Effects of Coasteering on Intertidal Rocky Shore Biodiversity

Strachan, O.[1,2], Penny, A.M.[3], Wale, M.A.[1,2]

[1] *School of Applied Sciences, Edinburgh Napier University, Edinburgh, UK – M.Wale@Napier.ac.uk*
[2] *Centre for Conservation and Restoration Science, Edinburgh Napier University, Edinburgh, UK*
[3] *Centre for Biological Diversity, School of Biology, University of St. Andrews, St. Andrews, Fife, UK*

As tourists are becoming progressively more aware of anthropogenic environmental impacts they are increasingly drawn to "ecotourism", which promises a more grassroots experience with a greater focus on immersion in local culture and nature (Ana, 2017). Ecotourism activities are often marketed as environmentally sustainable, but several emerging challenges are fueling debate over best practices, sustainable management, and growing demand (Micheli *et al*., 2017).

Many ecotourism experiences are focused on coastal areas due to their high biodiversity, natural beauty, and traditional tourist draw. This, coupled with the advancement of wetsuit technology and the increasing use of digital media to map and showcase locations of interest has led to increased interactions between recreational water users and marine organisms.

Negative local-scale impacts of increasing recreational water users fall into two main categories (Davenport & Davenport, 2006), increased demand on infrastructure, and impacts on local ecosystems and marine communities. The latter mainly occurs as a result of direct interactions between marine environments and recreational watersport participants within the intertidal zone. One such watersport is coasteering.

Coasteering originated in Wales around 15 years ago and is becoming increasingly popular around the UK. While coasteering participants navigate the rocky intertidal zone by swimming, climbing, jumping, and scrambling around various coastal features. This allows participants to engage with many intertidal organisms and become immersed in an environment often inaccessible to them.

Despite the increasing profile of coasteering as an ecotourism activity, it has been identified as a potential cause of damage to the rocky intertidal.

Here we demonstrate the potential negative effects of coasteering on the rocky intertidal site known as "The Delves", located in Dunbar, East Lothian. Species richness and abundance data were gathered at two sites; the "outer delves" an area regularly used for coasteering, and the "inner delves" an isolated undisturbed area. Specific emphasis was put on the measurement of features regularly used in coasteering.

We found that the disturbed sites had lower species richness with three species *Patella vulgata*, *Nucella lapillus*, and *Corallina officinalis* in particular having significantly reduced abundances in response to coasteering activities. Sessile species were found to be particularly susceptible to damage with reduced diversity and evenness observed at disturbed sites.

Repeated measurements are needed to fully understand if these negative effects persist, or possibly increase, throughout the coasteering season, and to generate strategies to mitigate these impacts.

References

Ana, M. I. (2017). Ecotourism, agro-tourism and rural tourism in the European Union. Cactus Tourism Journal, 15(2), 6-14.

Davenport, J., & Davenport, J. L. (2006). The impact of tourism and personal leisure transport on coastal environments: A review. Estuarine, Coastal and Shelf Science, 67(1), 280–292.

Micheli, F., Heiman, K. W., Kappel, C. V., Martone, R. G., Sethi, S. A., Osio, G. C., Fraschetti, S., Shelton, A. O., & Tanner, J. M. (2016). Combined impacts of natural and human disturbances on rocky shore communities. Ocean & Coastal Management, 126, 42–50.

Temporal trends in zooplankton and demersal fish community composition on the Scotian Slope during 1982-2019

Johanne Vad[1], Patricia Puerta[2], Zeliang Wang[3], Erica Head[3], Trevor Kenchington[3] and Ellen Kenchington[3]

[1] *Grant Institute, School of Geosciences, University of Edinburgh – johanne.vad@ed.ac.uk*
[2] *Instituto Español de Oceanograffia, Centre Oceanográfico de Baleares, Palma, Spain*
[3] *Bedford Institute of Oceanography, Department of Fisheries and Oceans Canada, Dartmouth, Nova Scotia, Canada*

Area being submitted to (delete as appropriate): *1. General Science Session.*

Preferred presentation medium (delete as appropriate): (i) oral.

We may have one of the e-poster sessions as part of a wine reception on Tue 8th Nov. Would you be available for this? (Delete as appropriate): Yes.

Are you a student? (Delete as appropriate): No.

You must be a student member of IMarESt to be eligible for the student prizes. Join for free here - https://www.imarest.org/membership/membership-registration/upgrade-your-membership/student-member-simarest

Understanding how marine ecosystem respond to environmental variation and human activities is key to predicting the consequences of climate change. We therefore analysed time series of both zooplankton (55 taxa; from spring and fall surveys) and demersal fish and invertebrate (32 taxa; from yearly trawls) community composition on the eastern Scotian Slope during 1982–2019. The study area, off Nova Scotia, Canada, is influenced by complex oceanographic interactions between warmer, north-eastward flowing waters derived from the Gulf Stream and colder south-westward flowing waters from the Labrador Current and Gulf of St. Lawrence[1]. In addition, the study area currently sees only limited fishing but did experience intense trawling before 1993[2]. Complex multivariate statistical analyses (trajectory analysis, multivariate regression trees and dynamic factor analysis) were applied to each ecological data set to assess (1) temporal trends and (2) identify potential tipping points. Abiotic field data as well as outputs from the Bedford Institute of Oceanography North Atlantic Model (BNAM)[3] were also examined to link ecological changes identified to shifts in the oceanographic conditions experienced in the region.

Considering the zooplankton data, our statistical approach revealed a single, significant linear trend common to both seasonal datasets, in which the abundances of 18 taxa decreased after 2008. Warmer-water species such as *Oithona atlantica* became more prevalent in the later part of the time-series while colder-water species (like *Calanus glacialis* or *Spinocalanus abyssalis*) appeared to decrease in abundance. Considering the demersal fish and invertebrate dataset, our statistical analysis revealed two periods of significant change in taxon abundances. First, a sharp increase in one third of the taxa was identified between 1996 and 2000. This was, for example, observed for *Lophius americanus* (American anglerfish) and *Hippoglossoides platessoides* (American plaice). Second, there was a decrease in the abundances of eighteen fish species after 2000 (including the longfin hake, *Urophycis chesteri,* or the Atlantic halibut *Hippoglossus hippoglossus*), while a few taxa, including the squid *Illex illecebrosus*, displayed strong increases in biomass towards the end of the time series.

Studies have suggested that surface and subsurface temperatures along the Scotian Slope have increased in recent decades, as the influence of warm slope water has grown[4]. This was confirmed by the analysis of satellite derived data as well as the BNAM outputs. It is believed that this increase in temperature has contributed to the biological shifts detected in both ecological compartments. This work is part of the Horizon 2020 iAtlantic project, which aims to assess the status of deep-sea and open-ocean ecosystems across the Atlantic Ocean. Analysis of ecological time-series from other study regions are underway to identify additional drivers of change across the Atlantic bassin.

References

1 Brickman, D., *et al.* (2015). Variability of Current Streams in Atlantic Canadian Waters: A Model Study. *Atmosphere-Ocean*, 56:3, 218-229.
2 Zwanenburg K. C. T., *et al.* (2000). The effects of fishing on demersal fish communities of the Scotian Shelf. *ICES Journal of Marine Science*, 57, 503-509.
3 Wang, Z., *et al.* (2018). BNAM: An eddy-resolving North Atlantic Ocean model t support ocean monitoring. *Can. Tech. Rep. Hydrogr. Ocean. Sci.*, 327: vii + 18p.
4 Brickman, D., *et al.* (2018). Mechanism for the recent ocean warming events on the Scotian Shelf of eastern Canada. *Continental Shelf Research*, 156, 11-22.

Adapting the Marine Stewardship Council's Risk-Based Framework to assess the impact of towed bottom fishing gear on blue carbon habitats

Kate Morris[1], Graham Epstein[2],other (BMF team tbc), Michel Kaiser[1], Joanne Porter[1], Andrew F Johnson[1,x]

[1]MarineSPACE group, The Lyell Centre, Heriot-Watt University, Edinburgh, Scotland, EH14 4AS, UK

[2]College of Life and Environmental Sciences, University of Exeter, Stocker Road, Exeter, EX4 4PY, UK / University of Victoria, Victoria, British Columbia, V8P 5C2, Canada.

[x]MarFishEco Fisheries Consultants Ltd, Brunswick Street, Edinburgh, Scotland, EH7 5HT, UK

Presenting author contact: kjm2001@hw.ac.uk

Area being submitted to: *1. General Science Session;*

Preferred presentation medium: (i) oral

We may have one of the e-poster sessions as part of a wine reception on Tue 8th Nov. Would you be available for this? Yes / No.

Are you a student? Yes / No.

You must be a student member of IMarESt to be eligible for the student prizes. Join for free here - https://www.imarest.org/membership/membership-registration/upgrade-your-membership/student-member-simarest

---

The abstract should be submitted to masts@st-andrews.ac.uk, in an editable format, by 16:00 Friday 19th August 2022.

*This template is an example of how to prepare an abstract for the 2022 MASTS Annual Science Meeting, to be held on **8-10 November 2022 at the Technology & Innovation Centre, Glasgow**.*

Please note that abstracts should be broad and applicable to a wide audience.

The title should be typed in font Arial 14 pt bold.

The Authors' names should be typed in Arial 9 pt, with the presenting Author underlined.

The Authors' affiliations should be typed in Arial 8 pt italics. The email address of the presenting Author is requested, and he/she will be referred to also as the Corresponding Author.

The main text should be typed in Times New Roman 10 pt.

A brief paragraph with acknowledgements may be added at the end of the main text.

A limited number of citations in the text are allowed, and the relevant list of references should be added at the end of the abstract. The references should be typed in Times New Roman 9 pt.

For consistency, please do not exceed one page in this format.

Acknowledgements

All the Authors are kindly thanked for having submitted an abstract formatted according to this template.

References

Authors (Year). Title. Journal title, number (issue) and page numbers.

Abstract: Wild capture fisheries are of global economic and social importance

providing commercial seafood and a primary source of protein to people globally. There is a broad research base on the environmental impacts of fishing gears and the processing methods involved in wild capture fisheries yet, they are also known to contribute to the global CO_2 budget. Evaluating the risk wild capture fisheries pose to ecosystem health is vital to sustainably scale fishing practices to meet increasing global nutritional needs, whilst meeting ambitions for reaching net-zero and reducing direct and indirect GHG emissions. Ecological risk assessments, trait-based assessments, and vulnerability assessments have long supported fisheries management systems globally but do not yet provide any representation regarding the impacts that fishing gears have on the ability of the habitat to capture and store carbon. Considering the importance of accessibility and transparency in approaches necessary for fisheries sustainability certifications, this paper describes a method to integrate habitat carbon capacity attributes into the Marine Stewardship Council (MSC) Consequence and Spatial Analysis (CSA) framework. Applying the CSA carbon extension developed herein produces different CSA risk scores compared to the MSC CSA that does not account for carbon. The CSA carbon extension tool developed is the first attempt made to incorporate carbon indicators into an extant risk-based framework, which can be widely adopted to assess the UK fishery's carbon impacts.

Acknowledgements: Kate Morris was funded by the James Watt Scholarship provided by HWU. Andrew Johnson was funded by HWU and the Blue Marine Foundation through MarFishEco Fisheries Consultants Ltd. Graham Epstien was funded by the Blue Marine Foundation. We would like to thank Samira Anand and Sarah Stephenson for their work collating background information that formed the background of this paper.