BeeCon 2020

Keynote Speaker:

Dr. Quinn McFrederick

from the University of California, Riverside presenting…

“Leveraging Symbionts to Protect Wild and Managed Pollinators”

October 16, 2020

Virtually Hosted by:

Centre for Bee Ecology, Evolution and Conservation (BEEc)

York University, Canada

The mission of BEEc is to foster interdisciplinary, innovative, collaborative, and cutting-edge research to be used for the advancement of knowledge and implementation of policy changes to help sustain pollinators globally.

For more information about BEEc, please visit https://bees.yorku.ca/

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About BeeCon

Fostering an inclusive, barrier-free, and safe space to host BeeCon is paramount. We aim and are committed to ensuring that while attending this event, every person feels safe, respected and free from harassment and discrimination. All event participants, speakers and guests are expected to uphold these values and York’s commitment to being a “welcoming and approachable campus, embracing global perspectives and differences in cultures, people and thinking, by engaging communities in collegial dialogue” (York University Free Speech Statement of Policy 2018, s.3(1)).

BeeCon is an annual free symposium for local and international melittologists (bee biologists) to present & discuss their work on a wide range of bee-related topics, including behaviour, genetics & genomics, ecology, and conservation. The inaugural BeeCon meeting took place in 2011 & has since been organized & hosted annually by YorkU researchers.

Support for this event has been provided by York University’s Vice-President Research & Innovation, the Faculty of Science and the Faculty of Environmental & Urban Change.

BeeCon logo by: Spencer Monckton.

PROGRAM (eastern standard time)	
9:15-9:30 am	Welcome & land acknowledgement
9:30-9:45 am	Biology of Some Weird Beetles Parasitic on Bees in Ontario Nora Romero
9:45-10:00 am	Opposing pressures of climate change and agricultural intensification on a native bee Evan Kelemen
10:00-10:15 am	Behavioural Characterization of a Solitary Bivoltine Sweat Bee, *Lasioglossum* (*Dialictus*) *ellisiae*, From an Ancestrally Eusocial Subgenus Lyllian Corbin
10:15-10:30 am	Networks Analysis with Bee Biology Included - Do the Conclusions Change? Bob Minckley
10:30-11:00 am – COFFEE BREAK	
11:00-12:00 pm	Keynote: Leveraging symbionts to protect wild and managed pollinators Quinn McFrederick, University of California, Riverside, USA
12:00-12:15 pm	Beneficial Microbes in Apiculture to Reduce the Need for In-hive Medications Brendan Daisley
12:15-12:30 pm	Impact of Delivery Method and Geographical Location on Probiotic Efficacy in Honey Bees Andrew Pitek
12:30-1:30 pm – LUNCH BREAK	
1:30-1:45 pm	Conservation Genomics of the Declining *Bombus terricola* Nadia Tsvetkov
1:45-2:00 pm	Insights into the phylogeny and biogeography of the cleptoparasitic bee genus *Nomada* Katherine Odanaka
2:00-2:15 pm	Applying Collections-based Phylogenomics to Everyone's Favourite Vegetarian Wasps Spencer Monckton
2:15-2:30 pm	The Effect of Aging Honeybee Queens on The Mutation Rate of Drones Dova Brenman-Suttner
2:30-2:45 pm	The Bee-CR: Up-cycling an Old PCR Machine Gives it New Purpose as an Insect Rearing Incubator Jessica deHaan
2:45-3:15 pm - BREAK	
3:15-3:30 pm	Tool use by Honey Bees: *Apis cerana* Bees Defend Their Colonies from Attacks by Giant Asian Hornets with Animal Dung Gard W. Otis
3:30-3:45 pm	Details of Provisioning Behaviour by the Hoary Squash Bee (*Eucera (Peponapis) pruinosa*) on Cultivated Cucurbita D. Susan Willis Chan
3:45-4:00 pm	Modeling Pollinator Foraging Behavior and Pollen Carryover Causes Rank Inversions in Estimated Pollinator Importance James (Keng-Lou) Hung
4:00-4:15 pm	Conservation Priority Areas for Canadian Bumble Bee Species Under Current and Future Climate Scenarios Amanda Liczner
4:15-4:30 pm	Community Science Adds to Our Knowledge About Bumble Bee (Apidae: *Bombus*) Distribution, Status, & Natural History Information: A comparison of the Bumble Bee Watch Program to a Database of North American Researcher-Collected Records Victoria MacPhail
4:30-4:45 pm	Examining the Canadian Public's Awareness of Bee (Hymenoptera: Apoidae: Anthophila) Conservation Nyssa Trip
4:45-5:00 pm	Closing Remarks
Social Hour	

LAND ACKNOWLEDGEMENT

We recognize that many Indigenous nations have longstanding relationships with the territories upon which York University campuses are located that precede the establishment of York University. York University acknowledges its presence on the traditional territory of many Indigenous Nations. The area known as Tkaronto has been care taken by the Anishinabek Nation, the Haudenosaunee Confederacy, the Wendat, and the Métis. It is now home to many Indigenous Peoples. We acknowledge the current treaty holders and the Mississaugas of the Credit First Nation. This territory is subject of the Dish With One Spoon Wampum Belt Covenant, an agreement to peaceably share and care for the Great Lakes region.

ABSTRACTS

Biology of Some Weird Beetles Parasitic on Bees in Ontario

Nora Romero, Packer Lab, York University

Authors: Nora Romero

Bees are parasitized by a number of insects, including the bizarre beetles in the genus *Ripiphorus* (Coleoptera: Ripiphoridae). Like other members in the family, *Ripiphorus* are an exceptional group of beetles. All species are parasitic on bees, and their life history includes larval phoresy, hyper-metamorphosis, and endo- and ecto-parasitism, habits almost unknown in the Coleoptera. Due to this complex life history, records of *Ripiphorus* are scarce, and details in their biology such as bee host species and plant associations are incomplete or lacking for most species of *Ripiphorus*. In this study I report the observations of *Ripiphorus fasciatus* (Say) primary larvae (triungulins) on 15 species of sweat bees (Hymenoptera: Halictidae), nine of which have not been recorded as bee host species for any *Ripiphorus* species. I also report the observation of eggs and live triungulins of *R. fasciatus* (Say) in flowers of Canada goldenrod (*Solidago canadensis*) and the capture of the beetle's adult female in the same plant. Descriptions of eggs and live triungulins of *R. fasciatus* (Say) and their observations on *S. canadensis* have not hitherto been recorded, which not only make these findings unique, but they also raise questions on the ecological role of *Ripiphorus* parasitism as a population-limiting factor of sweat bees in the area.

Opposing Pressures of Climate Change and Agricultural Intensification on a Native Bee

Evan Kelemen, Rehan Lab, York University

Authors: Evan Kelemen, Sandra Rehan

Anthropogenic activities are rapidly changing the environment, and species that do not respond face a higher risk of extinction. Species may respond to environmental changes by modifying their behaviors, shifting their distributions, or changing their morphology. Recent morphological responses are often measured by changes in body size. Changes in body size are often attributed to climate change, but may instead be due to changes in available resources associated with climate change. The intertwined effects of temperature and resource abundance can be uncoupled in populations of the small carpenter bee *Ceratina calcarata*, as agricultural land-use has reduced the abundance of wildflower resources available to this bee independent of climate change. We studied how the morphology of this bee has changed over the past 118 years (1902 – 2019) in relation to climate change and land-use. Over this time, summer temperatures increased. We found that male and female size decreased with increasing temperature. Male size also decreased with agricultural intensification. Female size, however, increased with agricultural intensification. These results suggest that rising temperatures correlate with a decrease in female

body size, while, opposite to predicted, decreasing local resources may select for increased in female body size. These opposing pressures act concurrently and may result in bee extirpation from agricultural habitats if selection for large sizes are unsustainable as temperatures continue to increase. Furthermore, this study emphasizes the need to consider multiple environmental stressors when examining the effects of climate change due to their interactions.

Behavioural Characterization of a Solitary Bivoltine Sweat Bee, *Lasioglossum (Dialictus) ellisiae*, From an Ancestrally Eusocial Subgenus

Lyllian Corbin, Richards Lab, Brock University

Author: Lyllian Corbin, David Awde, Miriam Richards

Sweat bees are well known for their remarkable social diversity and plasticity, however, the social behaviours of many species remain unknown due to a lack of empirical data. This is especially true for the behaviourally diverse subgenus, *Lasioglossum (Dialictus)*. Our objective was to investigate the social organization of *L. ellisiae*, an abundant *Dialictus* species in southern Ontario that is predicted to be eusocial. Based on inferences from pan-trapped specimens, we found that *L. ellisiae* exhibits a bivoltine flight phenology. Spring and summer females significantly differed in head width but showed similarly high levels of wear and ovarian development as expected for solitary species. Comparisons to a eusocial sweat bee, *L. laevissimum*, confirmed that *L. ellisiae* females do not exhibit a eusocial life history strategy. Thus, *L. ellisiae* is likely solitary bivoltine. Considering the ancestrally eusocial state of *Dialictus*, our findings suggest that *L. ellisiae* represents a reversal from eusociality to solitary bivoltine behaviour similar to its close relative, *L. vierecki*.

Networks Analysis with Bee Biology Included - Do the Conclusions Change?

Bob Minckley, University of Rochester

Authors: Lindsey Perrin and Bob Minckley

Network analysis is widely used to understand how bee-plant relationships respond to disturbance, restoration, extinction and climate change. Network stability and robustness is gauged by linkages and nestedness among other measures. A pervasive result is that abundant, widespread, social species provide the greatest structure in bee-plant networks. Rarely considered is how network structure changes with sampling protocol and intensity and the contribution of pollen specialist, pollen generalist, and cleptoparasitic bee species. We analyze a rigorously sampled community of 62 plant species and 237 bee species with a diverse set of oligolectic, polylectic and cleptoparasitic bee species, and few social species. Incorporating bee biology revealed that polylectic species maintained the greatest proportion of linkages, rather than species that were abundant. However, extrapolating our findings to understanding how the removal of bee species affects this community would require far more information on the mating system of the flora and the temporal and spatial dynamics of the flower-visiting bees.

BREAK

Megachile campanulae nest-making, back yard sensory bee cabinet, Toronto

Author: Sarah Peebles

tech: Stephen Humphrey, video, Rob Cruickshank, electronics, Dafydd Hughes, editing

KEYNOTE: Leveraging Symbionts to Protect Wild and Managed Pollinators

Quinn McFrederick, University of California, Riverside

The study of bee associated microbes - both beneficial and detrimental - is an important part of bee conservation. The McFrederick lab uses molecular and microbiological tools to understand these associations, with the ultimate goal of leveraging these associations to increase wild and managed pollinator populations and communities. In this talk, we will cover the data we have gathered that supports the hypothesis that flowers are hubs of microbial transmission, the novel microbes that we have described and our current understanding of their functional potential, how specialization and network position may affect microbial exposure and transmission, and interactions between bacterial symbionts, toxins, and pathogens.

Beneficial microbes in apiculture to reduce the need for in-hive medications

Brendan Daisley, Thompson Lab, Western University

Authors: Brendan A. Daisley, Andrew P. Pitek, John A. Chmiel, Shaeley Gibbons, Anna M. Chernyshova, Kait F. Al, Kyrillos M. Faragalla, Jeremy P. Burton, Graham J. Thompson & Gregor Reid

The prescribed use of antibiotics in apiculture is intended to prevent bacterial disease but can inadvertently harm bacterial symbionts that naturally promote honey bee health. For example, we find that routine administration of oxytetracycline can increase tetB (an efflux pump-based resistance gene) abundance in the gut microbiota of nurse-age workers and at the same time deplete key symbionts known to regulate immune function and nutrient metabolism, such as *Frischella perrera* and *Lactobacillus* Firm-5 strains. Moreover, these microbial changes were functionally associated with a ~50% decrease in capped brood (marker of hive nutritional status and productivity) and a ~30% reduction in antimicrobial capacity of adult hemolymph (indicator of immune competence). To assess how probiotic lactobacilli might be used counter these negative effects on hives and potentially reduce the need for antibiotics, we fed three specific *Lactobacillus* strains (2 strains exogenous/1 strain endogenous) to bee colonies using an edible BioPatty. The results showed that probiotic supplementation during the antibiotic recovery period alleviated some of the antibiotic-induced dysbiosis in comparison to the control groups that were treated with oxytet but did not receive probiotics. In addition, BioPatty usage also lowered larval pathogen loads of *Paenibacillus* larvae, thus complementing the intended effect of oxytet. We suggest that microbial-based therapeutics can serve as a sensible adjunct or alternative to antibiotics in regular hive management.

Impact of Delivery Method and Geographical Location on Probiotic Efficacy in Honey Bees

Andrew Pitek, Thompson Lab, Western University

Authors: Andrew P Pitek, Brendan A Daisley, John A Chmiel, Anna M Chernyshova, Gregor Reid & Graham J Thompson

Mounting evidence indicates that the microbiome (i.e., microorganisms living on/in a multicellular organism) of honey bees can greatly influence health trajectory in the face of a wide range of environmental stressors. The overall goal of our research is to utilize beneficial microbes to help improve honey bee resistance to nutritional stressors, parasitic pests, and infectious diseases within the context of Ontario's agri-food complex. In the present study, a three-strain probiotic was delivered as an edible BioPatty or an aerosol mist to apiaries in Ontario sites representative of natural, urban and agricultural landscapes. Early results show that both oral and topical delivery of the Lactobacillus strains accelerate colony build-up in a practical manner (easy to deliver products) that could be adopted by beekeepers, at least within a small apiary (~20 colonies) setting. Encouragingly, it appears that the oral treatment, in particular, is associated with low Varroa load (less than one mite per 100 bees), especially in urban habitats. Investigations are ongoing to test for differences in pathogenic bacteria responsible for American and European foulbrood diseases, and to further assess the anti-pathogenic and anti-parasitic properties of the probiotic formulation.

LUNCH BREAK

Conservation Genomics of the Declining *Bombus terricola*

Nadia Tsvetkov, Zayed Lab, York University

Authors: Nadia Tsvetkov, Victoria MacPhail, Sheila Colla, Amro Zayed

Bombus terricola is in decline and was recently placed on the IUCN Red List of Threatened Species. The reasons for the decline are not known, but pathogens were previously implicated and pesticide use is a strong predictor of species loss. Here, we use a conservation genomics approach to shed light on factors affecting the decline of this species. We sequenced the transcriptomes of 30 *B. terricola* worker abdomens from agricultural and non-agricultural sites. We found that workers collected from agricultural areas had upregulated genes that were associated the KEGG pathway for the biosynthesis of antibiotics. We then compared our list of deferentially expressed genes with previously published work in *Apis mellifera*. We found statistically significant overlaps with studies that exposed honey bees to pesticides and certain pathogens. An analysis of the non-terricola RNA found in the abdomens of our workers, confirmed the presence of these pathogens.

Insights into the Phylogeny and Biogeography of the Cleptoparasitic Bee Genus *Nomada*

Katherine Odanaka, Rehan Lab, York University

Authors: Katherine Odanaka, Michael Branstetter, Sandra Rehan

The cleptoparasitic bee genus *Nomada* (Hymenoptera: Apidae) is the most diverse lineage of cleptoparasitic bees and is found on every continent except Antarctica. Previous morphological work of the genus established 16 distinct species groups, however the validity of these groups has not been confirmed using molecular data. Additionally, there are two competing hypotheses regarding the biogeography of the *Nomada*: one suggesting an origin in South America and another suggesting a South African origin. Neither of these hypotheses have been formally tested. Using molecular techniques, we 1) tested the validity of the previously established 16 species groups, 2) use fossil calibration points to establish the age, and 3) use ancestral state reconstruction to infer the biogeography of *Nomada*. Ultraconserved elements (UCEs) are used to construct a phylogenetic tree representing each of the 16 species group and cover every ecoregion for biogeographic analyses. These data support 15 of the 16 formerly established species groups and suggests the need for revision of the remaining group. Here we present the first molecular phylogeny and historical biogeography for the *Nomada*. These results provide an important foundation for understanding their diversification and will be invaluable for future studies examining host-parasite relationships.

Applying Collections-based Phylogenomics to Everyone's Favourite Vegetarian Wasps

Spencer Monckton, Packer Lab, York University

Author: Spencer K. Monckton

Hymenopterous insects are among the world's most ecologically and economically significant animals, and potentially the most speciose order of insects. They include herbivores, pollinators, and natural enemies of other insects, yet their diversity – along with the underlying processes that give rise to it – remains largely unknown. Recent advances in both sequencing technology and bioinformatics have made it possible to tackle these problems with increasing ease, using genomic-scale molecular data the likes of which can now be obtained from museum specimens up to one hundred years old. As part of my research, I am using these methods to study the diversity of my favourite vegetarian wasps: sawflies. In particular, I am using an approach called hyRAD to recover genome-wide restriction site associated DNA (RAD) data from sawfly specimens up to eighty years old, obtained from natural history collections across North America. My objective is to use these data to investigate intraspecific and population-level patterns of genetic diversity, to infer likely glacial refugia, and to reconstruct routes of post-glacial recolonization for three widespread, northern North American species. I will discuss the use of this and other 'reduced representation' techniques (e.g. UCEs) to study hymenopteran diversity at varying scales – especially for everyone else's favourite vegetarian wasps: bees.

The Effect of Aging Honeybee Queens on The Mutation Rate of Drones
Dova Brenman-Suttner, Zayed Lab, York University

Authors: Dova Brenman-Suttner, Amro Zayed

Honeybees *(Apis mellifera)* are eusocial insects with defined social castes ranging from reproductives (diploid female queens and haploid male drones) to workers (diploid females) that perform colony tasks. Sociality in insects is associated with increased longevity of the reproductive queen caste and increased recombination; both processes may lead to elevated rates of mutation. Mutations generate the variation on which natural selection may act to allow organisms to adapt to different environments. However, because the mutation rate in honeybees, and specifically aging queen bees, has yet to be addressed, we are unable to understand how recombination and queen age contribute to the rate of mutation and evolution. Here, I test the hypothesis that the age of queens will affect the mutation rate of her haploid gametes, as evidenced by sequencing her haploid sons.

The Bee-CR: Up-cycling an Old PCR Machine Gives It New Purpose as an Insect Rearing Incubator Jessica deHaan, Richards Lab, Brock University

Authors: Jessica L deHaan, Miriam Richards

For my Masters project I am investigating the effects of developmental temperature due to nesting site, on the physiology of the small carpenter bee, *Ceratina calcarata*. These native bees are easy to relocate to experimental sites because of their nesting substrate; raspberry, teasel, or sumac twigs, and similarly easy to rear under lab conditions to observe their development. However, without access to an insect incubator, I could not accurately replicate the developmental temperatures that bees in sunny and shady locations experience. An attempt to design an in-field rearing system in which juveniles could be routinely examined, was not successful. I did, however, have access to an Eppendorf Mastercycler gradient PCR machine which was no longer suitable for molecular work. The PCR machine was programmed to replicate the extreme temperatures that a developing *C. calcarata* might experience, based on historical temperature data in Niagara. *C. calcarata* offspring were placed in their own 0.5ml microcentrifuge tube with the lid pierced to create a small air hole. Juvenile bees from the sun treatment were placed on the "warm" side of the PCR machine, while bees from the shade treatment were placed on the "cool" side and allowed to complete development.

BREAK

Native Bee Nest Sites

Author: Sarah Peebles
tech: Rob Cruickshank, video editing

Tool use by honey bees: *Apis cerana* bees defend their colonies from attacks by giant Asian hornets with animal dung Gard W. Otis, University of Guelph

Authors: H.R. Mattila, L.T.P Nguyen, H.D. Pham, O.M. Knight, and N.T. Phan

The ecological success of social insects stems from the ability of their work-forces to efficiently gather resources that fuel colony activities and to effectively defend their centralized, resource-rich nests. In Asia, honey bees have evolved under tremendous predatory pressure from social wasps in the genus *Vespa*, the most formidable of which are the giant hornets that recruit their nestmates to bee colonies and attack honey bee colonies in groups in order to kill adult defenders, occupy their abandoned nests, and prey on brood. We document for the first time an extraordinary collective defense used by *Apis cerana* colonies against the giant Asian hornet *Vespa soror* in Vietnam. In response to attack by these hornets, honey bees foraged for animal feces and applied spots of it and other filth materials around their nest entrances. Fecal spotting increased both in response to attacking hornets and to the marking pheromone that scout hornets apply during recruitment of their nestmates. Residual spotting continued for days after attacks ceased. Moderate to heavy fecal spotting suppressed attempts by *V. soror* workers to penetrate nests by lowering the incidence of multiple-hornet attacks and substantially reducing the likelihood of them approaching and chewing on entrances to breach nest walls. We argue that *A. cerana* forages for animal feces because it has properties that repel this deadly predator from nest entrances, providing the first report of tool use by honey bees and the first evidence that they forage for solids that are not derived from plants.

Details of Provisioning Behaviour by the Hoary Squash Bee (*Eucera (Peponapis) pruinosa*) on Cultivated Cucurbita D. Susan Willis Chan, Raine Lab, University of Guelph

Authors: Willis Chan, D. S. & Nigel E. Raine

The hoary squash bee (*Eucera pruinosa*) is a strict pollen specialist on cultivated *Cucurbita* (pumpkin and squash) across much of its range where there are no wild *Cucurbita* species. Here, I examine all aspects of nest provisioning by the hoary squash bee to determine the constraints on reproduction in the context of *Cucurbita* crops. Data were collected under field or semi-field conditions. Cultivated *Cucurbita* provided about 50,000 pollen grains per staminate flower, of which ~6% was displaced into the base of the flower where it was wasted. On a single foraging trip, bees collected ~3000 pollen grains. A fully-provisioned nest cell contained ~63,000 pollen grains. Based on these, about 20 foraging trips would be required to provision a nest cell. A provisioning cycle included time spent foraging and time spent within the nest between foraging trips. Under semi-field conditions, bees spent 9.72±0.33 minutes per provisioning cycle. There was a significant difference in the duration of provisioning cycles among the 48 bees observed and among observation days, but no significant difference in the duration within a day. The total amount of time needed to provision a nest cell was ~3 hours, corresponding to the period when pollen is available on *Cucurbita* flowers. Therefore, within the context of cultivated *Cucurbita*, hoary squash bees can produce one offspring per day. This information provides evidence that association with crops allows hoary squash bees to maximize their full reproductive potential, possibly explaining their successful expansion from Meso America across temperate North America.

Modeling Pollinator Foraging Behavior & Pollen Carryover Causes Rank Inversions in Estimated Pollinator Importance Keng-Lou James Hung, Thomson Lab, University of Toronto

Authors: Keng-Lou James Hung, Sophia L. Fan, Caroline G. Strang, James D. Thomson

Traditional approaches of evaluating pollinator importance have generally focused on quantifying pollinator abundance, flower handling time, and single-visit pollen deposition capacity. In combination, these metrics generate a compelling picture of the relative contributions of different pollinator taxa to the pollination of a given plant population. However, this traditional framework eschews the critical fact that approximately half of angiosperms species are self-incompatible, which means that the transfer of self versus outcross pollen needs to be distinguished in order to evaluate pollinator importance. Here, we documented the foraging behaviors of three bee genera (Andrena, Apis, and Bombus) in apple orchards to assess genus-level differences in outcross pollen transfer potential. In addition to the aforementioned traditional metrics for each taxon, we also measured the number of consecutive flowers visited per tree and the likelihood of switching to a different row upon departing a tree. The three bee genera differed with respect to many of the measured metrics, and their relative rankings changed as a function of (i) which metrics were included in assessing pollinator importance and (ii) underlying assumptions about pollen carryover patterns. Our results suggest that incorporating even straightforward observations of pollinator foraging behavior may have large impacts on estimates of the relative importance of different pollinator taxa for the pollination of a given plant species.

Conservation Priority Areas for Canadian Bumble Bee Species Under Current and Future Climate Scenarios Amanda Liczner, University of British Columbia, Okanagan

Authors: Amanda Liczner, Leif Richardson, Richard Schuster, Sheila Colla

Conserving habitat is necessary for protecting declining species, but identifying the most effective areas to conserve can be challenging. Bumble bees are among the most declining pollinators and are in need of effective conservation strategies. The objective of this study is to identify conservation priority areas for all Canadian bumble bees under current and future climate scenarios. We combined species distribution models with mathematical optimization program to identify which areas are most effective for conserving bumble bee species while minimizing costs. The models were performed for three different climate scenarios (current climate, low-carbon future, high-carbon future) and two conservation objectives to maximize the number of species, and phylogenetic diversity The conservation objectives produced similar areas of conservation priority with the Rocky Mountains, southern Ontario, and the southern Maritime region consistently identified as important for bumble bee conservation. Bumble bee conservation priority areas are not well represented within current protected areas. Future climate projections shift the priority areas northward, and into higher mountains. These identified priority areas are important to focus bumble bee conservation efforts to provide the most benefit to at-risk species while maximizing limited conservation resources.

Community Science Adds to Our Knowledge About Bumble Bee (Apidae: Bombus) Distribution, Status, and Natural History Information: A Comparison of the Bumble Bee Watch Program to a Database of North American Researcher-collected Records
Victoria MacPhail, Colla Lab, York University

Authors: MacPhail, V.J., Hatfield, R., and Colla, S.R.

Community science (aka citizen science) is a fast-growing field that involves members of the public collecting and/or analyzing scientific data. It has the potential to increase the scale and scope of data beyond that researchers could accomplish alone, leading to improved conservation efforts and policies, amongst other positive outcomes. Here we compared data collected by volunteers with the Bumble Bee Watch program (launched 2014) to data collected or collated by researchers (dating back to the early 1800s) on a per-species, province/state, ecoregion, and grid basis. While the Bumble Bee Watch program made up a small amount of the overall dataset (8.5% of 519,294 records) it represented a quarter of the records for the last decade (44,135 of 176,136). Forty-one out of 48 species, and all 63 provinces, territories, and states of Canada and the United States, were represented, with more records for ten species and more grids and ecoregions with records in the last decade as compared to the researcher data. Additionally, Bumble Bee Watch users provided new locations of rare species, confirmation of changes in distribution, new forage plant information, and more, particularly when compared over the last decade. While not a replacement for traditional research, community science complements it and improves our overall knowledge of these important pollinators.

Examining the Canadian Public's Awareness of Bee (Hymenoptera: Apoidae: Anthophila) Conservation Nyssa Trip, Colla Lab, York University

Authors: Nyssa van Vierssen Trip, Victoria MacPhail, Sheila R. Colla, Beatrice Olivastri

Understanding the general public's knowledge and perceptions of an issue can help drive action on the part of decision-makers. Such understanding is critical when decision-makers are faced with multiple stakeholders, which is the case with biodiversity conservation issues. We surveyed the Canadian general public using a telephone questionnaire to assess the level of knowledge and perceptions of native wild bee (Hymenoptera: Apoidea: Anthophila) health and conservation. We found that the general level of bee knowledge among participants was low. Half of participants named the non-native managed European honeybee (*Apis mellifera* Linnaeus 1758) as a wild bee, native to Canada. Over two-thirds of participants stated the provisioning of ecosystem services (ES) is the most important reason to conserve bees. Half of participants thought the Canadian federal and provincial government should be principally responsible for bee conservation. One-third of participants perceived no personal barriers to bee conservation and nearly one-quarter stated they did not know how to help bee conservation efforts. Our results highlight that scientific researchers can play an important role in outreach and education and environmental non-governmental organizations (ENGOs) can take an active lobbying role at the provincial and federal levels with respect to bee conservation.

Alys Tomlinson/Getty Images

Honey Milk Tea:

https://www.allrecipes.com/recipe/213146/honey-milk-tea-hong-kong-style/

Honey Coffee:

https://www.thespruceeats.com/cafe-con-miel-recipe-765369

Salad Dressing:

https://www.foodandwine.com/recipes/honey-lemon-dressing

Moody Mixologist

BeeCon 2020 Après:

https://www.moodymixologist.com/blog/pineapple-chamomile-lemonade

https://cookieandkate.com/bees-knees-cocktail-recipe/

Still looking for more honey recipes?

https://www.delicious.com.au/recipes/collections/gallery/22-impressive-desserts-made-with-honey/g4m3gn2i?page=2

Thank you for joining us!