



Evaluating the Quality of Citizen Science Bee Observations



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• Reports of bee declines have created a groundswell of interest in the important role of bees in ecosystem functioning, agricultural production, and their presence around us in protected areas, green spaces, and even our own backyards. People want to get involved and help to make a difference; gardeners, naturalists, land owners, and policy makers can all play a role in the conservation and monitoring of bees.

• Long-term monitoring programs that make use of citizen scientists are an ideal way to provide public education while collecting important ecological information. Successful citizen science programs must be properly developed if they are to produce valuable results that augment regular scientific research.

• The PollinatorWatch program was designed to engage citizen scientists in monitoring pollinating insects visiting flowers, but it has not yet been examined for how accurately it characterizes the bee fauna.

Can citizen scientists produce high quality data relevant to monitoring bees?

How can volunteer bee observations best be organized to provide reliable data to ecologists?

METHODS

Research Sites

- Two urban conservation areas in southern Ontario: Royal Botanical Gardens in Burlington and the *rare* Charitable Research Reserve in Cambridge
- Six sites selected to reflect the habitats that a typical observer might use as part of PollinatorWatch
- Mixed meadows with a variety of floral resources available throughout the season

Data Collection

- July through September 2009
- Sites were visited as frequently as possible throughout the season when weather conditions were ideal for bees (min. 15°C, low wind, no rain, dry vegetation)
- Volunteers were provided classroom and field training where they learned about this project, data collection procedures, and how to distinguish between bees, flies, beetles, wasps, & other flower visitors

Observation data	Specimen data
19 citizen scientists: Volunteer Land Stewards, Master Gardeners, and staff members at the research sites	1 researcher
Watched bees ¹ : using a 1m ² patch of flowers for 10 minutes and recorded which flowers the bees visited	Caught bees ¹ : i) on flowers in bloom in a sweep net for 30 minutes ii) in 15 pan traps coloured yellow, white, or blue placed on the ground
Bees organized by type based on recognizable, morphological characteristics	Bees identified to species level in the laboratory

¹The differences in protocol meant that a different number of bees could have been encountered, depending on whether or not they were foraging. To account for this discrepancy, we have used proportions rather than abundance of each bee type in our analyses.

TYPES OF BEES

Each citizen scientist used one of three schemes to organize their bee observations. Two schemes were based on existing citizen science programs and one was designed to investigate a new system for bee monitoring.

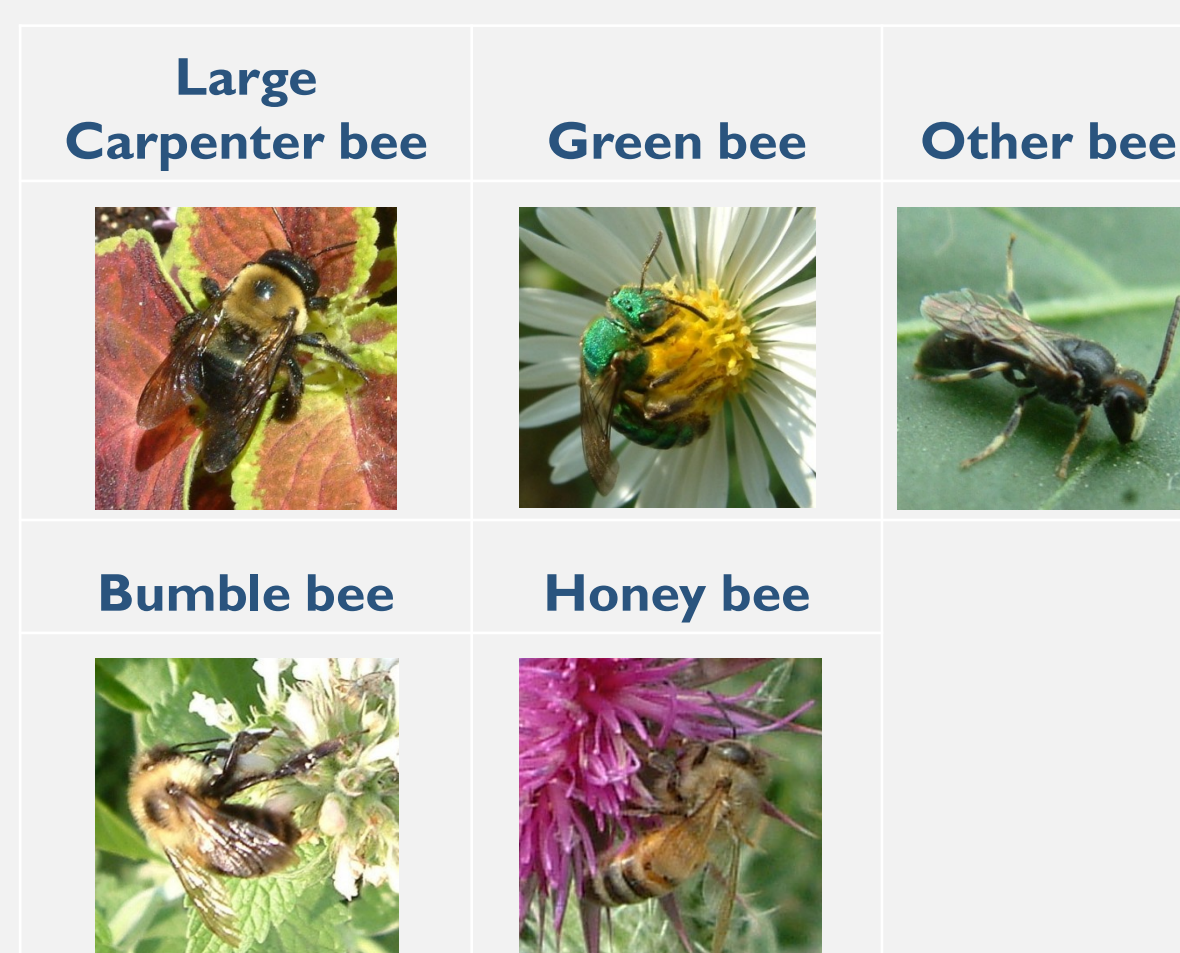
Group A

Examining a new format for PollinatorWatch, a cross-Canada program intended to monitor insect pollinators in a variety of habitats



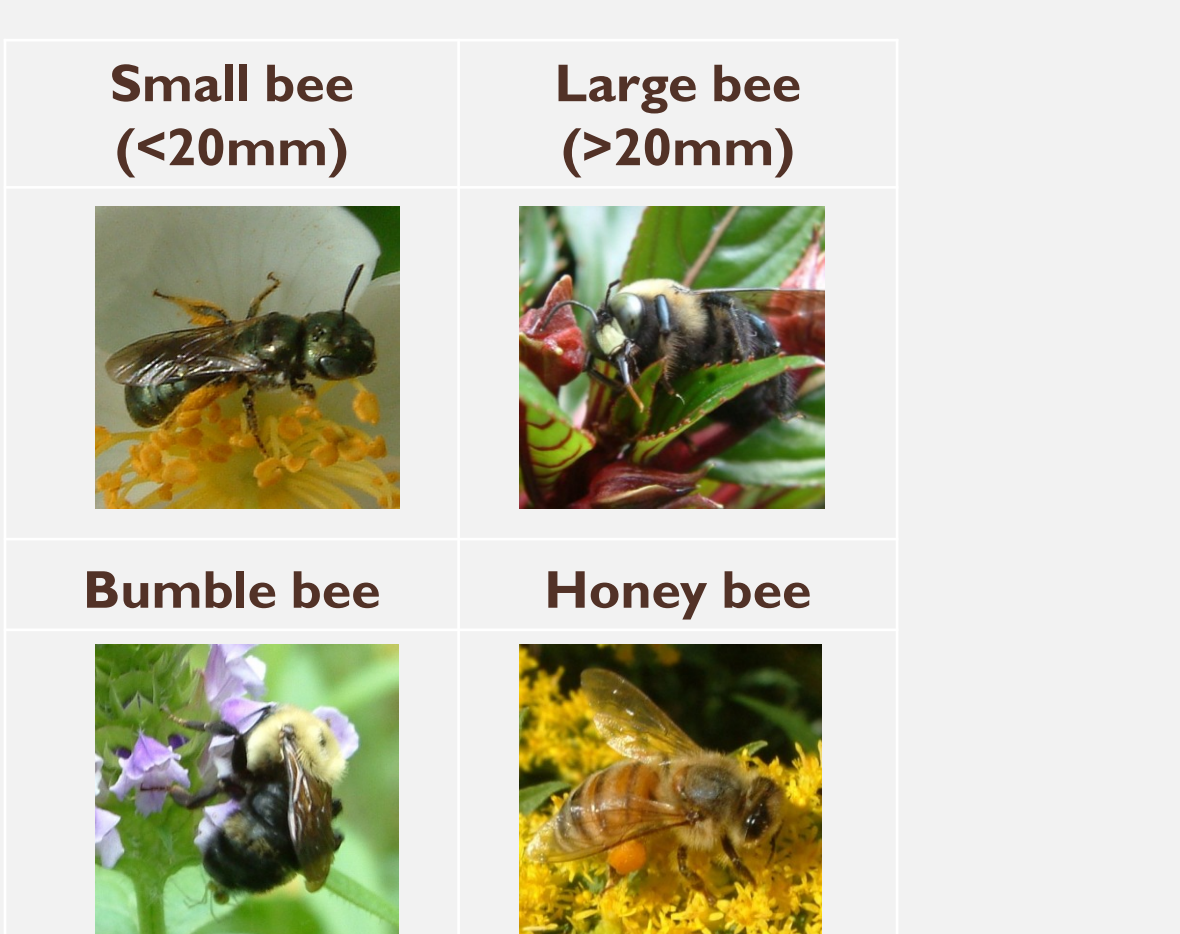
Group B

Based on the Great Sunflower Project, a North America-wide program designed to study bee visitors to sunflowers to understand pollination declines in gardens, crops, and wild lands



Group C

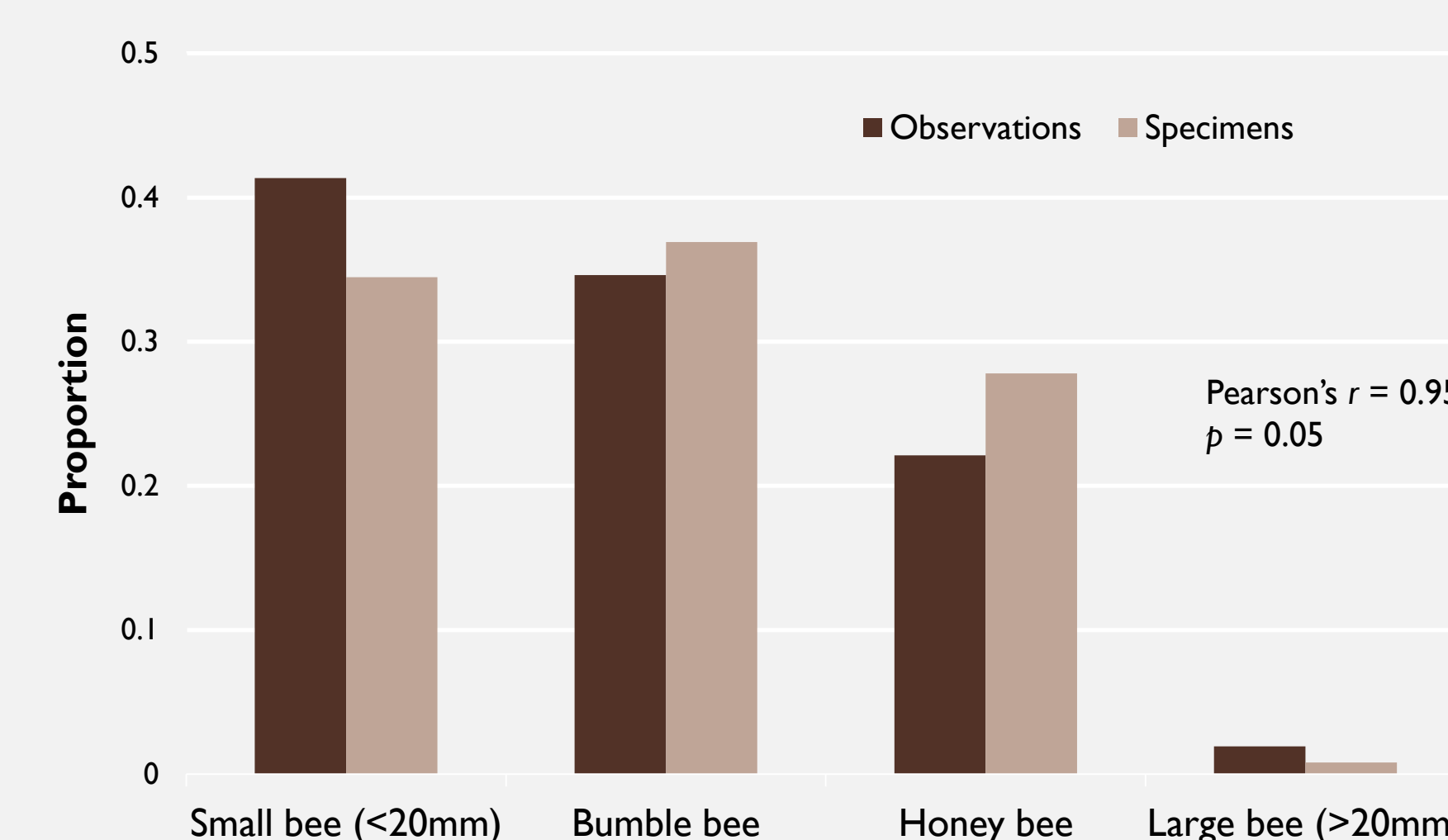
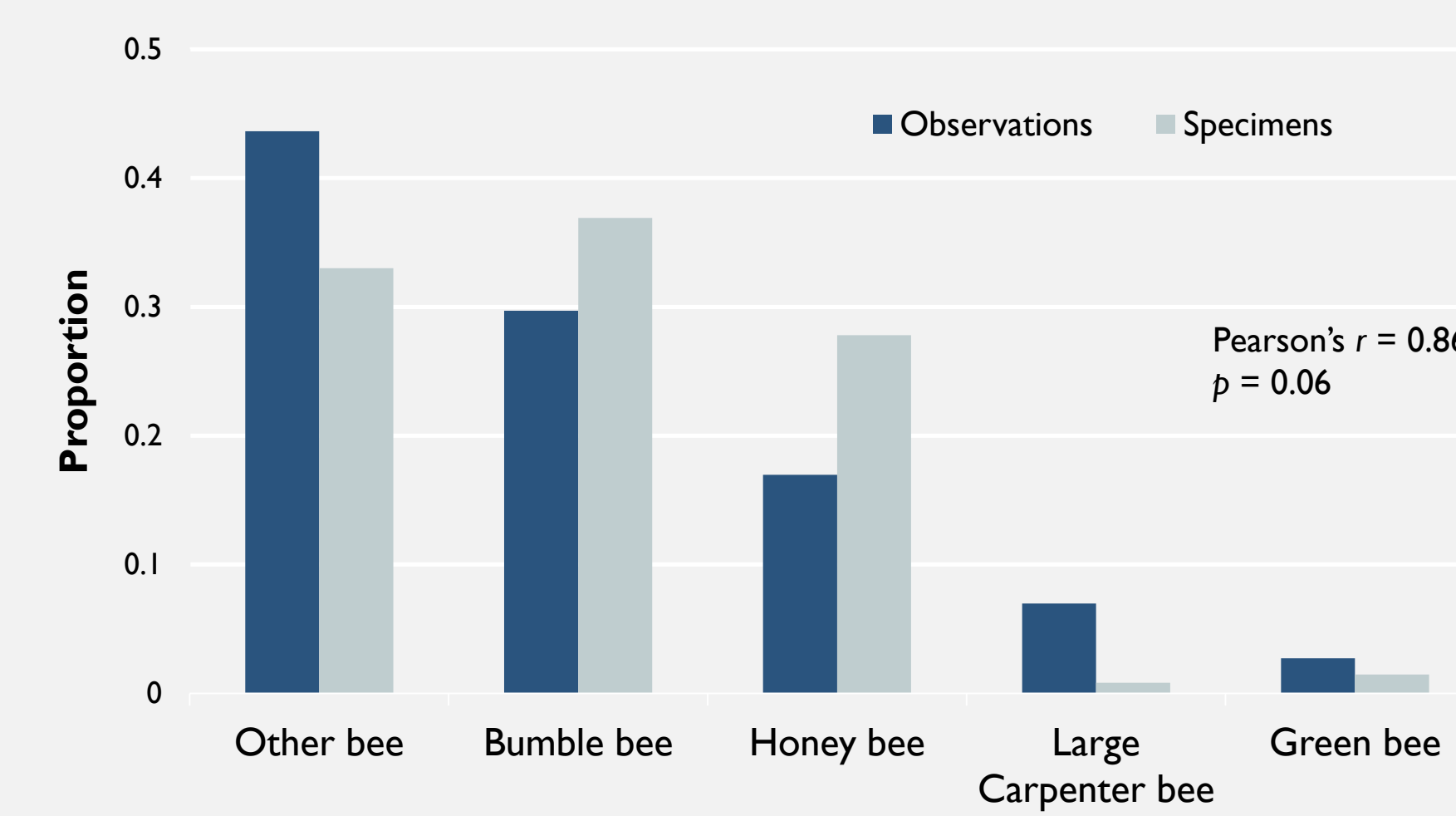
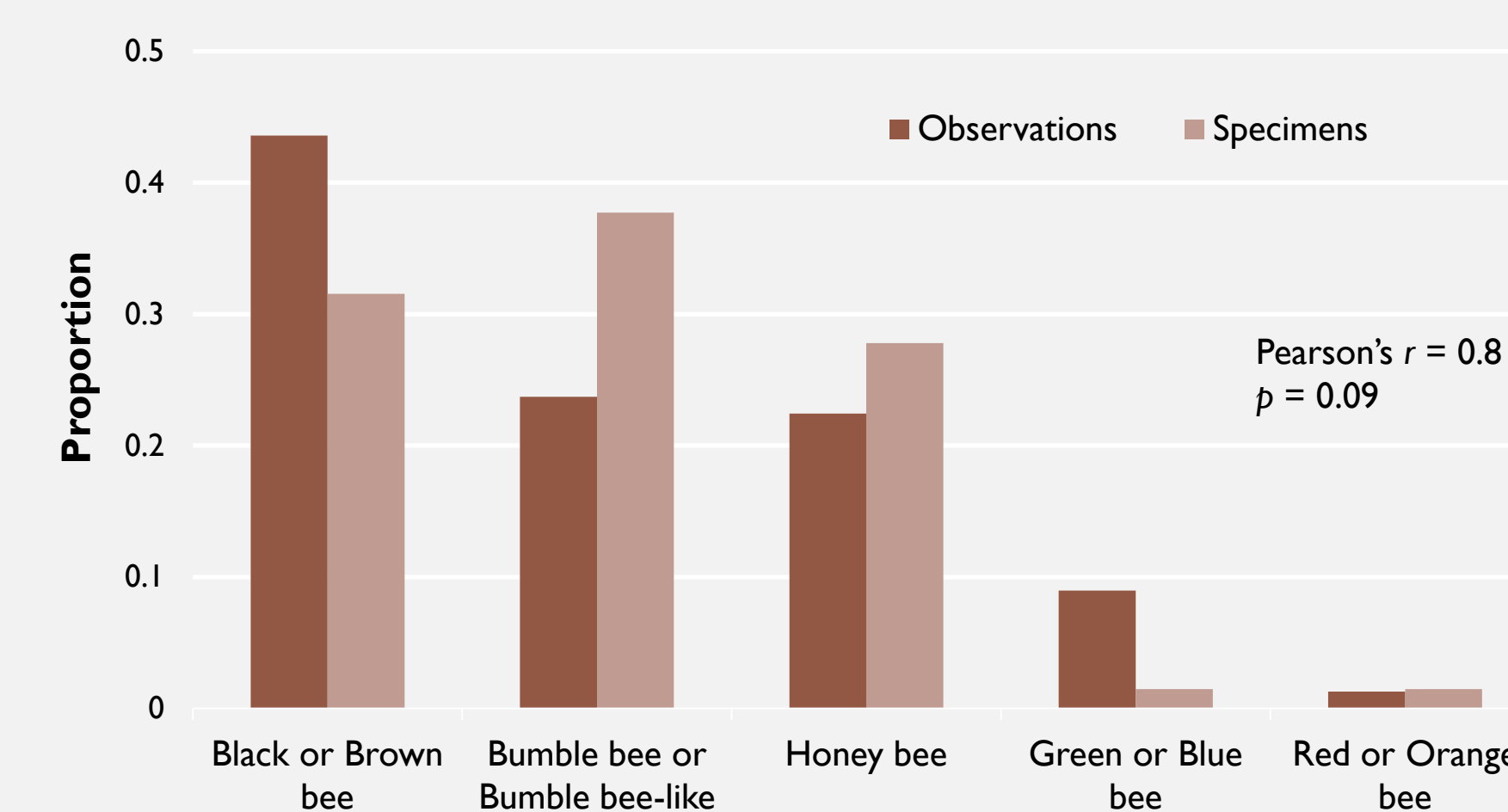
Designed after the Urban Bee Gardens program in the San Francisco Bay area which examines the role of bees in gardens and natural ecosystems



All bees from the specimen data-set were subsequently placed into the appropriate category for each citizen science scheme.

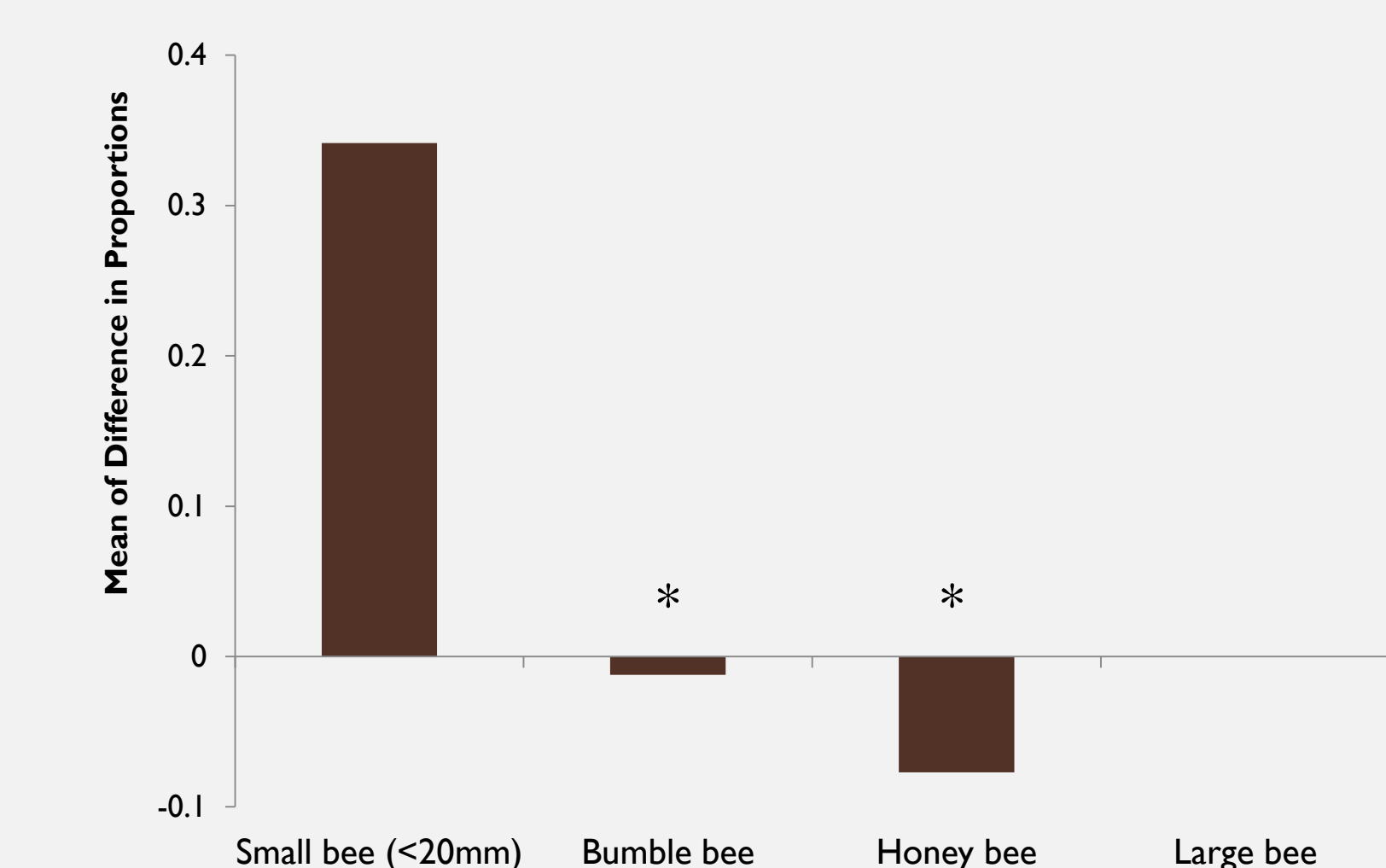
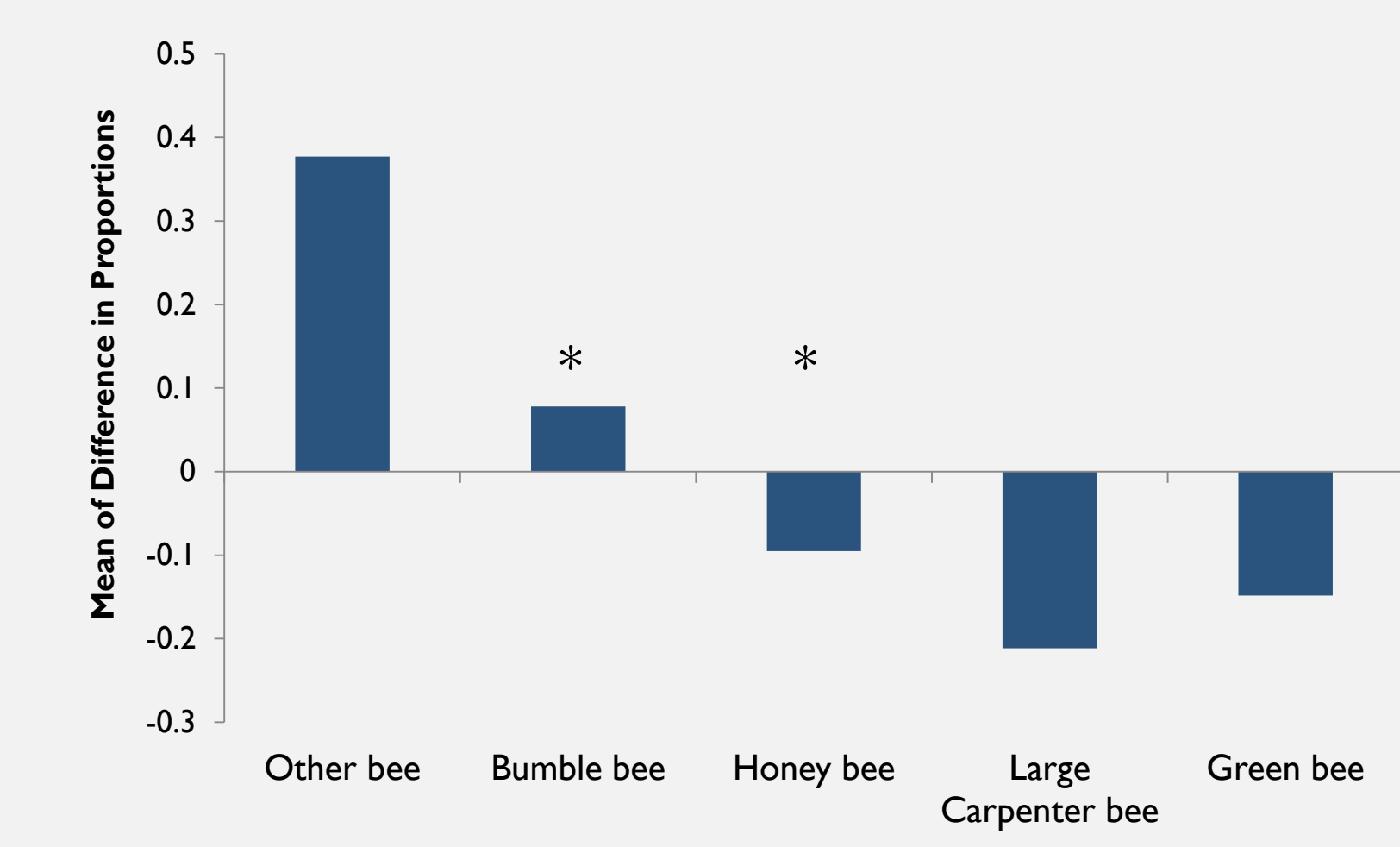
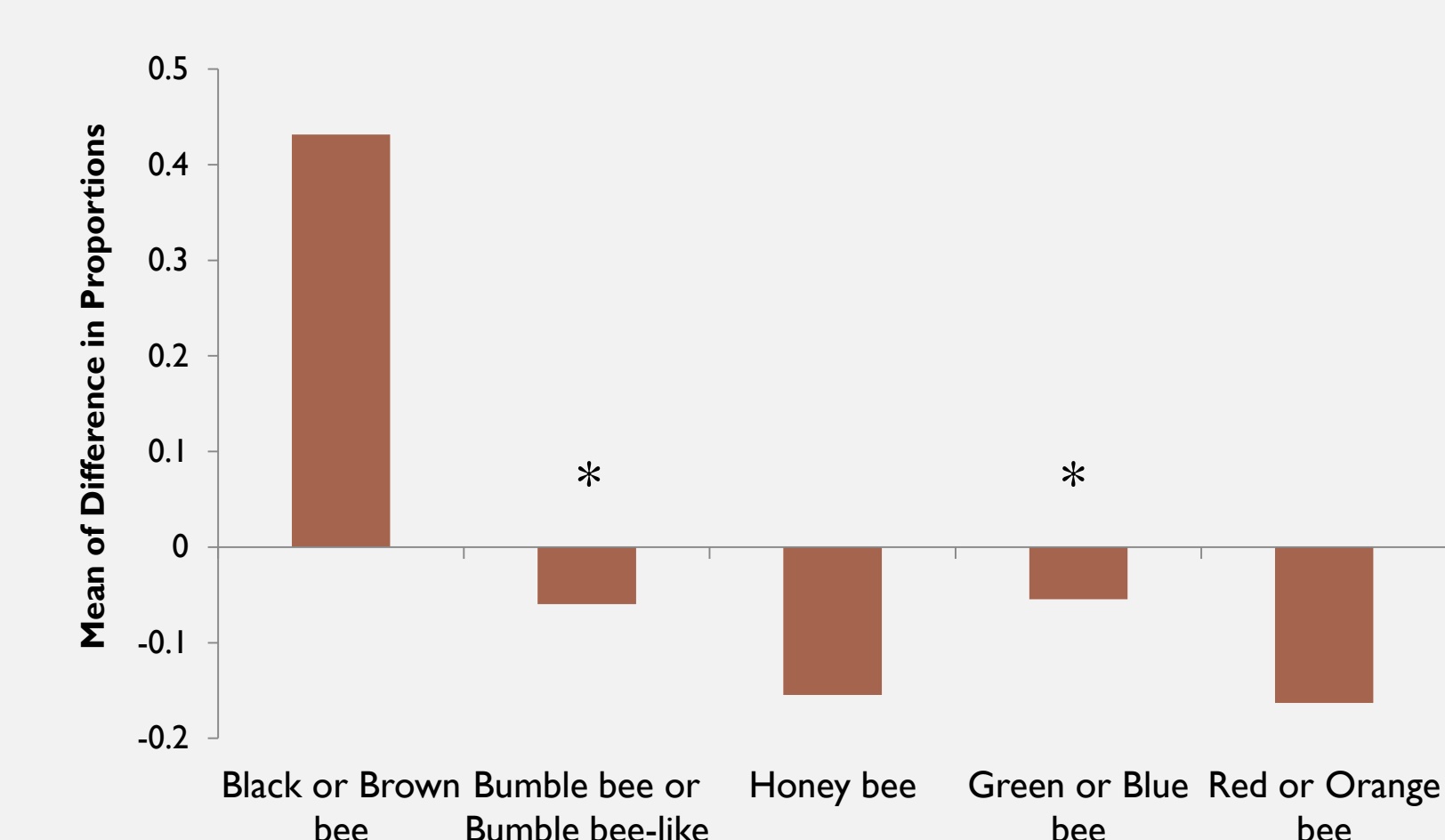
COMMUNITY COMPOSITION

Observation data were significantly positively correlated with specimen data. Citizen scientists can generate high quality records.



COMPARING BEE TYPES

Some bee types were closely matched between observations and specimens. These are the most reliable groups to use for citizen science data (marked with *).



*Matched pairs of observations and specimens are not significantly different from one another.

DISCUSSION

Citizen scientists can assemble high quality data through bee observations. When compared to typical bee sampling measures, observation data displays similar trends in community composition. However, the manner in which observation data is organized must be carefully considered if it is to be useful. Volunteers may produce the most reliable data when using easy to recognize characteristics (e.g. **green bodies**) or commonly identified bees (e.g. **Honey or Bumble bees**).

Broad categories that lump a variety of bees (e.g. Group B **Other bee** or Group C **Small bee**) are overrepresented in the specimen data-set as compared to the observation data-set. These groupings may be too broad, the volunteer training could be insufficient, or many bees in these groups were not foraging on flowers during observations. The more precise bee type categories (e.g. **Green bee**) provide clues about ecological integrity because we know of their habitat preferences. This is an important component of ecological monitoring programs.

Through this research, the PollinatorWatch program will be redesigned and enhanced such that ecologists can be assured that information collected by citizen scientists is valuable. Ultimately, the results of this project will contribute to long-term monitoring of bees in Canada. Conservation efforts by field ecologists, entomologists, and other science experts can help to protect wild bees in concert with public education and citizen engagement.

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