

Student Research Spotlight

The Redpath Museum's website is proud to present the Spotlight on graduate student research each month. Starting in June 2020, once a month, a student will be featured on the website's [Research](#) tab under *Student Research at the Museum*.

June 2020

Kirsten Crandall

Joint PhD candidate

**Millien Lab of McGill University and Kerr Lab of
University of Ottawa**



My name is Kirsten Crandall, and I was born and raised in Montréal, Quebec. I am a joint Ph.D. candidate in Dr. Virginie Millien's lab at McGill University and Dr. Jeremy Kerr's lab at the University of Ottawa.

Wide-scale education for everyone, from healthcare workers to hikers in the forest, remains the most challenging issue related to tick-borne diseases in Canada.

I was always curious about the wildlife around me. From a young age, I would collect (and proudly show my family) the shedded skins of the garter snakes from our backyard, analyze ants through a magnifying glass, and learn about different bird species at the bird feeder with my grandmother. In high school, I became enamoured by science, film, and photography, where I was convinced I would become a filmmaker. To continue to explore all these interests, I pursued an Arts and Science degree in CEGEP, which allowed me to rediscover my love for Biology. That was when the true love story began. I went on to complete a Bachelor of Science at McGill University, with a major in Biology and a minor in Psychology. During my undergrad, I volunteered at the McGill Herbarium as well as with the annual Fowler's toad (*Anaxyrus fowleri*) population survey in Long Point, Ontario. My interest in disease ecology increased while completing my Master of Science at McGill University in the Millien Lab. During this degree, I analyzed the spatial and temporal trends related to the body size variation of 17 mammalian hosts of Lyme disease in North America.

From this research and the numerous accounts of people negatively affected by tick-borne diseases near Montréal, my interest peaked as to what factors might be driving the increased number of cases of infectious diseases in Canada.

My Ph.D. research focuses on the connections between tick and mammal abundance and diversity, with disease risk and climate change at a large spatial scale in Ontario and Quebec. I like to conduct research using a wide variety of methods, such as specimen-based museum work, field surveys, field experiments, and modeling, to disentangle this complex disease system. Through discussions with members of the public during my fieldwork, I discovered that many people had limited knowledge or were misinformed about tick-borne diseases. Wide-scale education for everyone, from healthcare workers to hikers in the forest, remains the most challenging issue related to tick-borne diseases in Canada.

This poster was created to communicate my research findings on tick and mammal abundance from my fieldwork in Ontario and Quebec, while educating the public on potential risk areas in both provinces, preventative measures against ticks, and potential symptoms of tick-borne disease. The best way to combat misinformation is to create resources, like this infographic, that can be used to help educate everyone on the facts related to tick-borne diseases.



uOttawa

Tick-borne diseases

Be tick aware!

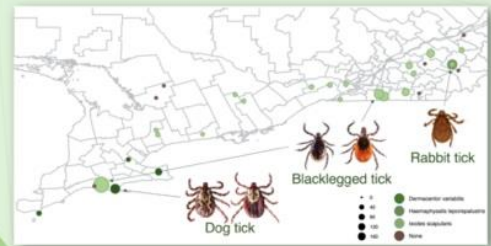
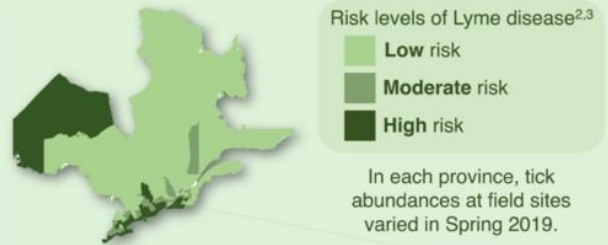
In Canada, ticks can carry multiple tick-borne diseases, which they can pass on as they feed on your blood. In 2017, over 2025 cases of Lyme disease were reported across Canada.^{2,3}



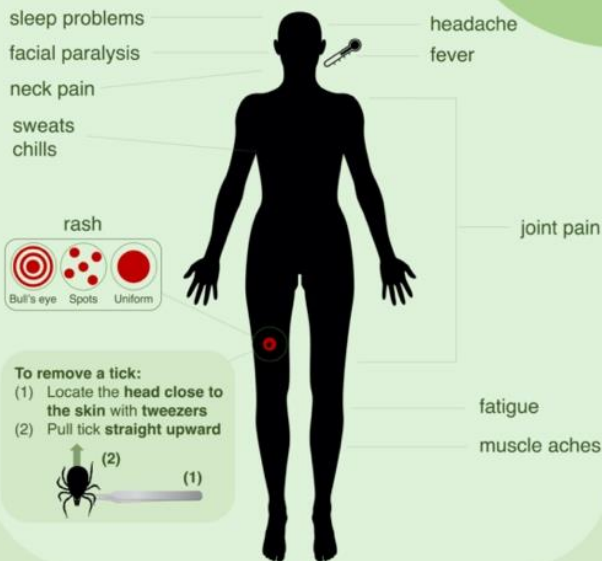
Tick three-host transmission cycle



Risk areas in Ontario and Quebec



Symptoms of tick-borne diseases⁴



Prevention^{2,3,4}



References:
 1. Keirans, J. E., H. J. Hutcheson, L. A. Durden, and J. S. Klompen. 1996. *Ixodes (Ixodes) scapularis* (Acari:ixodidae): redescription of all active stages, distribution, hosts, geographical variation, and medical and veterinary importance. *Journal of Medical Entomology* 33:297-318.
 2. Public Health Ontario. 2019. Ontario Lyme disease map 2019: estimated risk areas. Queen's Printer for Ontario, Toronto.
 3. Institut National de Santé Publique. 2019. "Cartographie du risque d'acquisition de la maladie de Lyme". <https://www.inspq.qc.ca/zoonesomatiologie-de-lyme/>
 4. Ostfeld, R. S. 2011. Lyme disease: the ecology of a complex system. New York (NY): Oxford University Press.

August 2020

Betzi Pérez Ortega

PhD candidate

Hendry Lab of McGill University



My name is Betzi Pérez Ortega, I was born and raised in the small town of Santiago in the province of Veraguas, Panama. My love for nature began at an early age, as I spent much of my childhood on my uncle's farm where I built my best memories with my family.

Our main projects focus on the long-term monitoring of humpback whales in Panama's Pacific Ocean, and bottlenose dolphins (*Tursiops truncatus*) in the Bocas del Toro archipelago on Panama's Caribbean coast



Smithsonian Tropical Research Institute

When I finished high school, I decided to attend the University of Panama and study biology. During the last year of my degree, I started to work as a volunteer in the Smithsonian Tropical Research Institute (STRI). This was my first experience working in a research project and it opened the door to more opportunities. With STRI, I worked as a research assistant in multiple projects, where I focused on organisms such as birds and social insects. The latter project on insects resulted in my first publication, where I described the behavior of a species of fungus-growing ant (*Trachymyrmex cf. zeteki*) attacked by a diverse community of parasitoids wasps. People always ask me how I moved from studying insects to whales? I saw a whale for the first time when I was doing my bachelor's thesis studying the carrying capacity and human impact on Isla Iguana, in Panama's Pacific Ocean. In that moment I decided that I wanted to study marine mammals. But it was not easy to get there. No one was studying whales or dolphins in Panama in that time, but the experiences I was earning as a research assistant at STRI helped me start to develop my scientific skills and allowed me to achieve my goal. I had the opportunity to apply to a master's degree in the Institute of Marine Sciences and Limnology at the National Autonomous University of Mexico (UNAM). When I was accepted, it was a dream come true – I would be living and studying in the "Aquarium of the World"! My Master's thesis focused on the reproductive behavior of humpback whales (*Megaptera novaeangliae*) breeding in the coast of Baja California Sur.

When I returned to Panama after my Master's, I started to collaborate with [Panacetacea](#), a new non-profit organization dedicated to the research and conservation of marine mammals in Panama. In 2017, I was elected as the president of the Panamanian branch, and I have remained in this position since. Our main projects focus on the long-term monitoring of humpback whales in Panama's Pacific Ocean, and bottlenose dolphin (*Tursiops truncatus*) in the Bocas del Toro archipelago on Panama's Caribbean coast. Since the beginning of my Ph.D. at McGill in the Hendry Lab, Bocas del Toro has been my workplace for the last 5 years. My thesis is focused on the effects of tourism boat noise on the physiology and acoustic behavior of the resident population of dolphins. This poster on my research was presented at the World Marine Mammal Conference, while the video was made for the Smithsonian Fellow Symposium video contest ([view it here!](#)) "Your project in a nutshell," where I won first place! In the words of the jury, "*this video explains the science and makes a connection to the viewers. The video draws you into the story*". I hope the video has the same effect on you. As Albert Einstein said, "*you don't really understand something unless you can explain it to your grandmother*".

Given the deep connection that we have forged with the people of Bocas, Panacetacea in collaboration with Heather Stewart from McGill and other researchers working in Bocas, we have launched a GoFundMe campaign to help families in need and those who have been the most affected by the COVID-19 in the archipelago ([view the video here!](#)). Any support from the McGill and the greater Montréal community would be greatly appreciated, as I wish to uplift the community that I have grown to love and with which I am conducting my Ph.D. research. The GoFundMe page can be accessed [here](#).

Physiological response of bottlenose dolphins (*Tursiops truncatus*) to anthropogenic stressors, Panama.

ID: 1001



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Introduction

1. Marine organisms are exposed to many natural (eg. predation, disease) and anthropogenic (noise, pollution, ecotourism) stressors.
2. Cortisol is a hormone secreted by the adrenal gland that is used as an index of a stress response.
3. Ecotourism may be considered a stressor, with high boat traffic (Fig. 1).



Figure 1. High number of tour boats following the same group of dolphins in Dolphin Bay, Bocas del Toro.

Objective

Evaluate the stress response of free-ranging dolphins with respect to boat traffic during the high and low tourism season and the potential effect in the reproductive hormones.

Methods

- 26 biopsy samples were collected during high (Nov-Apr) and low (May-Oct) tourist season in Dolphin Bay, Archipelago of Bocas del Toro, Panama (Fig. 2).
- Validated enzyme immunoassays were used to measure blubber concentrations of cortisol, progesterone and testosterone.



Figure 2. Map of the study area. In the right corner, Tristan, one of the animals biopsied in Dolphin Bay.

Cortisol concentration of Bocas dolphins tends to be significantly higher during the high tourist season compared with the low season.



Acknowledgments

All samples were collected under the Ministry of Environment of Panama scientific permit NP-SEJA-88-18 and approved by the Institutional Animal Care and Use Committee of the Smithsonian Tropical Research Institute-STR. We thank to A. Guzmán, D. Barragán, Ch. Beteta and J. Torczyk and K. Mathison for their field and lab assistant support. Funding for this project was provided by: A. Hendry Lab, Department of Biology and Redpath Museum at McGill University and the following institutions and organizations.



Results

- Overall mean \pm SD cortisol value was 0.43 ng/g \pm 0.29 (n=16) and ranged from 0.07 to 1.05 ng/g.
- No significance difference was found between males and females; $t(14)=-1.95$, $p=0.07$ (Fig. 3a).
- Cortisol concentration tend to be significantly higher (0.52 ng/g \pm 0.31) during the high tourist season compared with the low season (0.26 ng/g \pm 0.14; $p=0.038$) (Fig. 3b).
- No relationship between blubber cortisol and testosterone have been detected yet ($r=0.04$, $p>0.05$). Progesterone can not be determined yet from our data.
- The lower value of progesterone was 1.07 ng/g and the higher value was 49.17 ng/g, both from the same animal known as Tristan.

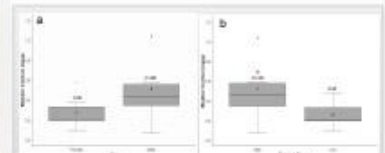


Figure 3. Blubber cortisol concentration of Bocas bottlenose dolphins measured in male and female and during high and low tourism season.

Conclusions

- Our preliminary results suggest that bottlenose dolphins in Bocas del Toro physiologically respond to the high number of tour boats operating during the high tourism season. Nevertheless, the cortisol mean value in this study is very low compared with the 1.4 ng/g and 5.6 ng/g reported by Champagne et al. [1, 2] respectively. This difference in the baseline mean values could be the result of the sampling technique. Remote biopsy sampling, used in this study, is a less invasive technique than capture-release. Also, the lack of relationship between cortisol and reproductive hormones could suggest that this population is under a temporal acute stress rather than a chronic stress.
- Two females were sampled and showed high concentration of progesterone, suggesting that they were pregnant.

Ongoing research

Includes the analysis of biopsy samples from a control population of dolphins that is not involved in dolphin-watching activities.

Literature cited

- [1] Champagne et al. *Mar Mamm Sci* 2017, 33(1): 134-152.
- [2] Champagne et al. *Gen. Comp. Endocrinol.* 2018, 244: 176-183.