain, it's felt at every level of the food web and so far we don't know much about the wider consequences."

HEEDING OUR PAST

A pattern of overuse followed by a concerted effort to recover depleted populations was what Dr. Heike Lotze found when studying the human effect on marine mammals, fish, birds, plants and invertebrates over the past centuries.

"The drastic impact came with European colonization and market expansion, especially in the 19th century," says Lotze, Dalhousie's Canada Research Chair in Marine Renewable Resources. "The fisheries, fur and feather trades were commercialized and mammals such as porpoises and whales were used for fuel, food and fashion. Birds were valued for their feathers, meat and eggs. The result was a drastic reduction in populations and in some cases extinction."

With the introduction of protection acts, the first for migratory birds in 1918, followed by concerted efforts to protect the great whales and other marine mammals, many species have come back. But the same hasn't yet happened for many fish and invertebrates. "We are just beginning to close some areas for fishing to allow fish stocks to recover. For lobster, 100 years ago, eight-pound lobsters would be pulled from traps. Today, these large lobsters are protected by size limits in the fishery to allow the population to rebuild."

It's not just hunting or fishing that threaten species – human sewage, polluted discharges and habitat loss severely affect sea life. Even the ocean plants have changed. Increases in toxic algal blooms and invasive species are widespread. "When you evoke changes to the bottom of the food chain, it's felt at every level of the food web and so far we don't know much about the wider consequences."

What disturbs Lotze is that we haven't learned enough from our mistakes. We know that many species can't sustain heavy exploitation yet we barely reduce fishing pressure. Also, when one species is depleted, we just move on to new target species, repeating our mistakes.

She cites a current example: "Sea urchins and sea cucumbers are emerging fisheries, sought after by Asian markets. We know that in other parts of the world commercial fisheries of these species have collapsed after only five to 10 years yet we are not establishing checkpoints to prevent the same from happening here."

Lotze knows that humans have had a significant impact on the world's oceans. But she also knows that our past presents very powerful lessons. "If we take heed, we can recover and maintain these important ecosystems so that our oceans remain productive and diverse for the future."

BREAKING NEW GROUND IN OCEAN DATA COLLECTION

No matter where you are, the evening news has a pretty standard format. Breaking stories first, human interest next, a bit of sports and then the weather report. In the future, Dr. John Cullen, Dalhousie's Killam Chair in Ocean Studies, expects an ocean forecast will be added to that mix – one that, through computer animation, provides real-time tracking of storm surges, strong currents and blooms of plant life in the sea.

Like the weather report, an ocean forecast would be based on predictions of computer models. In order to accurately predict, you must first have reliable, comprehensive data from which to anticipate the future. To further complicate the process, the data would have to contain measurements from the ocean's entire ecosystem – biological, physical and chemical. All three are interrelated within the marine environment.

To date, collection of these measurements has been only intermittent, proving time consuming and expensive. This is because the traditional methods developed over the last 80 years involved people going out and physically taking measurements. Cullen and his team are developing an innovative system for measuring that will revolutionize the data-collection process.

They have established an automated Marine Environmental Prediction System. They hope to enhance the system with robotic sensors that stay in the ocean for months and "talk to us" upon request.

"We have systems that can measure all day and night over an extended period of time, allowing us to have reliable and relevant data," says Cullen.

This has hugely positive implications for safer navigation. Warnings of storm surges and harmful algal booms (red tides) could mitigate the impact on coastal communities and aquaculture farms. Climate change, currents, sea level, water temperature and sea life become much easier to study and interpret.

Cullen says the ocean has been pretty much invisible to us, but that is changing. "We have the technology to describe, as never before, the changes in the physical, ecological and biogeochemical state of the ocean that must be understood to develop local, regional and global strategies for environmental protection."

"Warnings of storm surges and harmful algal booms (red tides) could mitigate the impact on coastal communities and aquaculture farms."

Dr. John Cullen

Abriel Photo

Abriel Photo

Dr. Marlon Lewis

"If we want to predict the effect of climate change and other impacts on the ocean, we need good, skillful oceanographic modelling."

THE SCARLET KNIGHT

What Dr. Marlon Lewis calls "the future of oceanography" has set sail or, to be precise, is aglide in the Atlantic Ocean. A submersible RU27 glider, nicknamed The Scartlet Knight, was launched from New Jersey with an intended destination of Spain, in the first transoceanic voyage for the unstaffed vehicle. The robot glider will send researchers valuable data about ocean temperature, salinity and density via satellite while en route.

"You see much more detail than you would ever see from a ship," explains Lewis, professor of oceanography at Dalhousie and founder of Satlantic Incorporated. "They can take measurements with higher resolution and can travel in far worse conditions."

Satlantic makes a wide range of ocean sensors for the robot gliders, which are powered by lithium batteries and maneuvered by radio messages sent from student researchers. The glider takes a profile of water conditions which is emailed to recipients every six to eight hours.

The Scarlet Knight was launched by a team of Lewis' colleagues at Rutgers University, world leaders in working with these devices. Last year, they launched a similar glider from New Jersey to Nova Scotia. It travelled 2,600 miles and measured more than 2,150 vertical oceanographic profiles before calling in for a pickup just outside Halifax Harbour.

Dalhousie plans to purchase several of the new gliders which will be deployed on a variety of missions on the shelf waters of Nova Scotia. The glider "patrols" will make key observations to support ocean predictions in association with the new Ocean Tracking Network.

"We're not great at ocean forecasting primarily because the ocean is so poorly observed," Lewis says. "But if we want to predict the effect of climate change and other impacts on the ocean, we need good, skillful oceanographic modelling. And that can only come with good data."

Abriel Photo

Dr. Moira McConnell

A SEA OF AMBIGUITY

If a ship is owned by a Canadian, registered in Panama, captained by a Norwegian, crewed by seafarers from many other countries and sailing from port to port, which nation's laws and practices govern? It reads like a modern-day riddle but with an international industry like shipping, this is a common situation.

Dalhousie's Dr. Moira McConnell is interested in developing effective international standards, particularly in the maritime sector. Her current research is in achieving "decent work" for seafarers, the more vulnerable of the world's workers.

"When ships operate transnationally, there are many complex issues and it can be unclear which workplace standards apply," says McConnell. "The issue is broad, from social security to work hours to something as simple as the provision of drinking water. Without international standards that are effectively implemented and enforced by the responsible state, there is risk of exploitation and poverty."

"The issue is broad, from social security to work hours to something as simple as the provision of drinking water."

As a special advisor to the International Labour Organization, McConnell has helped draft a comprehensive international agreement merging 70 international legal instruments, some dating as far back as 1920, on this issue.

McConnell's concern for international gaps isn't just with the ocean as a workplace; she is also very interested in environmental protection and related human health and economic impacts.

"A big threat to our oceans is the discharge of ships' ballast water that contains an invasive species that survives," she says. "This could have significant economic, environmental and human health impacts. It's not like an oil spill, which can be cleaned up; there is no remedial action for an invasive species."

But how do you regulate this? Is it pollution? Does it fall under environmental or shipping law, or both? McConnell has worked with lawyers from six countries – China, Brazil, South Africa, Iran, Ukraine and India – to research and recommend "best regulatory practices."

Through research, McConnell and her colleagues are working to help countries achieve sustainable economic development by establishing clear, enforceable, legal approaches to protect humans and the environment – and not a moment too soon.

Abriel Photo

REVERSING A DEPLETING TREND

Dr. Boris Worm

In 2006, Dalhousie's Dr. Boris Worm and several research colleagues published a study in *Science* that showed that the world's oceans could be virtually depleted of seafood by 2050, if current trends of biodiversity loss continue.

The study also showed that the ocean's ability to produce seafood, resist diseases, filter pollutants and rebound from stresses such as overfishing and climate change is being dramatically reduced, due in part to the depletion of multiple species.

"We saw this same picture emerging throughout the world's oceans. In losing whole species, entire ecosystems are at risk."

"We saw this same picture emerging throughout the world's oceans. In losing whole species, entire ecosystems are at risk," says Worm. "I was amazed at how consistent these trends are – beyond anything that was suspected."

But not everyone agreed with the research results. Dr. Ray Hilborn from the University of Washington felt that the data used was incomplete, and that some well-managed species were rebounding. Working through their difference of opinions, Worm and Hilborn teamed up in 2007 with 19 other researchers to develop more comprehensive data bases that include detailed information from fish stock assessments and surveys. This information has helped them better assess the statistics and trends in world fisheries and ecosystems.

Their new study 'Rebuilding Global Fisheries', which appeared in *Science* this summer, shows that it's not too late to repair the ocean's biodiversity, if a diversity of management tools, including as gear restrictions, closed areas, and controls on fishing capacity, are implemented together. Says Worm: "We know what measures are needed to end the overfishing crisis. We have some good regional examples that work. Now we need to implement them much more broadly – and do it soon."

“When policy is established based on political clout or interest group pressures, it’s not necessarily the right one and most often there is no accountability attached.”

UNPREDICTABLE DECISIONS

The world’s oceans are of vital importance to our very existence. Therefore, decision-making about their use and protection is a tremendous responsibility, one that should be supported by social, economical and research perspectives. But that is not usually the case.

This perplexes Dr. Lucia Fanning, director of Dalhousie’s Marine Affairs Program, whose research focuses on improving predictability in marine policy decision-making. She has found that some decisions have been made, not because they were guided by good information, but because of extenuating circumstances that influenced the decision-making process. She calls this the “twister factor” because of its unpredictable nature and this, she believes, is a dangerous way to conduct business.

“When policy is established based on political clout or interest group pressures, it’s not necessarily the right one and most often there is no accountability attached,” says Fanning. “Often this means that there is an incredible waste of objective scientifically defensible data that never got interpreted into useable knowledge that could more effectively drive the decision-making process.”

The extension of the Georges Bank (between Cape Cod and Nova Scotia, with both U.S. and Canadian control) moratorium to 2012 demonstrates her point. To protect the fishery, the federal government and Nova Scotia declared a moratorium on drilling for oil and gas on the Canadian portion of Georges Bank from 1988 to 2000. The “twister factor” at this time was the 1988 Canadian federal and provincial elections and the power of the fishing constituency in rural electoral districts.

When the Canadian moratorium came to an end, a public review panel was convened with the task of recommending whether the moratorium still made sense.

During this process, the then-U.S. President Bill Clinton announced a U.S. moratorium on all new offshore oil and gas exploration in American-controlled areas which meant that part of Georges Bank was also off limits. Fanning says that this “twister factor” essentially made the Canadian review useless.

“It simply scuttled the review process. There was no way anyone could have unbiased deliberations knowing that was the U.S.’s stance,” says Fanning. “The result was the extension of the Canadian moratorium to 2012. Was it the right decision? It’s hard to say because it was driven by extenuating circumstances and not by sound, reliable information.”

Through her work with Dalhousie’s Marine Affairs Program, Fanning is developing a robust decision-making model that has mechanisms in place to address those unpredictable “twister factors.”

Dr. Lucia Fanning

Abriel Photo

Abriel Photo

SANDWICHED BETWEEN LAND AND OPEN WATER

Dr. Helmuth Thomas

With an eye to the seven gigatons of carbon released every year, Dr. Helmuth Thomas is working to help find a complex answer for a seemingly simple question: "where does all that carbon go?"

Since about half remains in the atmosphere as carbon dioxide, the rest should be absorbed by the oceans and the land. But research shows that some carbon is unaccounted for – about two gigatons. Thomas, Dalhousie's Canada Research Chair in Marine Biogeochemistry, is working to better understand where it goes. In doing so, he is first focusing on coastal oceans, under-researched areas that Thomas feels have great importance.

"The coastal waters are sandwiched between land and the open ocean making them the passage way for raw sewage, fertilizer run-off and other human-made pollutants as they flow into deeper water," explains Thomas. "What happens along this pathway is very important. Is our food source being destroyed? Does the marine environment being altered allow invasive species such as noxious algal blooms to take over an area?"

"Responding to climate change requires a comprehensive understanding of all of the factors that contribute to it."

His work looks at coastal carbon cycles, key factors in climate change processes. By quantifying and studying carbon flows from land to ocean in eastern Canada and northwestern Europe, Thomas' research will help improve knowledge of the marine world, and increase the ability to predict changes in the carbon cycle based on environmental factors.

Thomas feels strongly that getting a clear understanding of the causes of climate change is needed, and soon. "If we don't take any action to mitigate the causes of climate change, many millions of people will be at risk from extreme events such as heat waves, drought, floods and storms, with coasts and cities threatened by rising sea levels, and many ecosystems, plants and animal species in serious danger of extinction."

At the same time, he says that scientists should tread lightly when claiming a climate change indicator, without understanding all of the variables. Changes in the weather, ocean temperature and wind speed and direction are caused by phenomena other than carbon dioxide. For example, the North American Oscillation, the major atmospheric and climate model, is responsible for weather variability in the North Atlantic region. It affects temperature changes, moisture distribution and the intensity, number and track of storms.

"Responding to climate change requires a comprehensive understanding of all of the factors that contribute to it," says Thomas. "I'm hopeful that my research will contribute to the overall insight needed to respond to the climate change crisis."

TRACKING THE OCEAN'S INTERNET

Dr. Ron O'Dor thinks on a grand scale. In fact, his current project is so massive that it involves all seven continents and five oceans, about one million marine animals and more than 50 organizations from 20 countries. It's called the Ocean Tracking Network (OTN), headquartered at Dalhousie University.

OTN is a tracking initiative that monitors ocean conditions and marine life response to these conditions. It works by dropping small receivers at one-kilometre intervals on the ocean floor to form "listening lines." Scientists tag sea creatures – from small salmon to whales – with tiny transmitters, so their movements can be tracked for the next two decades as they cross over the listening lines. Sensors added to the receivers will measure ocean depth, temperature and salinity, providing crucial information about climate change and the potential for natural disasters such as tsunamis.

O'Dor, a Dalhousie biology professor and senior scientist of the Census of Marine Life in Washington D.C., says this project is poised to revolutionize the way oceans are viewed and understood. "By implementing such a widespread data collection network, we will access information that can be used to address marine resource management, ocean modelling and climate change," says O'Dor.

To accomplish this, new technology is needed. Dalhousie has teamed up with several Canadian industrial partners across the country to pursue the research and development. The end result will be state-of-the-art tracking equipment that can provide real-time and historical data by capturing underwater sound waves.

There's remarkable potential for global applications of the technology, says Dr. Michael Stokesbury, OTN's senior project manager. "While researchers are tracking Greenland shark migration patterns in the Canadian Arctic that may be affected by the melting of the polar ice cap, other scientists will be tracking the movements of king penguins as they feed in Antarctic waters," he explains.

"By implementing such a widespread data collection network, we will access information that can be used to address marine resource management, ocean modelling and climate change."

The data will be uploaded to a central location at Dalhousie, where it will be securely managed and heavily analyzed by OTN partners, so as to provide sound, reliable information toward conservation policy, fisheries management, global warming research and many other issues.

But building such an expansive network and developing this innovative technology requires major funding, something O'Dor and his team have worked hard to attract. In Canada, the OTN project will be a partnership among CFI, NSERC, SSHRC and the Department of Fisheries and Oceans. Globally, the project represents a commitment of in-kind and cash contributions of over $150 million to OTN's global partnership as part of the United Nations Intergovernmental Oceanographic Commission's Global Ocean Observing System.

In the interim, O'Dor continues to engage international research partners about OTN. "Never before have the world's most prolific oceanic researchers been so excited by a project's potential. They know that we are on the cusp of something that could profoundly impact fish stocks depletion, natural disasters prediction and climate change," says O'Dor. "Since the 1950s, the world has seen a 90 per cent drop in the population of large oceanic fish. OTN doesn't have the power to arrest bad guys, but, like a CSI, it can show who did it and where."

Dr. Ron O'Dor

Contributed

CRUSTY CLARIFICATION

“Oceanic crust has a huge presence on the Earth’s surface … there is still much we don’t know about it.”

A detailed benchmark of the oceanic crust’s generation and make-up will be the result of Dr. Mladen Nedimović’s ambitious data collection voyage. It will take at least three years to process and interpret the massive amount of data but it will be worth the wait. The information is of great importance as it provides the most detailed insight yet into the Earth’s oceanic crust, the part of Earth’s surface that resides underneath deep ocean.

“Oceanic crust has a huge presence on the Earth’s surface, double the amount of the continental crust (land), but its location makes it challenging and expensive to study,” says Nedimović, Dalhousie’s Canada Research Chair in Geophysics and Petroleum Exploration. “The crustal formation process is very complex and there is still much we don’t know about it.”

Nedimović and his colleagues collected data that will image in detail some 10,000 km^3 of the East Pacific Rise (southwest of Mexico), a fast spreading ridge. They used thousands of listening devices that captured seismic energy released every 50 metres along several thousand kilometres of ship track. The seismic equipment is used to construct an image of the subsurface.

“There are competing hypotheses about how the new thin but dense oceanic crust is formed. It may be formed by one type of molten rock (magma) found in a single melt lens centred on the ridge axis or it could be the result of several types of melts and magma lenses found at or near the ridge axis,” says Nedimović.

The formed images will be so detailed that they will also provide insight into the relationship between the location of the magma lenses and surface phenomena such as volcanism, faulting, hydrothermal venting, and the unique biological communities that thrive around these vents.

“Just as it may help to answer questions, it will undoubtedly generate even more questions. That’s the beauty of basic science research.”

Nedimović is co-principal investigator on this $20 million research project funded by the United States National Science Foundation.

Dr. Mladen Nedimović

Pearce Photo

Abriel Photo

THE INFLUENCE OF SALMON INTERBREEDING

Dr. Jeffrey Hutchings

Poached, planked, barbequed or baked, Atlantic salmon is enjoyed by many people worldwide. Much of the salmon consumed today has been grown on aquaculture farms because wild Atlantic salmon has suffered a population decline of up to 99 per cent in some waterways.

Compared to the fishing industry, aquaculture is the ‘new kid on the block’ and only now are issues around environmental impacts and species interbreeding becoming a major area of interest. Just what happens when escaped farmed salmon mate with wild salmon? What impact, if any, will this have on the already scarce wild salmon population?

Longtime scientist of endangered species, Dr. Jeffrey Hutchings is conducting research to find out just that. Working with the Atlantic Salmon Federation and the Department of Fisheries and Oceans, Hutchings, Dr. Dylan Fraser of Concordia University and graduate students Paul Debes, Aimee Houde and Njal Rollinson are determining the implications of intermingling on the wild salmon’s future.

“Just what happens when escaped farmed salmon mate with wild salmon? What impact, if any, will this have on the already scarce wild salmon population?”

Now in its sixth year, the research is beginning to show that interbreeding may indeed influence the survival rate of the wild salmon. “We took wild salmon from two areas of the province and interbred them with salmon from an aquaculture facility,” explains Hutchings, Dalhousie’s Canada Research Chair in Marine Conservation and Biodiversity. “After the required two generations of breeding, we have been examining characteristics vitally important to existence, such as growth rate, response to environmental change, and egg development patterns, to see how they differ. Preliminarily, we are seeing an impact, although the magnitude of the image varies among populations.”

Much of the physical research is being undertaken at the Aquatron Laboratory, Dalhousie’s aquatic research facility. Hutchings has teamed up with Drs. Louis Bernatchez and Eric Normandeau, researchers from Laval University, to conduct gene expression studies and theoretical modeling that will assess the risk that the resulting genetic makeup of future fish could have on the existing wild salmon population.

Hutchings says his team’s work is extremely important to the survival of the wild Atlantic salmon, and vital to developing a recovery strategy and conversation plan for the species. “Information is the key to good management. Without it, you’re unable to implement effective plans.” Hutching brings that same conviction to his role as chair of the Committee on the Status of Endangered Wildlife in Canada, a national science advisory body that assesses which wild species are in some danger of disappearing from Canada. “We use the best available information, usually a combination of science, aboriginal and community knowledge, when making our recommendations to the federal government.”

DAL'S COMPETITIVE EDGE

The Life Sciences Centre is home to one of Dalhousie's competitive advantages – the Aquatron, a laboratory that has helped Dalhousie remain a leader in marine simulation research for the last 35 years. The Aquatron has served the Dalhousie research community alongside both industry and government. The lab has a world-class reputation is founded on its ability to provide researchers with incomparable precision.

"Researchers want to have repeatable results," explains John Batt, manager of the Aquatron Laboratory. "You want an experiment to behave the same way every time you do it, which is hard to do with aquatic research in the field. Our facilities give them that level of control."

There are other aquatic facilities in North America as large as the Aquatron, but few that allow for the same degree of variable control: to drain and fill tanks at will at large and small scales; to use fresh or salt water; or to precisely control temperature. Researchers can use the large Pool Tank as an artificial reef for marine animals, simulate an entire atmosphere of sea water in the Tower Tank or contain salt water marshes in a wet lab.

One of the core components of the Aquatron's mandate is to form stronger ties with the research community beyond campus. Increasingly, companies and government departments are contacting the Aquatron for research assistance, and Dalhousie's

One of the core components of the Aquatron's mandate is to form stronger ties with the research community beyond campus.

Industry Liaison and Innovation office is working to link them with researchers who can help get their projects off the ground and into the water.

One of those companies is Trojan Technologies, global leaders in water treatment using environmentally-friendly ultraviolet light. The company hosts more than 4,000 municipal disinfection facilities in over 50 countries. Trojan has been using both the Aquatron's Pool Tank and Tower Tank to test new methods of removing foreign contaminants from ballast water released by cargo ships, in accordance with new regulations from the United Nations' International Marine Organization.

"The Aquatron was a perfect fit with what we felt was needed to do a comprehensive assessment to determine the capabilities and limitations of UV technology in destroying invasive aquatic

species," says Trojan president and CEO Martin DeVries. "It offered us the ability to do research with real ocean water with the analytical capabilities, academic staff and graduate students available on campus."

Batt says that in addition to companies like Trojan, many public sector organizations have taken advantage of the Aquatron's resources in recent years. These include the Department of Fisheries and Oceans, Environment Canada, Parks Canada and the National Research Council.

"We've turned the Aquatron from a large piece of infrastructure into a tool for research and economic development," says Batt. "We can help develop industry ideas and test bed them to reality."

Adapted from the Industry Liaison and Innovation 2008 Annual Report.

AQUATRON LABORATORY

Opened:	September 20, 1974
Dedicated research space:	approx. 50,000 square feet
Pool Tank:	Volume – 680,000 litres Diameter – 15.25 m (50') Depth – 3.91 m (12'10")
Tower Tank:	Volume – 117,100 litres Diameter – 3.66 m (12') Depth – 10.46 m (34'4")
Wet Labs:	23
Heat exchangers:	21 (heating and chilling)
Maximum seawater capacity:	3,500 litres per minute

HOT OCEAN NEWS AT DALHOUSIE

RESEARCH EXCELLENCE

Dalhousie's Stage 1 proposal for a Canada Excellence Research Chair in Ocean Science and Technology ranked among the highest in all Canadian universities. The University is interviewing candidates to compete in the final round of this competition to bring outstanding researchers to Canada.

SEABIRD RESEARCH

Killam post-doc **Rob Ronconi** is working on seabird research in the Bay of Fundy. The team has been tracking seabirds to identify habitat hot spots, and discover migration routes to breeding grounds in the southern hemisphere. The impetus for the "hot spot" identification is to provide information to oil spill response teams in the event of a real spill in the Maritimes. This work is funded by Environment Canada, the National Geographic Society and the Ocean Fund (Royal Caribbean Cruise Lines).

HONORARY DEGREE

Jesse Ausubel received an honorary degree at Dalhousie's spring convocation. He was a key organizer of the Census of Marine Life, an international marine life observation program that boasts a network of over 2,000 scientists. He also helped inspire the creation of the Ocean Tracking Network (OTN), a $168 million global conservation project uniting leading ocean scientists around the world. The first OTN listening devices were deployed off Halifax, Canada in April 2008, and Perth, Australia in February 2009.

HEALTHY OCEANS

PhD candidate **Jack Lighten** is helping to assess the biological health of Canada's three oceans – Pacific, Atlantic and Arctic. The research will provide guidance on how to best manage fisheries in light of forecasted dramatic climatic shifts. Lighten, along with post-doc **Dr. Ian Bradbury**, will look at how climate change is likely to affect species distributions within Canada's three oceans. They will consider current and past population distributions and processes, and extrapolate into the future. They will be using leading-edge DNA sequencing technology and bioinformatics software. The project is part of the Canadian Healthy Oceans Network (CHONe).

MANAGING KNOWLEDGE

Raza Abidi is leading a joint initiative between the Faculties of Science and Computer Science called the Platform for Oceanographic Knowledge Management. It extends the capabilities of OTN by enabling researchers across the globe to share scientific work in real time. Key players include Dalhousie's **Jinyu Sheng**, **Keith Thompson** and **Mike Stokesbury**, and **Ian Jonsen** from DFO (adjunct in Biology).

SCIENTIST OF THE YEAR

Ron O'Dor, a Dalhousie biology professor, senior scientist for the Census of Marine Life in Washington and scientific director of OTN, has been named *Canadian Geographic's* Environmental Scientist of the Year. He has dedicated much of his life to researching the oceans and enhancing our understanding of marine life.

HONOURING RANSOM MYERS

The former students of the late **Ransom Myers** recently undertook a fundraising campaign to commemorate Ram with a permanent memorial, highlighting his extensive publication record, in the North stairwell of the Life Sciences Centre's Biology wing. Dr. Myers, who passed away in 2007, was well respected internationally for his research into the demise of marine ecosystems.

PREDICTING SEDIMENT MOVEMENT

ACOA has provided $1.1 million to assist Dalhousie's **Alex Hay** and Halifax-based Nortek Scientific in developing a commercially viable prototype of a highly sensitive underwater acoustic instrument. It aims to improve our understanding and prediction of how sediments move through water – significant, given the havoc that sediment accumulation or movement can have on shipping lanes and other areas.

DISTRESSED TURTLES

A recent article in the journal *Marine Pollution Bulletin*, co-authored by Dalhousie's **Mike James**, confirmed that plastic ingestion by leatherback turtles clearly poses a health risk. The leatherbacks eat jellyfish and sometimes mistake bags or other plastics as a meal. One-third of 371 postmortems conducted on the turtles showed they had eaten plastic.

ACIDIC WATERS

Dalhousie PhD student **Kim Davies** recently had a paper published in the journal *Nature Geoscience*. Building on the problem of ocean acidification, it focuses on how mussels have adapted to extremely acidic waters near underwater volcanoes.

OVERLOOKED SPECIES

PhD Candidate **Tyler Zemlak**, along with researchers at the University of Guelph and in South Africa and Australia, has found evidence that classic approaches for identifying species have overlooked several species of marine fishes in the Indian Ocean, a message that carries important conservation concerns. The coastal waters of Africa and Australia are thought to share approximately 1,000 species of marine fishes. However, using DNA barcoding, a reliable genetic technology for identifying species, the team highlighted several inconsistencies that likely represent overlooked species in the Indian Ocean. These findings are consistent with the emerging realization that our oceans are not as connected as previously assumed, and adds a whole new layer of conservation concerns.

BOARD ANNOUNCEMENT

Marketing and Transportation professor **Mary Brooks** has been named a member of the Marine Board of the U.S. National Research Council. She will join six others in providing advice on maritime transportation, ports and related issues.

TOP TEN REASONS TO PROMOTE HEALTHY OCEANS

By Ron O'Dor, Professor, Dalhousie University and Senior Scientist, Census of Marine Life, and Darlene Trew Crist, Education and Outreach Network, Census of Marine Life

1

THE OCEAN IS ONE BIG INTERCONNECTED WATER BODY.

What we do in one part of the ocean ultimately impacts another part. Currents circulate the water around the globe. It is estimated that a drop of water in the North Atlantic could make its way around the world carried by the great "ocean conveyor belt current system" and arrive back in the North Atlantic in 1,000 years!

2

THE OCEAN IS AN IMPORTANT FOOD SOURCE.

The more we know about life in the oceans, the more we can work to ensure that it is around for future generations.

3

THE OCEAN INFLUENCES WEATHER AND CLIMATE.

The ocean dominates the Earth's energy, water, and carbon cycles. Half of the Earth's primary production takes place in the sunlit areas of the ocean. As well the ocean acts as a carbon sink – absorbing about half of all carbon dioxide added to the atmosphere.

4

THE OCEAN SUPPORTS GREAT DIVERSITY OF LIFE.

Over the last ten years, scientists have been surprised by the enormous diversity of life in the ocean – much like the diversity found in rainforests. Like its terrestrial counterpart, diversity in the ocean is a good thing: it means that life can adapt to changing conditions.

5

THE OCEAN HAS UNIQUE ECOSYSTEMS.

From hydrothermal vents that rely on chemical energy to support life to coral reefs that help regulate the amount of carbon dioxide on the planet to fertile fishing grounds that provide the world with food, the ocean has many unique habitats filled with a spectacular array of creatures.

6

THE OCEAN AND HUMANS ARE INTERCONNECTED.

The ocean provides us with food, medicines, mineral and energy resources, serves as a water highway connecting peoples and nations, and provides a source of recreation and pleasure to all who venture upon it or to its shores.

7

THE OCEAN IS FILLED WITH BEAUTY.

In nearly ten years of investigating life in the global ocean, scientists have unilaterally reported being amazed by the beauty and wonder of life they have found below the surface, and the public feels the same.

8

THE OCEAN IS A HUGE UNEXPLORED LABORATORY.

Much like the moon or Mars, we know little about the ocean. Less than five percent of this vast ocean has been explored! Recent technological innovations, however, have given us a window into what was an opaque ocean. Using sophisticated equipment from submersibles to remotely operated vehicles equipped with video cameras, we are now able to explore previously unexplored places.

9

THE OCEAN SERVES AS A MARINE HIGHWAY.

Census studies have shown that not only do people use the ocean as a water highway, but marine animals do as well.

10

THE OCEAN IS OUR FUTURE.

Pharmaceuticals, chemicals, energy, food – the ocean can serve as a source for all of these well into the future if we learn more about it so that we can manage it efficiently and wisely.

A STRATEGIC APPROACH TO OCEAN RESEARCH

By Iain Stewart, Assistant Vice President (Research)

The oceans sector has always been at the heart of the Nova Scotian economy. Over 15 per cent of the provincial economy, or $5 billion in direct and indirect economic activity, comes from the sea*.

This includes traditional industries such as marine transportation, shipbuilding, the fisheries and defence. It also includes more recent activities such as offshore oil and gas exploration and development, ocean engineering, and oceanography services and equipment. Emerging industries such as biotechnology, functional foods, and wave and tidal power hold great promise. More than 60,000 Nova Scotians currently depend directly or indirectly on oceans industries.

However, by its very nature, the ocean-related economy is international and this means heavy competition from other regions of the world. Nova Scotian firms face ongoing pressure to reduce costs, adapt and innovate. To remain competitive, local companies must have access to the latest ideas and technologies and to well-trained and highly skilled employees.

Dalhousie University already plays a key role by providing the private sector with: 1) high quality graduates 2) knowledge and expertise important to business innovation in the oceans sector (drawing on environmental studies, law, policy, science, engineering, management and many more disciplines), and 3) leading-edge research.

Oceans research is one of Dalhousie's strategic priorities. Seventy six faculty are dedicated to oceans research, 10 of whom are Canada Research Chairs. In fact, Nova Scotia is home to the largest concentration of oceans researchers in Canada. Researchers from Bedford Institute of Oceanography, the National Research Council's Institute for Marine Bioscience, Defence R&D Canada, Environment Canada, InnovaCorp, universities and colleges combine to make this part of the country an oceans research hub.

Going forward, the challenge is to build partnerships that better connect the private sector to the talent, ideas and capacity the "research hub" has to offer. If we succeed, Nova Scotia will enjoy a strong, vibrant oceans sector for many years to come. ■

* *The "Economic Impact of the Nova Scotia Ocean Sector 2002-2006" by Gardner Pinfold, March 2009, for Nova Scotia Economic Development and the Atlantic Canada Opportunities Agency.*

Iain Stewart has recently joined Dalhousie University as Assistant Vice President (Research). He will be providing administrative leadership to strategic oceans' research and innovation initiatives. Prior to this appointment, he held the position of Assistant Associate Deputy Minister of Industry Canada where he led development of the Science and Technology Strategy and a range of supporting research funding initiatives.

OutFront RESEARCH THAT MATTERS

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