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Hobbyist Beekeepers and Their Importance for Future Beekeeping and Food Production




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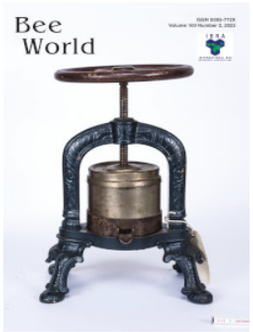

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# Hobbyist Beekeepers and Their Importance for Future Beekeeping and Food Production

**Boris Maciejovsky, Barbara Baer-Imhoof and Boris Baer**

## Introduction

Keeping domesticated honey bees (*Apis mellifera*) in urban areas and backyards has become increasingly popular in the broader public (Velardi et al., 2021). This trend is triggered by multiple factors: On one hand, beekeepers want to support declining pollinators and their services (Aizen & Harder, 2009); on the other, they want to become more self-sufficient during periods of rising prices and food shortages (Parle, 2020), such as the COVID pandemic (Bixby et al., 2021), or keep bees just as a hobby (Duarte Alonso et al., 2021). This increasing interest in non-commercial beekeeping is a global phenomenon (Owen, 2017), and resulted in economic developments targeting hobbyist beekeepers such as small-scale beekeeping suppliers, rooftop beekeeping services, or the development of novel beekeeping approaches such as the flow hive. Hobbyist beekeepers are organized in associations and clubs, which are widespread in many countries and act as communication- and meeting platforms that can help alleviate social isolation and improve mental health and well-being (Velardi et al., 2021). These clubs provide many community services for free or at a low cost such as regular outreach events to promote pollinators and their health, introductory classes for new beekeepers, as well as buddy systems where experienced beekeepers mentor beginners over longer periods of time (Engebretson et al., 2022). Club members are also engaged in removing or relocating unwanted colonies or assisting with the management of poorly maintained hives. Finally, clubs support research and provide bee material and information for research purposes (personal observation, Showler, 2010).

Hobbyist beekeepers are plagued with the same problems to keep their bees healthy and alive as commercial apiarists (Genersch, 2010). They have to manage parasites and pathogens infesting their hives, the exposure of their bees to pesticides (Kulhanek et al., 2017), environmental changes as well as legal restrictions limiting their ability to keep their bees in some areas. Hobbyist beekeepers typically don't move their hives, which poses additional challenges, such as exposure of bees to extreme weather conditions, progressive urbanization and rising population densities, loss of keeping and foraging grounds, or the presence of non-managed hives that can be defensive or interbreed with managed stock (Ellis, 2022).

In 2020, an estimated 115,000-125,000 people kept honey bees in the U.S. (Engebretson et al., 2022), and their bees provided an estimated US$17 billion a year in pollination services (Velardi et al., 2021). The vast majority of >90% of these beekeepers were categorized as small-scale operators, owning fewer than 50 hives, but the total number of hives these apiarists maintain added up to an estimated 10% of the country's managed hives (Tubene et al., 2023). Despite their importance, the contributions of hobbyist beekeepers and their associations received little attention so far (Engebretson et al., 2022; Velardi et al., 2021). A literature search on Web of Science conducted in March 2023 revelated 65 publications containing the search term 'commercial beekeeping'. Searching for 'hobbyist beekeeping' resulted in only two hits, 'backyard beekeeping' in three distinct articles, all of which had been published between 2021 and 2023.

To better understand the hobbyist beekeeper community in Southern California, we invited beekeepers from five clubs located between San Diego and Los Angeles to participate in a survey. Beekeeping in this geographic region is particularly important and challenging. California is the largest producer of agricultural goods within the U.S. (Glenny et al., 2017) and therefore highly dependent on honey bees for pollination. However, the hot and dry climate, the presence of more defensive Africanized honey bees, and progressing urbanization in this region make beekeeping particularly challenging. Therefore, keeping colonies alive over several years requires advanced skills and experience.

## Material and Methods

We developed an online questionnaire consisting of 21 questions to better understand the following aspects of the local hobbyist beekeeping community: (i) size, scale, experience, and commercial significance of hobbyist beekeeping, (ii) identification of key resources used by keepers, as well as areas requiring additional support, and (iii) identification of the major challenges of keeping local bees. The study received IRB approval from UCR (HS 22-135) and the materials are available from the authors upon request. A list of all questions can be found in the Supplemental Material. Data collection took place primarily during the Bee Health Conference 2022, organized by UCR's Center for Integrative Bee Research (CIBER, see https://ciber.ucr.edu) in Riverside, California. Overall, we collected 42 responses.

When participants were asked to rate their experience in certain fields, we used a ranking scale between 1-10. To analyze the data, we used ANOVAs and Spearman Correlations in SPSS, version 28.

## Results

Forty-two beekeepers participated in our study, with 25 (60%) keeping bees as a hobby, and 17 (40%) mentioning professional ambitions (question 1). Our results revealed that most participants (74%) own between one to five colonies (question 3) and spend fewer than five hours per week on their hives (question 2).

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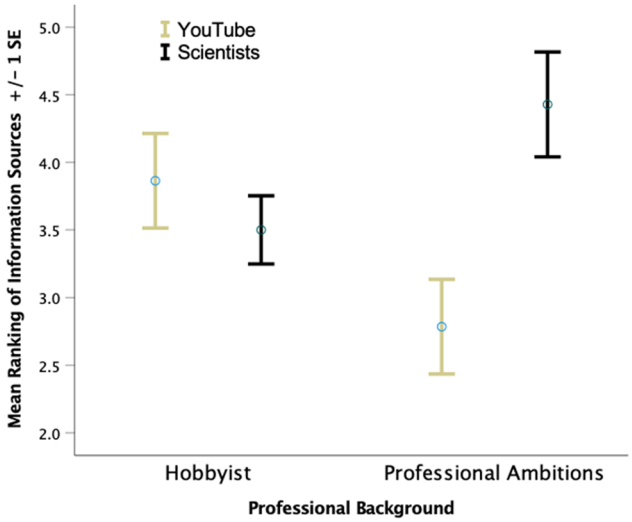


**Figure 1.** Comparing the mean ranking (from 1 to 10) of information sources for hobbyist beekeepers and beekeepers with professional intentions.

Around one-third of them owned their colonies for fewer than three years, reflecting a recent increased interest in beekeeping (question 4). A third of our participants owned their hives for more than ten years, indicating significant skill levels (question 4). Among our 17 beekeepers with professional ambitions, only two (12%) reported generating a significant income, while five (29%) broke even. Among the 25 hobbyists, five (20%) were able to break even (question 20). If they did, the profit mainly came from selling honey, wax, or related products, as well as catching or removing swarms or colonies, or providing teaching services (question 21). The results of non-parametric Spearman correlations indicate that beekeepers with more hives (r (39) = 0.348, $p = 0.030$), who engage in more beekeeping hours per week (r (39) = 0.555, $p < 0.001$), and who had been involved with beekeeping for longer (r (38) = 0.435, $p = 0.006$) reported more income. The two beekeepers who generated significant income kept between 100 and 999 colonies. The minimum number of hives beekeepers reported to break even was between three to five hives.

In terms of information sources used by our participants, around half indicated that they relied on beekeeping clubs and associations, followed by scientists and scientific literature as well as other beekeepers, and to a lesser degree on social media and YouTube (question 6). However, these results are qualified by experience (Figure 1).

Hobbyists relied significantly more often on social media and YouTube (F (1, 34) = 4.28, $p = 0.046$), whereas professionals relied significantly more often on scientists (F (1, 34) = 4.41, $p = 0.043$). Regarding the resources that they would like more access to, the beekeepers mentioned clubs and associations, as well as scientists and researchers (question 12). Responses to this question did not differ significantly between hobbyists and professional beekeepers.

Overall, our participants were most confident about their self-assessed knowledge about disease treatment (question 9) and Breeding (question 8) but considerably less confident in their knowledge regarding pesticides (question 10) and remote health sensing (question 11), as shown in Figure 2. Professionals rated their breeding knowledge at 4.75 out of 10, which was significantly higher than the corresponding rating by self-identified hobbyists at 3.12 out of 10 (F (1, 39) = 4.72, $p = 0.036$). With respect to novel disease treatment, pesticides, and bee-sensing we did not find significant differences between professionals and hobbyist participants.

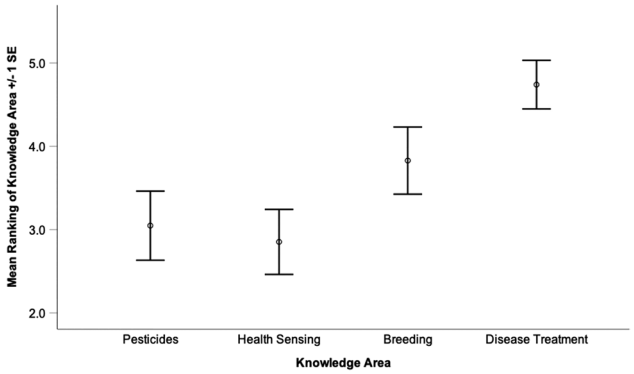


**Figure 2.** Comparing the mean ranking (from 0 to 10) of how beekeepers would rank their knowledge in the areas of breeding, disease management, pesticides, and health sensing.

When asked about challenges beekeepers are facing (question 15), around 60% of our participants mentioned managing parasites and pathogens, followed by climatic conditions (heat and drought), bee losses caused by pesticides, access to foraging grounds, and regulatory limitations of beekeeping in their county. These challenges were perceived as equally important by both hobbyists and professional beekeepers.

18 beekeepers (43%) kept local survival bees and an additional 14 (33%) would be open to keeping such bees as long as it was safe to do so (question 16).

## Discussion

Our survey successfully reached those beekeepers we were primarily interested in, given that three-quarters of our respondents were hobbyist beekeepers owning fewer than five hives. One-third of our participants indicated that they had kept bees for over a decade, representing a largely untapped source of knowledge about locally adapted beekeeping practices. Further research is needed to better understand the idiosyncrasies of successful beekeeping in Southern California. The resulting best management practices can prevent future hive losses on the one hand (Tubene et al., 2023), and can additionally be used in training future beekeepers. It would be interesting, for example, to know whether new beekeepers would accept training that deviates from the information they might have obtained from social media, or if their beekeeping practices could be shaped by recent interventions based on applied behavioral science. These studies suggest that small interventions like incentives, nudges, and goal-setting improve a variety of behaviors, ranging from exercising (Milkman, Gromet, et al., 2021) and getting vaccinated (Milkman, Patel, et al., 2021) to volunteering (Rai et al., 2023).

Our respondents reported some of the same challenges to keep their colonies alive and healthy as beekeepers in other regions of the U.S. (Kulhanek et al., 2017), but also mentioned additional issues that are absent elsewhere, such as excessive heat or drought. One aspect we were interested in was the perception of local beekeepers towards non-managed honey bees, which occur naturally in Southern California and are referred to as survivor bees. Our survey indicated that beekeepers get in contact with these bees, for example when they collect swarms to remove unwanted colonies. These bees are hybrids between managed bees, which are kept by local beekeepers or transported to the region for temporary pollination services, and Africanized honey bees that invaded the Southern part of the U.S. in the early 1980s (Pinto et al., 2005). The latter are known for their defensiveness, which makes them unsuitable to keep in urban areas or close to humans and life stock. However, a recent characterization of local survivor bees revealed that they are a highly variable admixture of four different genotypes, including some Africanized bee genetics (Zárate et al., 2022). Interestingly, feedback from local beekeepers and our own experience keeping these bees indicate that some of these colonies show acceptable levels of defensiveness, similar to what has been reported for Africanized honey bees in Puerto Rico (Rivera-Marchand et al., 2012). Based on their responses to question 16 and comments provided to other questions, up to three-quarters of our participants already keep or are willing to keep survivor bees, if it is safe to do so. This finding is important because local survivor bees prosper in Southern California without human management, coping well with environmental challenges such as climatic extremes and parasites. These bees could therefore be suitable as future resilient bee breeding stock. Follow-up studies are therefore warranted to prepare a local queen bee breeding program for stress-tolerant bees with low levels of defensiveness (Zarate et al., 2023). That these bees would be accepted by most of our respondents, is in line with findings from Uruguay, where beekeepers got used to working with locally hybridized bees (Branchiccela et al., 2014).

However, more work is required to plan the logistic details of such a breeding program as a collaboration between beekeepers and researchers. Such plans require developing best practices and training to encourage and promote the use of survival bees by local hobbyist beekeepers. Recent developments in applied behavioral science might suggest innovative ways to establish such collaborations that could be based on choice architecture and simple nudges (Mertens et al., 2022) that make it easier for beekeepers to persist in their efforts.

Our survey indicates that Southern California beekeepers own significant numbers of hives, but to date, most of our participants do not generate any income from their bees. Nevertheless, 40% of our respondents expressed some professional ambitions. These beekeepers could team up and provide additional hives to pollinate Californian crops. In years in which commercial beekeepers experience unusually high colony losses, such support is especially important. Based on conference feedback and numerous follow-up discussions, we learned that teams of beekeepers are already trialing such setups on a small scale. Therefore, a successful breeding program for resilient honey bees is an important contribution toward affordable pollination services and food security in the future.

## Conclusions

We find that hobbyist beekeeper clubs could play a pivotal role in the future to safeguard honey bees and their pollination services. Hobbyist beekeepers provide important community services which could be expanded in the future. These include (i) training a new generation of beekeepers in responsible beekeeping, (ii) maintaining hives that could be used for breeding or pollination events, especially during bee hive shortages after massive hive losses elsewhere, (iii) generating additional income for low-income beekeepers by improving the commercialization of honey, wax or pollination services, (iv) providing key community services such as the safe removal of unwanted hives without the use of pesticides, or outreach events, and (v) potential future collaborations, involving research and extension activities to improve and implement new management tools to improve bee health.

## Supplementary Material

The details of the online questionnaire available via the "Supplementary" tab on the article's online page (https://doi.org/10.1080/0005772X.2023.2270836).

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## Data Availability Statement

The data is available from the authors upon request.

## Disclosure Statement

The authors report there are no competing interests to declare.

## Geolocation Information

This study focused mainly on beekeepers with apiaries in locations within San Diego County, Orange County, and Los Angeles County in Southern California.

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