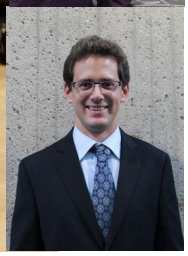
30 years MARINE AFFAIRS PROGRAM

Making Waves 2016

Graduate Project Presentations of the Master of Marine Management Class of 2016



Thursday December 8, 2016
9:00 am to 3:30 pm
&
Friday December 9, 2016
9:00 am to 1:00 pm

Room 1009
Rowe Management Building
6100 University Avenue
Dalhousie University, Halifax, NS

DALHOUSIE UNIVERSITY

Making Waves 2016 Schedule - Thursday December 8, 2016

Time	Name	Title
9:00	Coffee/Tea	
9:15	Introductory Remarks – Claudio Aporta, Director, Marine Affairs Program	
9:30	Meghan Borland	A tale of two standards: A case study of the Fair Trade certified Maluku handline caught tuna (*Thunnus albacares*) fishery
9:52	Laura Miller	The fair way or the Chiloé? Exploring the role of certification in the governance of labour in aquaculture in Chiloé, Chile
10:14	Jenny Weitzman	Assessing the potential of ecolabels to improve social acceptance within Nova Scotia's finish aquaculture industry: A stakeholder approach
10:34		**Break**
10:55	Laurie Starr	Blowing it out of the water: How breaking down illegal, unreported, and unregulated (IUU) fishing can contribute to its effective management in Indonesia using an area based approach.
11:17	Peter Wessels	Enhancing Small-scale Fishing Communities Through the Advancement of Women's Participation in the Sustainable Livelihoods Framework
11:39	Nicolas Winkler	Diving dangerously: Exploring human health and resource trade-off of extreme dive profiles in a Caribbean dive fishery
12:00		**Lunch**
12:45	Travis Aten	The application of the ecosystem approach and future directions for the international management of migratory sharks in the Northwest Atlantic
1:07	Jordan Gardiner	Small and Mighty: Why forage fisheries management could benefit from an ecosystem based framework. A case study on Bay of Fundy/Southwest Nova Scotia herring stock component
1:29	Roxanne Graham	A Comparison of Eight Country Plans for the Invasive Indo-Pacific Lionfish in the Wider Caribbean
1:50		**Break**
2:10	Augusta Lipscombe	Assessing the current and future risk of ballast-sourced species invasions in Canada's eastern Arctic under a climate change scenario
2:32	Krista Bouwman	An analysis of the Scotia-Fundy vessel users and what this means for the North Atlantic right whale
2:54	Kendra Moore	Evidence-informed conservation policies: Mitigating vessel noise within gray whale (*Eschrichtius robustus)* foraging habitat in British Columbia, Canada

Each student is allotted 20 minutes for their presentation (13 minutes for presentation, 7 minutes for questions). There is a 2- minute break for change-over of presenter.

Making Waves 2016 Schedule – Friday December 9, 2016

Time	Name	Title
9:00	Alba Garcia Rodriguez	Queen conch (*Lobatus gigas*) in the Grenadine Islands: a preliminary assessment on its abundance and current management needs
9:32	Lauren Dehens	What counts in making MPAs count: The role of legitimacy as a contributor to perceived MPA success in Canada.
9:54	Teresa MacDonald	Using Adaptive and Fisheries Management to Increase MPA Success: A Case Study of the Gilbert Bay MPA
10:16	Catherine Schram	Spatial Protection for Porbeagle Sharks, *Lamna nasus*, in the Northwest Atlantic: The Road to Recovery?
10:36	**Break**	
10:56	Monica Reed	Towards adaptive management of mooring systems to reduce the threats of yachting tourism in MPAs.
11:18	Kayla Glynn	Who's paying the bill? Assessing and valuing damage to the marine environment in accordance with the polluter pays principle for the practical purpose of compensation after ship-source oil spills
11:40	Ashley David	Marine microplastic and nanoplastic litter in Nova Scotia: Confronting the rising tides of plastics in our marine waters, coastlines and organisms
12:00	**Wrap Up/Lunch/Awards**	

Each student is allotted 20 minutes for their presentation (13 minutes for presentation, 7 minutes for questions). There is a 2- minute break for change-over of presenter.

Making Waves 2016 Abstracts

(in alphabetical order)

Travis Aten

Aten, T. 2016. The application of the ecosystem approach and future directions for the international management of migratory sharks in the Northwest Atlantic [graduate project]. Halifax, NS: Dalhousie University.

Abstract

Sharks have existed on Earth for millions of years. However, shark populations are in decline globally. Many sharks are apex predators and therefore play crucial roles in maintaining ecosystem stability. The decline of shark populations is especially true for the large migratory sharks of the Northwest Atlantic. Anthropogenic factors such as overfishing and bycatch are the top causes pushing these shark populations into decline. Recently, sharks have gained more attention within the international realm. New frameworks are attempting to improve shark management on the high seas by incorporating the ecosystem approach. Sharks within the high seas are the responsibility of RFMOs. Two RFMOs in the Northwest Atlantic, NAFO and ICCAT are attempting to manage shark populations from an ecosystem approach; however, populations are still in decline. Therefore, this project has attempted to answer whether or not ICCAT and NAFO have been applying the ecosystem approach towards international shark management. Indicators for the ecosystem approach were created to determine whether shark measures within NAFO and ICCAT follow the approach, a comparative analysis of how other RFMOs manage sharks was completed to determine if NAFO and ICCAT are on par with other RFMOs, and recommendations were provided for international shark management.
Solutions to successful shark management are possible and perhaps simple in the Northwest Atlantic. The evidence suggests that NAFO and ICCAT have only partially been applying the ecosystem approach even though international frameworks have been calling for the application of the approach. Furthermore, NAFO and ICCAT are not leaders compared to other RFMOs when it comes to international shark management. International shark management has to make great strides in the near future if shark populations are to persist.

Keywords: international shark management, RFMOs, Northwest Atlantic Fisheries Organization, International Commission for the Conservation of Atlantic Tunas, ecosystem approach

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Travis completed two internships, the first at the Northwest Atlantic Fisheries Organization (NAFO) located in Dartmouth, NS and the second at the Ecology Action Centre in Halifax under the supervision of Susanna Fuller. While at NAFO Travis spent his time focusing on international shark management by RFMOs and was able to attend NAFO meetings as an observer. At the Ecology Action Centre Travis and Susanna worked on a report supporting the need for improved biodiversity protections for areas beyond national jurisdiction. The report focused on three case studies in the North Atlantic: attempts to protect biodiversity by the Sargasso Sea Commission, RFMO conservation methods for sharks, and NAFO's attempt to protect vulnerable marine ecosystems from offshore oil exploration.

Meghan Borland

Borland, M.E. 2016. A tale of two standards: A case study of the Fair Trade certified Maluku handline caught tuna (*Thunnus albacares*) fishery [graduate project]. Halifax, NS: Dalhousie University.

Abstract

Fishery certification programs and ecolabels have emerged as a method for promoting the sustainability of global fisheries. The Marine Stewardship Council (MSC) certification program is considered the largest, most recognized seafood certification program, yet the MSC is criticized for its lack of accessibility to small-scale fisheries in developing countries. New to the seafood industry, and in part filling the accessibility gap, is Fair Trade USA's Capture Fisheries program. This program was developed to provide the benefits of Fair Trade to small-scale fishermen and their communities and offers a mechanism to increase the prominence of certified small-scale fisheries in the developing regions of the world. Sixty percent of internationally traded seafood products originate from developing regions of the world, and thus it is imperative to gain an understanding of how to best utilize seafood certifications in developing countries to promote ecological, economic, and social sustainability. The role of Fair Trade in relation to MSC is not yet understood, and this is particularly the case in Indonesia, a nation with a Fair Trade certified tuna fishery, and one that is also working towards achieving wide-scale MSC certification across tuna fisheries. This research focused on the Fair Trade certified handline caught yellowfin tuna (*Thunnus albacares*) fishery in Maluku, Indonesia to understand the role of Fair Trade USA in relation to MSC. The relevance and appropriateness of both the Fair Trade and the MSC standards in relation to the FAO Voluntary Guidelines for Securing Sustainable Small-Scale Fisheries was assessed, and focus groups and interviews with key informants were conducted. While Fair Trade USA and MSC may remain two separate certification programs, due the inherent 'continual improvement' element of the Fair Trade USA Capture Fisheries Program, it can be viewed as a pathway to MSC certification.

Keywords: certification program; ecolabels; Fair Trade USA; Marine Stewardship Council; fishery improvement projects; small-scale fisheries; sustainability; fisheries management

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Meghan completed her internship at Yayasan Masyarakat dan Perikanan Indonesia (MDPI) located in Bali, under the Improving Fisheries Information and Traceability of Tuna (IFITT) Project. The IFITT project has implemented traceability systems within small-scale tuna fisheries in Indonesia, in order to enable sustainable data collection. Meghan's internship focused on the economic component of the IFITT project. Her work contributed to the development of a cost-benefit analysis framework that will enable the assessment of the business case of traceability. During her internship, Meghan compiled data relating to the costs of the implementation of traceability systems across small-scale handline tuna fisheries in Indonesia. In addition, in order to understand how processing differs following the implementation of traceability technology, Meghan spent two weeks in tuna processing plants conducting a time/cost processor collection study. This experience allowed Meghan to develop an understanding of consumer-facing traceability systems and seafood supply-chains.

Krista Bouwman

Bouwman, K. 2015. An analysis of the Scotia-Fundy vessel users and what this means for the North Atlantic right whale [graduate project]. Halifax, NS: Dalhousie University.

Abstract

The North Atlantic right whale is endangered under the *Species at Risk Act* thus, its protection is of the utmost importance. In Canada, conservation efforts have led to changes in policy; a voluntary area to be avoided in Roseway Basin and shipping lane amendments in Grand Manan Basin have been implemented; both regions are prime right whale feeding areas. Despite the measures in place, non-compliance occurs and right whales still fall victim to ship strikes. MEOPAR (Marine Environmental Observation Prediction and Response), is using passive acoustic monitoring to find whales in real time. The efforts of MEOPAR will lead to a whale alert system for the Scotia-Fundy region; in order to be successfully, the needs of the mariners must be evaluated. A representative sample of the fleet is required to survey them on their needs therefore, an analysis of the Scotia-Fundy users must be conducted. This study analyses all vessels using the Scotia-Fundy region. The primary analysis used vessels' MMSI number as their identifier to calculate how many days each vessel was present in the Scotia-Fundy region for the year 2015. The top 20% most frequent vessels were extracted and underwent further analysis. From the second analysis, various vessel characteristics were revealed such as average speed, vessel size and vessel type. The result of this study is a list of vessels most frequently present in the Scotia-Fundy region and an idea of how likely they are to impact right whales based on their physical characteristics. The list created is the first step to surveying a representative sample of the fleet thus, ensuring successful implementation of a whale alert system.

Keywords: North Atlantic right whale; conservation; whale alert; the fleet; ship strikes; vessel compliance; MEOPAR; Scotia-Fundy region.

Krista completed her internship with MEOPAR, a non-for-profit organization that aims to reduce vulnerability and strengthen Canada's marine environment. On the east coast, MEOPAR has aided significantly in the conservation of the North Atlantic right whale. During her internship Krista conducted an analysis of the Scotia-Fundy vessel users; this entailed obtaining data from their Automatic Identification System and using the program R to manipulate the data. Under the guidance of Dr. Chris Taggart, Krista was able to gain more insight on activities conducted and types of vessels found in the Scotia-Fundy region. The newly gained knowledge has helped her have a better understanding of the threats present in the region for right whales.

Ashley David

David, A. 2016. Marine microplastic and nanoplastic litter in Nova Scotia: Confronting the rising tides of plastics in our marine waters, coastlines and organisms [graduate project]. Halifax, NS: Dalhousie University.

Abstract

According to Moore (2008), "plastics are now one of the most common and persistent pollutants in ocean waters and beaches worldwide" (p. 131). Significant increases in plastic production is a considerable driver in the amount of plastic observed in the marine environment (UNEP, 2014). It is estimated that the amount of marine litter along the coast of Nova Scotia is increasing (Grieve, 2012) with local studies finding that sea birds and mussels contain elevated levels of plastic as compared to studies completed elsewhere (Bond et al., 2014; Mathalon and Hill, 2014). Scientists confirm that marine plastics are entering the food chain with as much as 178 microplastic fibers found in a single wild Nova Scotia mussel (e.g. Bouwmeester, et al., 2015). Much of the international and federal regulations pertaining to marine litter focuses on sea-based sources of litter; however, the scientific community states that land-based activities make up approximately 80 per cent of marine litter (Andrady, 2011; Berman, 1995; Sheavly, 2005; Zhou et al., 2011; UNEP, 2005). The report ends with recommendations on how Nova Scotia can address marine litter concerns from both a local and global perspective.

Key words: marine pollution; marine debris; plastics; waste management; Nova Scotia

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Under the supervision of the Clean Foundation's Charlynne Robertson and Erin Burbidge, **Ashley** David undertook a research project on marine litter including generating recommendations on how to address the issue of microplastics and nanoplastics at the local and global perspectives. The Clean Foundation has operated the Great Nova Scotia Pick Me Up program, Nova Scotia's largest volunteer-driven community litter clean-up program, since 1988. Clean also delivers an award-winning Ship-to-Shore program which engages commercial fishers to address concerns regarding waste disposal practices at sea and the lack of waste management resources at fishing harbours. Given the growing widespread concerns associated with microplastics and nanoplastics in the marine environment, Ashley's project aligned with Clean Foundation's interests to assess how they may consider developing or evolving their litter programs to ensure that they continue to tackle the issue of marine litter in the most effective and proactive way.

Lauren Dehens

Dehens, L. 2016. What counts in making MPAs count: The role of legitimacy as a contributor to perceived MPA success in Canada. [graduate project]. Halifax, NS: Dalhousie University.

Abstract

Marine protected areas (MPAs) are powerful management tools used worldwide for conserving marine species and habitats. Yet, many MPAs fail to achieve their management objectives because of shortfalls in understanding stakeholders' perceptions on the level of legitimacy they afford to an MPA, which can negatively impact an MPA's effectiveness. The purpose of this study was to determine the importance of various factors in shaping different stakeholders' and managers' perceptions on MPA effectiveness and the level of legitimacy they afford to an MPA. Interviews were conducted with various stakeholders from two coastal MPAs in Atlantic Canada: Musquash MPA in New Brunswick, and Basin Head MPA in Prince Edward Island. Results indicated that most factors for legitimacy are important to stakeholders for MPA effectiveness, however some differences in perceptions were evident between and within different stakeholder groups, and among stakeholders and managers. Consensus was shared across case studies on the importance of community leadership and the establishment of trust. A novel legitimacy framework, as well as a more refined suite of indicators vetted by stakeholders for obtaining MPA legitimacy are presented and recommended for use by MPA managers in establishing/assessing the legitimacy of Canada's future coastal MPAs. The results of this research allow for an increased understanding of stakeholder perceptions of legitimacy and help to simplify the task Canadian MPA managers have of establishing legitimate and ultimately effective MPAs during their efforts to reach Canada's national targets of having covering 10% of national oceans in MPAs by 2020.

Keywords: Marine Protected Areas, MPA Effectiveness, Legitimacy, Stakeholder Perceptions, Canada

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Lauren completed her internship in St. Andrews, New Brunswick at the St. Andrews Biological Station (SABS) with hosts Dr. Peter Lawton and Dr. Andrew Cooper of the Department of Fisheries and Oceans. Her work over the internship consisted of research gathering and reviewing for the existing ecologically and biologically significant areas (EBSAs) and Significant Benthic Areas (SBAs) in the Bay of Fundy, Quoddy Region. This data served to re-evaluate the existing EBSAs and SBAs in place, to better site areas of interest for marine protected areas in the future. A focus was also taken to review the historical and ecological significance of Musquash Marine Protected Area, as it relates to her graduate project.

Alba Garcia-Rodriguez

García-Rodríguez, A. 2016. Queen conch (*Lobatus gigas*) in the Grenadine Islands: a preliminary assessment on its abundance and current management needs [graduate project]. Halifax, NS: Dalhousie University.

Abstract

The queen conch (*Lobatus gigas*) is a very important fisheries resource among Caribbean countries due to its cultural and economic value. However, queen conch has been overexploited in many areas of the Caribbean. In Union Island, St. Vincent and the Grenadines, the conch fishery has been an essential part of local livelihoods for the past century. Despite the importance of conch in the area, knowledge of the current status of the population is limited. Therefore, an abundance assessment was conducted to contribute data on conch density and distribution. In addition, the effectiveness of current conch conservation measures was assessed. Conch density was determined following the underwater survey methods of a study conducted in 2013 in the same study area. Surveys were completed within the Tobago Cays Marine Park (TCMP), as well as outside the marine protected area. Results showed reduced conch density in comparison to results from the 2013 study. In addition, the TCMP seemed to have no effect towards conch protection, as there was no significant difference in conch abundance inside and outside the park. Furthermore, the abundance of juveniles inside the park was lower in 2016 when compared to results from 2013. Multiple factors could have influenced these findings and, therefore, further research is required to better understand the current density of this species. The results and recommendations of this study, combined with continued monitoring, could contribute to better-informed conch fishery management in St. Vincent and the Grenadines.

Keywords: Queen conch, Fisheries management, MPA effectiveness, St. Vincent and the Grenadines, Tobago Cays Marine Park.

Alba completed her internship with Sustainable Grenadines Inc, in St. Vincent and the Grenadines. SusGren is a non-profit organization based in Union Island that promotes the conservation of the natural environment across the Grenadines Islands. Alba conducted monitoring activities of queen conch in Union Island, with the collaboration of the Tobago Cays Marine Park Rangers and the local community, including fishermen. Monitoring activities of this important marine species were conducted under the Eastern Caribbean Marine Managed Areas Network (ECMMAN) Project. Participatory mapping, as well as underwater surveys resulted in the acquisition of scientific data that generated increased knowledge of conch abundance in the area. The obtained information can improve current management of this species, and contribute to its conservation. This internship was conducted under the guidance of Dr. Lucia Fanning (Professor, Marine Affairs Program, Dalhousie University) and Orisha Joseph (Program Manager, Sustainable Grenadines).

Jordan Gardiner

Gardiner, J. 2016. Small and Mighty: Why forage fisheries management could benefit from an ecosystem based framework. A case study on Bay of Fundy/Southwest Nova Scotia herring stock component [graduate project]. Halifax, NS: Dalhousie University.

Abstract

Forage fish are defined as mid-trophic level species that are preyed upon by many top predators within their respective ecosystems. The dependence on these forage fish from top predators, makes them a crucial link between the energy providing autotrophs and higher energy predators within an ecosystem. It has been suggested that forage fish species are more valuable in the water, acting as support for these top predators, than being directly fished for other uses such as human consumption, bait or fish meal/oil. In Nova Scotia (Canada), many lobster fishers rely heavily on forage fish species as bait within lobster traps. Forage fisheries within Atlantic Canada include Atlantic herring (*Clupea harengus*), mackerel (*Scomber scombrus*), and capelin (*Mallotus villosus*). The current management of these fish in Canada is based on single species assessments. However, due to forage fish's unique interactions with both the ecosystems and other fisheries, a management plan that focuses on these interactions is crucial for ecosystem sustainability. Accordingly, this project assessed the current single species management of these forage fisheries using a holistic analysis on a case study of the Southwest Nova Scotia/Bay of Fundy herring stock component that assessed factors within a political, economic, socio-cultural, technological and environmental framework through a PESTE analysis. From this analysis, the strengths, weaknesses, opportunities and threats within the current management regime were determined. Using these opportunities and threats a gap analysis was conducted to identify alternative ecosystem based management frameworks for forage fisheries.

Keywords: forage fish; ecosystem based fisheries management; Canada; Nova Scotia; herring; fisheries management; sustainability; PESTE analysis; SWOT analysis.

Jordan completed her internship with WWF-Canada in Halifax, Nova Scotia. For her internship, Jordan worked under the supervision of Aurelie Cosandey-Godin, MMM Alumni, on an internal report for WWF-Canada's *Food for All* Initiative. The internal report focused on the use and markets of forage fish within Canada. For this report, Jordan had the opportunity to use both desktop research as well as speak with a variety of stakeholders. Jordan gained invaluable experience and skills related to WWF-Canada program delivery, project management, and stakeholder engagement.

Kayla Glynn

Glynn, K. M. 2016. Who's paying the bill? Assessing and valuing damage to the marine environment in accordance with the polluter pays principle for the practical purpose of compensation after ship-source oil spills [graduate project]. Halifax, NS: Dalhousie University.

Abstract

The objective of this study was to evaluate how marine environmental damage caused by a ship-source oil spill is assessed intergovernmentally and internationally for the practical purposes of determining compensation. A comparative analysis of five case studies involving environmental damages caused by specific ship-source oil pollution incidents was performed. In completing the comparative analysis, the strengths, weaknesses, opportunities and threats (SWOT) method was applied to each case study, which then informed a gap analysis resulting in recommendations for improving Canada's existing regime. The results of the comparative case study analysis supported the conclusion that assessing marine environmental damage is a challenging practice and different jurisdictions have developed distinct approaches. Results indicated that further scientific study, including baseline monitoring of ecosystem services and their projected monetary values, are required in order to advance the practice of assessment both internationally and domestically. Results also revealed significant gaps in Canada's current regime in terms of comprehensively assessing marine ecosystem goods, services and functions to enable appropriate compensation. The gaps identified within Canada's regime include having no assessment guidelines in place for polluters and having no government agency appointed the task of performing consistent environmental damage assessment. Recommendations for addressing these gaps and strengthening Canada's regime include enforcing guidelines for assessment of environmental damage after pollution incidents and implementing mandatory cooperative assessment between the polluter and the government. Canada's existing regime for assessing damage to marine environment for the practical purpose of compensation is under-developed, and could be improved by incorporating measures that would more comprehensively assess ecosystem goods, services, and functions.

Keywords: polluter-pays principle; liability; compensation regime; ship-source oil spill; maritime law; environmental economics; decision-making; management

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Under the supervision of Dr. Aldo Chircop, **Kayla** completed her internship in Vancouver, BC, with Clear Seas Centre for Responsible Marine Shipping. Her work over the internship consisted primarily of research and data gathering for her project regarding the legislation and policy associated with intergovernmental and international environmental damage compensation regimes. Kayla gratefully acknowledges that her work was supported by Mitacs through the Mitacs Accelerate Program and by Clear Seas Centre for Responsible Marine Shipping. Thanks to their generous support Kayla was able to travel to London, England in order to conduct interviews with claims managers at the International Oil Pollution Funds (IOPC Funds) and technical experts at the International Tanker Oil Pollution Federation (ITOPF). The recommendations from her project will be provided to Clear Seas, the IOPC Funds, and ITOPF among other interested stakeholders. Additionally, Kayla was able to contribute to many of Clear Seas' outreach and engagement projects, which she greatly enjoyed. Kayla continues to be gainfully employed by the communications team at Clear Seas.

Roxanne Graham

Graham, R. 2016. A Comparison of Eight Country Plans for the Invasive Indo-Pacific Lionfish in the Wider Caribbean [graduate project]. Halifax, NS: Dalhousie University.

Abstract

The coastal Caribbean region is generally characterized by the following ecosystems: coral reefs, mangroves and seagrasses, also including other environments, such as sandy beaches and rocky shores. These tropical ecosystems incorporate a high diversity of associated flora and fauna and have significant ecological, aesthetic, economic and amenity value to the countries and territories of the region. Moreover, the islands collectively encompass a major global marine biodiversity hot spot. Over the years, the multitude effects of climate change and marine invasive species (MIS) have posed a major threat to the island biodiversity and combined, the complexity of the interaction of these two global drivers has increasingly been showing devastating effects. Today, the Caribbean Sea is plagued with the invasive lionfish *(Pterois volitans* and *P. miles).* As the range of the lionfish throughout the Caribbean has grown and their abundance has increased, recognition that the lionfish poses a grave threat to the native marine ecosystems has prompted the development of lionfish management plans across the region. Eight (8) countries' response and management plans for the lionfish were evaluated using the US Environmental Protection Agency (USEPA) Aquatic Invasive Species (AIS) framework and their criteria and scoring assessment for state management plan and assessment consideration of climate change and/or changing conditions. The countries include Anguilla, Bahamas, Cayman Islands, Grenada, St. Eustatius, St. Lucia, St. Vincent and the US Virgin Islands. Although specific strategies differ amongst the islands depending upon needs, culture, and individual circumstances, most of the plans include three main components: education and outreach, control and monitoring protocols, and research and information management. The research also provided a comprehensive perspective of the opportunities and obstacles to enhancing both individual country and regional management of lionfish species through the use of a Comparison Matrix. This ultimately led to suggestions for intra- and inter-country cooperation and the transfer and development of interventions which could thereby make a major contribution to the conservation of significant island biodiversity.

Keywords: Wider Caribbean Region, lionfish, marine invasive species, plans, climate change, management, compare, adaptive capacity

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Roxanne completed her internship in her home country Grenada, through the Fisheries Division, attached with the Ministry of Agriculture, Land, Forestry, Fisheries and the Environment. Under the supervision of the National MPA Coordinator, Mr. Roland Baldeo and the National MPA Biologist and MMM Alumni, Mr. Olando Harvey, she was able to gain invaluable experience and skills related to project delivery, stakeholder engagement and community outreach. Roxanne was a coordinator of the official launch of the lionfish control project, teacher under the lionfish education program for local schools in coastal communities, and coordinator of other lionfish campaigns. She was also the Lead Coordinator of the MPA Summer Camp Program. Working with the Fisheries Division, Roxanne was also able to network and source the management plans and supporting documents needed for her graduate research project. Her academic supervisor is Dr. Lucia Fanning, Professor with the Marine Affairs Program.

Augusta Lipscombe

Lipscombe, M.V.A. 2016. Assessing the current and future risk of ballast-sourced species invasions in Canada's eastern Arctic under a climate change scenario [graduate project]. Halifax, NS: Dalhousie University.

Abstract

The use of ballast water is an important and globally accepted method for maintaining vessel stability, as well as a major pathway for nonindigenous species (NIS) introduction. Canada has responded to this threat in the form of regulation, but existing policy may need to be adjusted to more effectively address environmental and socioeconomic changes. One area of particular interest is the eastern Canadian Arctic, where climate change in combination with growing development opportunities has resulted in an increase in marine vessel traffic volume. It is expected that this situation may lead firstly to an increasing probability of NIS introduction. Secondly, the likelihood of NIS establishment may also grow, as warming water temperatures may increase the environmental similarity between the Arctic and source ports. Due to the ecological fragility of the region, the unique relationship between the Inuit peoples and the environment, and the limited existing knowledge of the Arctic, species invasions in the eastern Canadian Arctic may have severely negative impacts. A policy analysis and risk assessment was conducted to identify ways in which Canada's approach to ballast water management may be improved to better address this threat. Further, a projected risk assessment of the years 2055 and 2105 was conducted to predict how continued climate change may affect the risk level of ballast-mediated species invasions. It was found that though the current and predicted future risk levels are relatively low, focusing management efforts on limiting NIS introduction through improved ballast water management methods may significantly reduce the risk.

Keywords: ballast water management, aquatic invasive species, risk assessment, policy analysis, eastern Canadian Arctic, climate change

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Augusta worked as an intern with the Maritime Activity and Risk Investigation Network (MARIN) Research Group in the Industrial Engineering Department, Dalhousie University under the supervision of internship host, Dr. Ronald Pelot. Augusta's work focused on understanding the legal requirements of ballast water management in Canada, as well as performing a regional risk assessment regarding ballast-sourced species invasions. During her internship, Augusta gained skills relating to both policy analysis and risk assessment as well as a general understanding of ballast water management, both nationally and globally. She was also able to develop her GIS, statistical analysis, and critical thinking skills. Through her internship, Augusta had the opportunity to speak with various professionals in industry, government, and research and gather necessary information for her final graduate project.

Teresa MacDonald

MacDonald, T. 2016. Using Adaptive and Fisheries Management to Increase MPA Success: A Case Study of the Gilbert Bay MPA [graduate project]. Halifax, NS: Dalhousie University.

Abstract

The Gilbert Bay Marine Protected Area (MPA) was established in 2005 with the purpose of conserving the genetically discrete Gilbert Bay cod subpopulation. However, following the implementation of the MPA the cod subpopulation has continued to decline. Tagging studies revealed that adult Gilbert Bay cod travel outside of the MPA boundaries during the summer to feed. This coincides with the migration of offshore northern cod into inshore waters, resulting in the mixing of the cod subpopulations. A small commercial northern cod fishery operates adjacent to the Gilbert Bay MPA, in the area where northern cod and Gilbert Bay cod congregate. It is speculated that because of by-catch, the commercial fishery removes adult Gilbert Bay cod from the small subpopulation. One possible method for improving the effectiveness of the MPA is using a combination of management measures both inside and outside the MPA boundaries. This paper evaluates the use of adaptive management inside MPA boundaries and fisheries regulations outside of the MPA boundaries. Adaptive management could be used to strengthen the scientific indicators used to monitor the MPA and guide the development of new regulations. Fisheries regulations could be used to mitigate the impact of the commercial fishery on Gilbert Bay cod. This could be accomplished by implementing regulations to dissuade fishers from fishing near the MPA or encourage them to use fishing methods that minimize impacts on the by-catch. Using these management strategies at the same time could circumvent each of their limitations resulting in a more effective MPA.

Keywords: Gilbert Bay, MPA, Cod, Fisheries Management, Adaptive Management

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Teresa completed her internship with the Department of Oceans and Fisheries (DFO) at the Bedford Institute of Oceanography. While completing her internship at DFO she was supervised by Dr. Bradbury. Her work over the internship consisted mainly of research and data gathering for her graduate project paper.

Laura Miller

Miller, L. 2016. The fair way or the Chiloé? Exploring the role of certification in the governance of labour in aquaculture in Chiloé, Chile [graduate project]. Halifax, NS: Dalhousie University.

Abstract

Aquaculture has emerged as an increasingly important element of global food production systems as the total global population continues to rise, and climate change impacts yields in both agriculture and capture fisheries. However, in order for aquaculture to effectively contribute to food security in the face of these changes, it will need to be executed in a manner that is both environmentally and socially sustainable, the latter meaning that human suffering cannot underlie its expansion. Given the relative newness of the sector and the importance of social justice for its sustainability, it is critical that investigations into the social aspects of aquaculture are carried out to enrich the academic literature, before the sector becomes more established and further regulations are set in place. The existing scholarly literature indicates that governance of the sector has not adequately regulated labour practices in farms in the global South. Certification is promoted by NGOs as a regulatory measure to improve governance in aquaculture and other resource commodities, but the literature contests the extent to which certification is appropriate or effective for farms in the global South. This paper explores the extent to which certification is able to effectively govern labour practices in aquaculture production in the global south. The evolution of governance of labour in Atlantic farmed salmon production in Chiloe, Chile is used as a case study to exemplify the role of certification specifically, along with the state and NGOs, and what this has meant for labour. The analysis reveals that there are two ways in which certification fails to adequately govern labour practices in the Chiloe example. First, the environmental focus of the five most prominent transnational aquaculture certification standards has meant that the social criteria required to improve labour conditions are overwhelmingly absent. Second, though the literature points to the importance of collaboration amongst both public and private actors in order for certification to be effective as a regulatory measure, the case study of Chiloe shows that even when cooperation between these bodies occurs, the concerns of workers are still marginalized while the interests of industry are elevated.

Keywords: aquaculture; Chile; labour; certification; governance; sustainable livelihoods

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Laura had the pleasure of interning with Fair Trade USA in Oakland, California this past summer. Fair Trade's Seafood Program helps to strengthen fisher livelihoods by incentivizing seafood supply chains to adhere to robust and rigorous environmental and social standards that promote safe, fair working conditions and healthy, thriving communities. Laura's work with the Seafood team included market research that helped to inform the expansion of the recently established Program, public communications projects that promoted Fair Trade seafood, and the creation of a toolkit that is now used to help certificate holders understand Fair Trade's traceability requirements and how these can best be met. She had a wonderful time and made many great friends, and looks forward to watching Fair Trade seafood grow!

Kendra Moore

Moore, K. A. (2016). Evidence-informed conservation policies: Mitigating vessel noise within gray whale (*Eschrichtius robustus)* foraging habitat in British Columbia, Canada [graduate project]. Halifax, NS: Dalhousie University.

Abstract

Anthropogenic noise is increasing within our oceans from growing human use. This rise in the ambient soundscape of the marine environment is increasing pressure on the life processes and health of marine animals. Cetaceans rely on the use of sound for their life processes, and are thereby particularly susceptible to anthropogenic noise, like that from boats and other vessels.

Whale watching vessels are directly exposing whales to their noise output. The current literature postulates that baleen whales are less susceptible to smaller vessels, like whale watching boats, as smaller boats emit high frequency sound, presumed out of the range of baleen whale low frequency communication. This interaction is analyzed within the foraging habitat of the eastern Pacific gray whale (*Eschrichtius robustus*) in Clayoquot Sound, British Columbia using passive acoustic monitoring. Noise disturbance from whale watching vessels is investigated using acoustics to analyze the contribution of vessel noise to the background sound levels of gray whale foraging habitat, and the differences in gray whale vocalizations in the presence of vessel noise.

Evidence of acoustic disturbance is coupled with an analysis of the current policy regime and characterization of the Tofino whale watching fleet whale encounters to recommend future management and policy reform to minimize cumulative impacts of vessel noise on gray whales. The enablers and barriers to evidence use within policy and management are identified to ease amendments to the current strategies for effective whale conservation in BC. This evidence-use approach supports strengthening acoustic protection of cetaceans, which assists in safeguarding the local tourism activities of whale watching.

Keywords: Anthropogenic noise, passive acoustic monitoring, whale watching, gray whales, evidence-informed decision-making.

Kendra completed her internship in Ahousaht, BC, with the Whale Habitat and Listening Experiment (WHaLE) project with Dr. Dave Duffus of the University of Victoria's Whale Research Laboratory. WHaLE is a project of the Marine Environmental Observation Prediction and Response Network (MEOPAR), which aims to address whale-vessel risk utilizing passive acoustic monitoring technology. During her internship, Kendra assisted in underwater acoustic data collection, sea surface whale observations and the analysis of eastern Pacific gray whale vocalizations within Clayoquot Sound, BC. Under the supervision of Dr. Peter Wells, an adjunct professor at Dalhousie University, the interaction of vessel noise and gray whale vocalizations were analyzed within her graduate project to identify the implications for management and policy of acoustic disturbance from whale watching vessels for gray whales.

Monica Reed

Reed, M. 2016. Towards adaptive management of mooring systems to reduce the threats of yachting tourism in MPAs.

Abstract

Marine protected areas (MPAs) are often popular tourism destinations, and therefore, must be managed to accommodate tourism while protecting marine ecosystem health.
This project explored the potential for adaptive management of mooring systems to reduce the threats of yachts in MPAs, specifically The Tobago Cays Marine Park (TCMP), St. Vincent and the Grenadines, and the Sandy Island/Oyster Bay Marine Protected Area (SIOBMPA), Grenada. Linkages between processes and yachting pressures operating within the MPAs were assessed with the DPSIR conceptual framework. In-water assessments of the current mooring systems were conducted to create mooring databases. Google Earth was used to map the current locations and identify sites for the new mooring systems. Visitation data from the MPAs were analyzed to provide insight on park usage (number of yachts, people per boat, time spent in MPA, size of boats, regulatory violations). A review of literature and management documents allowed for the identification of mooring management best practices, as well as the threats associated with yachts mooring within MPAs. The research informed adaptive mooring management plans (AMMPs) for both MPAs. The AMMPs aim to maximize the benefits of mooring systems and mitigate the threats of yachts to MPAs. Indicators have been selected for monitoring with the intent of informing management adaptations and providing data to enhance the understanding of the MPAs' carrying capacities. This study contributes to the need for mechanisms to ensure that yachting tourism in MPAs does not compromise biodiversity or the delivery of ecosystem goods and services.

Keywords: marine protected areas, mooring systems, tourism carrying capacity, adaptive management

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Monica completed her internship with Sustainable Grenadines Inc. (SusGren), a non-profit organization working to strengthen and empower local communities in the Grenadines in protecting their environment and livelihoods. The opportunity was through the Queen Elizabeth II Diamond Jubilee Scholarships Program, which provided training and financial support and placed her within the program's network.

Based on Union Island, St. Vincent and the Grenadines, Monica had the opportunity to lead a project focused on minimizing yachting impacts within two marine protected areas. This allowed her to gain experience in project planning, in-water data collection, stakeholder engagement and management plan development. She also assisted with other initiatives, including monitoring and tagging leatherback sea turtles; programming for the celebration of the Caribbean Endemic Bird Festival; and technical report writing. Furthermore, SusGren put on the 2016 Annual Meeting of the Grenadines Network of MPAs so Monica had the opportunity to attend and assist with the event. This allowed her to make connections with a diverse set of people, from MPA managers to biologists to politicians, that all contribute in some capacity to enhancing sustainable livelihood opportunities and marine conservation in the Grenadines.

Catherine Schram

Schram, C. 2016. Spatial Protection for Porbeagle Sharks, *Lamna nasus,* in the Northwest Atlantic: The Road to Recovery? [graduate project]. Halifax, NS: Dalhousie University.

Abstract

Sharks have dominated the seas as apex predators for more than 400 million years, but today they are being fished by humans at an unprecedented rate. Many of the biological characteristics of sharks make them particularly vulnerable to overfishing. Conservation of sharks is critical, not only because they are a commercially valued species that are threatened with extinction, but also because sharks are keystone species and play an important ecological role in marine ecosystems. One common mechanism being used around the world to conserve marine biodiversity is the implementation of marine protected areas (MPAs). The traditional design of an MPA is limited in its capacity to protect mobile and migratory species that travel outside the boundaries of the MPA. However, the potential value that protected areas can have for pelagic conservation is becoming more widely discussed and explored. There is currently a lack of research on the relationship between mobile species and MPA networks internationally as well as in Nova Scotia, so studying the movements and migrations of these species can allow managers to better design connected areas which would have ecological, social, and economic benefits. This project examines a depleted population of endangered porbeagle sharks, *Lamna nasus,* off the Atlantic coast of Canada and evaluates the effectiveness of incorporating sharks into the Maritimes network of MPAs to assist in the recovery of this mobile predator in the temperate Northwest Atlantic. A spatial analysis of fisheries landings data using ArcGIS identified several potential sites of interest throughout the Maritimes region. Recommendations for future work include obtaining fisheries independent data on porbeagle movements and distribution, further studying the identified sites of interest, and studying how the changing climate may affect shark distributions.

Keywords: Porbeagle sharks, Marine Protected Areas, Connectivity, Conservation, Northwest Atlantic, Network Planning

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Catherine completed her internship with the Oceans and Coastal Management Division at Fisheries and Oceans Canada in Dartmouth, NS. Her internship, supervised by Maxine Westhead, allowed her to gain first hand experience in the research, planning, and consultations necessary for marine protected area establishment in Canada. Interning with Fisheries and Oceans allowed Catherine to access decades worth of shark research conducted out of the Bedford Institute of Oceanography. Throughout her time at DFO Catherine assisted with a number of projects, including compiling information on ecologically and biologically significant areas in the Maritimes Region, conducting an MPA assessment, attending a fisheries association consultation, and assisting with a public open house to engage local Nova Scotians on marine protected areas and ocean conservation in the province.

Laurie Starr

Starr, L. E. 2016. Blowing it out of the water: How breaking down illegal, unreported, and unregulated (IUU) fishing can contribute to its effective management in Indonesia using an area based approach. [graduate project]. Halifax, NS: Dalhousie University.

Abstract

Fisheries are declining on a global scale. While some of this decline has been attributed to mismanagement of fisheries leading to overcapacity and overfishing, a significant portion of the literature suggests that illegal, unreported, and unregulated (IUU) fishing should be held accountable for part of this decline. IUU fishing often employs destructive fishing methods and undermines the science behind fisheries management. Such practices are particularly prevalent in developing countries and contribute to the loss of billions of dollars each year. Too often, actions to mitigate IUU fishing address it as a single problematic unit. This project suggests that breaking up IUU fishing into three separate units might allow for more effective management. Using Indonesian tuna fisheries as a case study to evaluate this approach the first part of this study develops a framework upon which to build an "IUU vulnerability index". The second part of this study compiles a suite of NGO-initiated and government-initiated actions that work to combat either illegal, unreported, or unregulated fishing into the "IUU toolbox". Together, these approaches should provide decision makers with an alternative to the traditional blanket method to combat IUU fishing and facilitate a tailored approach to build legal, regulated, and reported (LRR) fisheries.

Keywords: IUU fishing; developing country; Indonesia; decentralization; vulnerability index; IUU toolbox

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Laurie completed her internship with Yayasan Masyarakat dan Perikanan Indonesia (MDPI), an Indonesian NGO with a focus on implementing sustainable practices in small scale artisanal fisheries. The purpose of this internship was two-fold. The first was to conduct a gap analysis on an existing tuna processing plant by comparing its current practices to how it aligned with the principles of the Marine Stewardship Council's (MSC) Chain of Custody (CoC) standard. The MSC CoC is one of the three pillars that, when combined, allow a fishery to bear the MSC label on their final product, and become "MSC certified"; a desirable certification for seafood that wishes to be marketed as "sustainable". The second component of this internship was to develop a pair of tools that MDPI could use for current and future partners to outline: (1) an overview of the supply chain and the necessary documentation within each node (i.e. fishermen, suppliers, processors, and market) and (2) recommendations on changes that should be made within the supply chain in order to better comply with the MSC CoC.

Jenny Weitzman

Weitzman, J. 2016. Assessing the potential of ecolabels to improve social acceptance within Nova Scotia's finish aquaculture industry: A stakeholder approach [graduate project]. Halifax, NS: Dalhousie University.

Abstract

While aquaculture has grown exponentially in recent years and has been promoted for its economic benefits and potential to contribute to improved food security, conflicts over public health, land use, and environmental concerns have accompanied its rapid growth. Ecolabelling is widely recognized as a market-based tool for improved sustainability in fisheries and aquaculture, but the ability of ecolabels to address diverse public concerns is not well understood. This research used a stakeholder approach to identify challenges and opportunities for ecolabelling, and discuss its potential to influence social acceptance within a controversial finfish aquaculture industry. This study used mixed-methods (Q-methodology, surveys, and interviews) to explore the perceptions of stakeholders towards ecolabelling finfish aquaculture in Nova Scotia, Canada. Results show that aquaculture producers are highly supportive of ecolabelling, but that other stakeholders have mixed opinions on their benefits, challenges and potential uptake. An analysis of current production methods found that ecolabels could have industry-wide adoption. This study argues that ecolabelling may offer economic benefits, reduce environmental concerns, and represent a shared vision between stakeholders, but is not a panacea for social acceptance. A media analysis found several prominent concerns about aquaculture. The connectedness of diverse environmental, socio-economic, and management concerns challenges the ability of ecolabels to influence social acceptance, since ecolabels only address environmental concerns. Furthermore, the variability between schemes must be acknowledged and better understood to fully assess their potential within Nova Scotia's aquaculture industry. This study provides recommendations to aquaculture producers, governments, NGOs, and other stakeholders interested in pursuing aquaculture ecolabelling.

Keywords: aquaculture; ecolabelling; certification; social acceptability; social licence; perceptions; Q-methodology

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Jenny completed her internship with the Aquaculture Association of Nova Scotia (AANS) in Halifax, Nova Scotia. She worked as an outreach assistant, and helped in the delivery of the AANS's public engagement and outreach events during the summer. During this internship, Jenny traveled throughout Nova Scotia to community events, festivals and educational events to inform the public and interested groups about aquaculture in the province. Through her internship, Jenny gained the opportunity to learn the perspectives of a range of groups, and interact with various aquaculture stakeholders. The resources and experiences provided by the AANS provided Jenny with valuable insights relevant to her research. Her academic supervisor was Dr. Megan Bailey, Assistant professor within the Marine Affairs Program at Dalhousie University and Canada Research Chair in Integrated Ocean and Coastal Governance (Tier II).

Peter Wessels

Wessels, Peter. 2016. Enhancing Small-scale Fishing Communities Through the Advancement of Women's Participation in the Sustainable Livelihoods Framework [graduate project]. Halifax, NS: Dalhousie University.

Abstract

Globally, fisheries are in a precarious position. Climate change, over-fishing and pollution threaten marine eco-systems and the communities that rely on them. As so often is the case, these pressures are experienced disproportionately by lower-income nations (LIN) and in the marine context, small-scale fisheries (SSF) in particular. Despite SSF being the dominate scale of fishing the world over they remain undervalued and inadequately managed. However, there is strong evidence that, if better understood and properly managed, they could be a more viable fishing sector than large-scale fisheries and be a unique starting point for implementing strategies addressing poverty alleviation, sustainable livelihoods and other issues facing LIN. In order to better manage SSF in the future, it will require a more holistic and participatory approach, and there may be no better place to start than by examining the substantial yet underappreciated roles of women in SSF. In many ways, the contribution of women in SSF in LIN far surpasses that of men and yet they remain marginalized not only in their roles and in decision making but even within fisheries research. This paper presents some of the evidence supporting SSF as a viable sector in LIN and more importantly the often hidden contributions of women working in these SSF. This paper present research conducted on the gender dimension in tuna fisheries in the Maldives. And finally, through the sustainable livelihoods approach and a gender focused research framework, this paper will explore strategies for enhancing conditions and standings of women working in SSF in LIN.

Keywords: Gender dynamic, small-scale fisheries, sustainable livelihoods framework, women's participation

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Peter completed his internship with the International Pole and Line Foundation (IPNLF) in the Maldives. IPNLF in collaboration with Ministry of Fisheries and Agriculture (MoFA) and the Marine Research Center (MRC) in the Maldives, is deepening their engagement with social issues in tuna fisheries sustainability, and is turning its attention to the vital, yet often under-recognized roles women have throughout one-by-one tuna supply chains and in the seafood industry generally. Acknowledging that the data on female workers is very limited, IPNLF has embarked on a program of research in the Maldives to map the roles women are playing along one-by-one tuna supply chains. Peter spent his two-month internship observing and interacting with people involved in the one-by-one tuna supply chain. In Addition, Peter had the opportunity to present his initial findings at the 6th annual Gender in Aquaculture and Fisheries conference in Thailand.

Nicolas Winkler

Winkler, N. 2016. Diving dangerously: Exploring human health and resource trade-off of extreme dive profiles in a Caribbean dive fishery. [graduate project]. Halifax, NS: Dalhousie University.

Dive fishers around the world employ compressed air diving to harvest marine living resources in the quest for livelihoods. Fishers can suffer catastrophic health consequences while exploiting these fisheries resources that are in states of overexploitation. While the health effects of diving fisheries have been well documented, the underlying drivers of unsafe dive practices remain unaddressed. Applying an ethnographic approach, this study examined why fishers undertake unsafe dive profiles in the Caribbean Spiny Lobster (*Panulirus argus*) and Queen Conch (*Lobatus gigas)* small-scale dive fishery of Grenada. Semi-structured, qualitative interview data from fishers were supplemented by direct and participant observation, and analyzed using a thematic, grounded theory approach. Factors promoting unsafe dive practices, vulnerabilities in the fishery as well as dive related risk factors were identified. Unsafe dive profiles are largely driven by uncertainties in the market for catch, which are also influenced by changes in the ecology of the fishery. Three approaches exist for fisheries managers: reduce vulnerabilities affecting fishers, address underlying drivers, and mitigating diving risk factors. Under appropriate management and socio-economic regimes it is not inconceivable that the Grenadian dive fishery could be a safe, sustainable and economically viable model.

Keywords: Dive fishery; SCUBA; decompression illness; co-management; Grenada

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Nicolas conducted six weeks of independent field research in Grenada during which he liaised with fishers, the Division of Fisheries of the Ministry of Agriculture, Lands, Forestry, Fisheries & Environment of the Government of Grenada, stakeholders in the recreational dive sector and independent air compressor operators. Nicolas conducted interviews with fishers concerning the dive practices in the multi-species SCUBA dive fishery. Nicolas also undertook participatory dives with both conch and lobster fishers. In parallel to his graduate project, Nicolas co-initiated the first global review of dive fisheries systems with Hannah Bassett at the School of Marine and Environmental Affairs, University of Washington, USA. Nicolas' graduate research was conducted under the academic guidance of Dr. Claudio Aporta (Director, Marine Affairs). Nicolas presented two separate perspectives of this research at the International Marine Conservation Congress in August in Newfoundland, Canada and at the Gulf and Caribbean Fisheries Institute in November in Grand Cayman, Cayman Islands.