# Classification of honeybee flight activity patterns reveals impact of recruitment behaviours

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AbacusBio Ltd / FutureBees NZ

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# What to expect from this talk

1. How did we get here? *or*
   Why is remote monitoring of honeybee colonies an important tool?

2. How to define honeybee physiology?

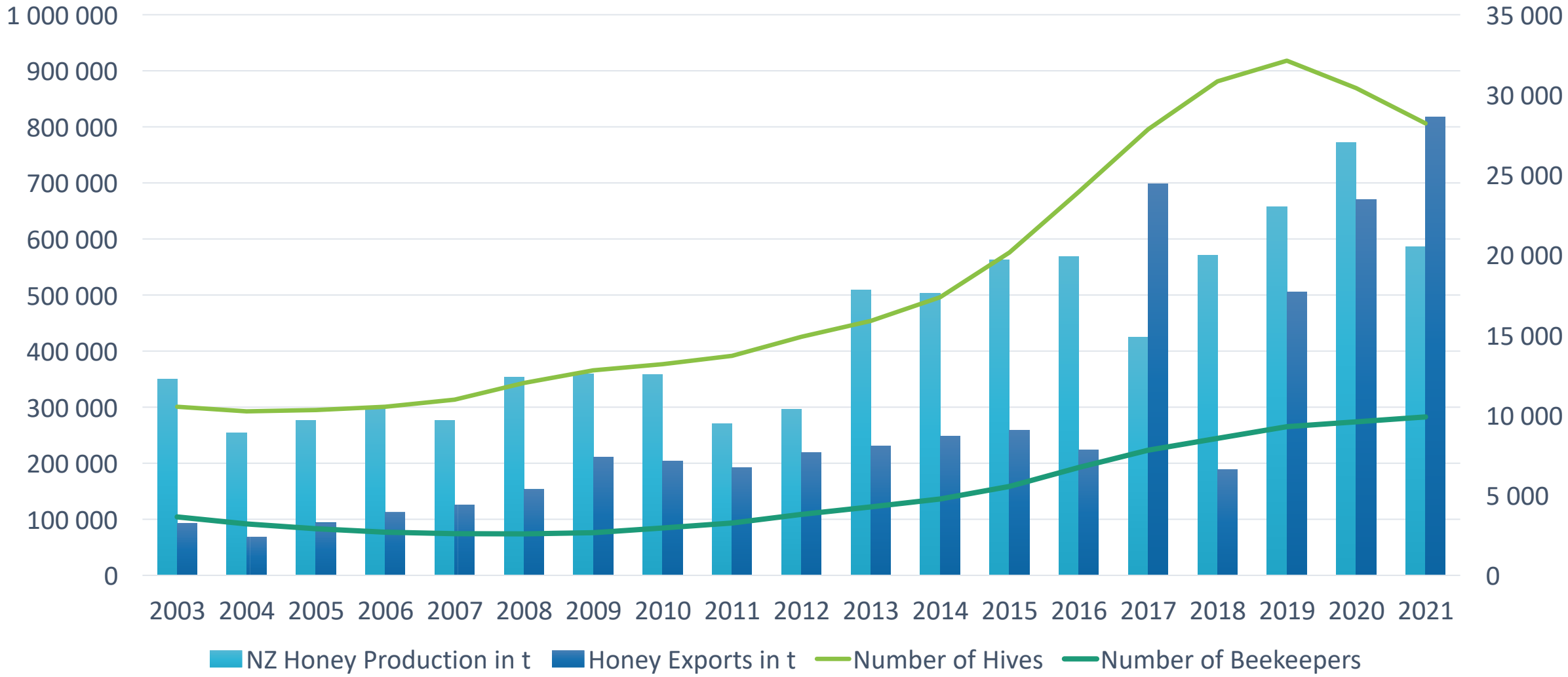
3. What can we learn from flight activity patterns?

4. How does this impact how we view physiological changes?

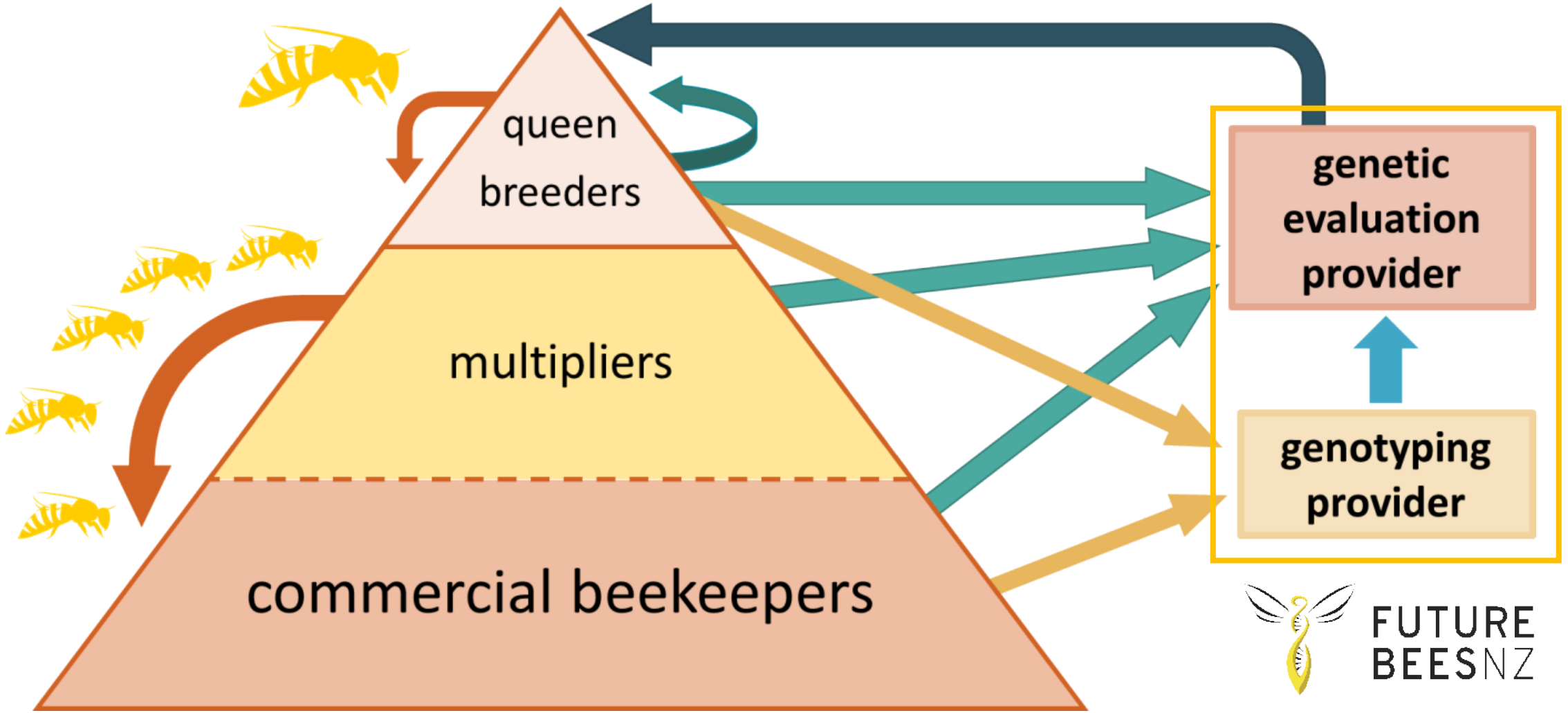
5. What do we need to do next?

# New Zealand – 4 seasons in a day and 100 climates in one country

# Key Stats for NZ Beekeeping



# Goal for NZ Genetic Improvement System

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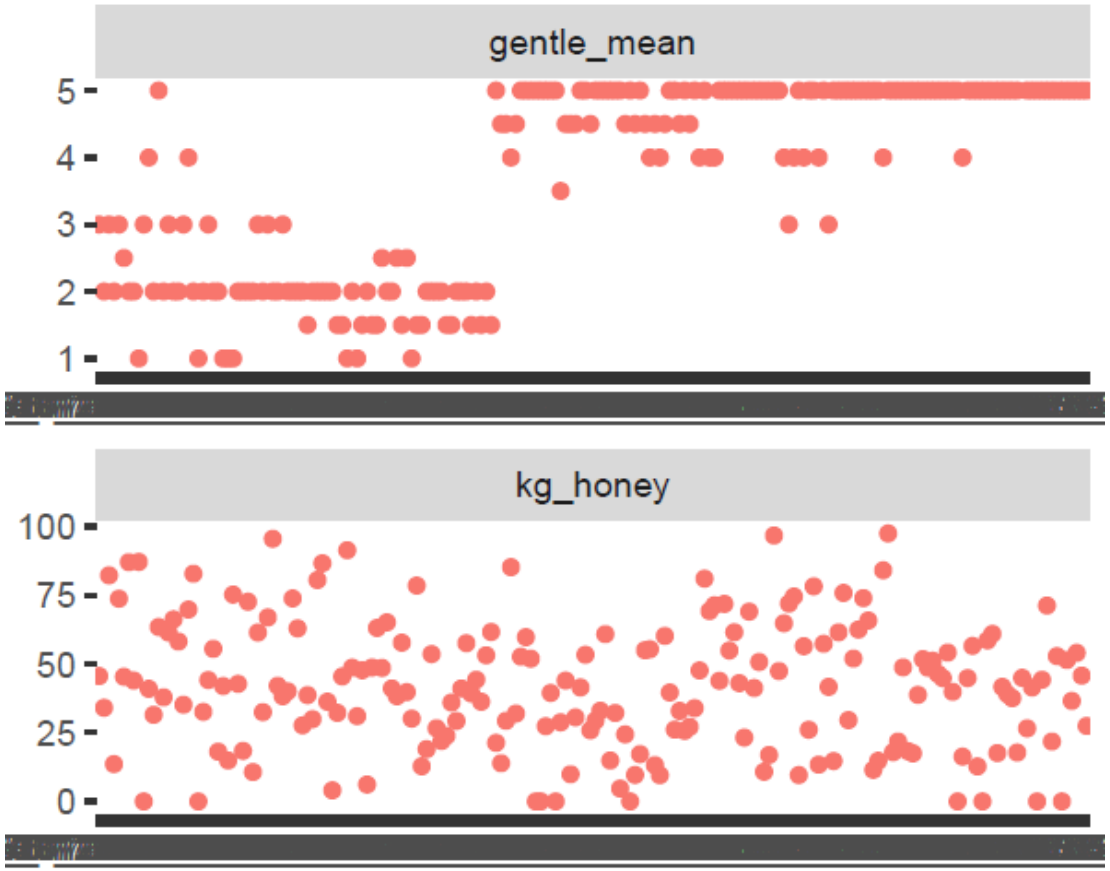
# Phenotype Collection is challenging

# Step 1: Standardised Colony Evaluations


# Non-Bee sources of variation: Beekeeper * Environment

TPHCo 2017

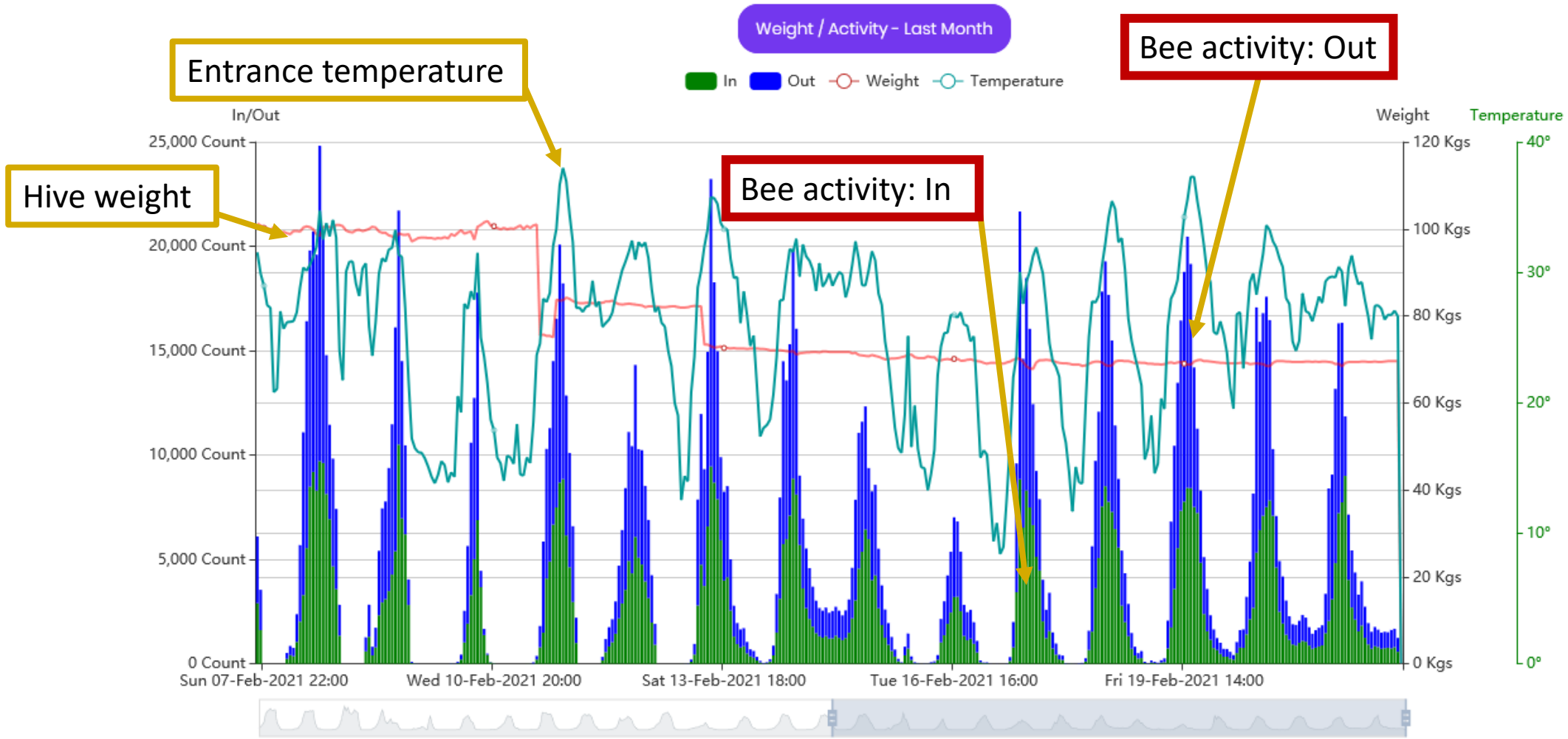



# Hive Telemetry as an alternative Source of Data



FutureBees NZ
www.BeeApp.buzz
Bee Intelligence

# Hive telemetry as a source of information



# How do we define Honeybee Physiology?

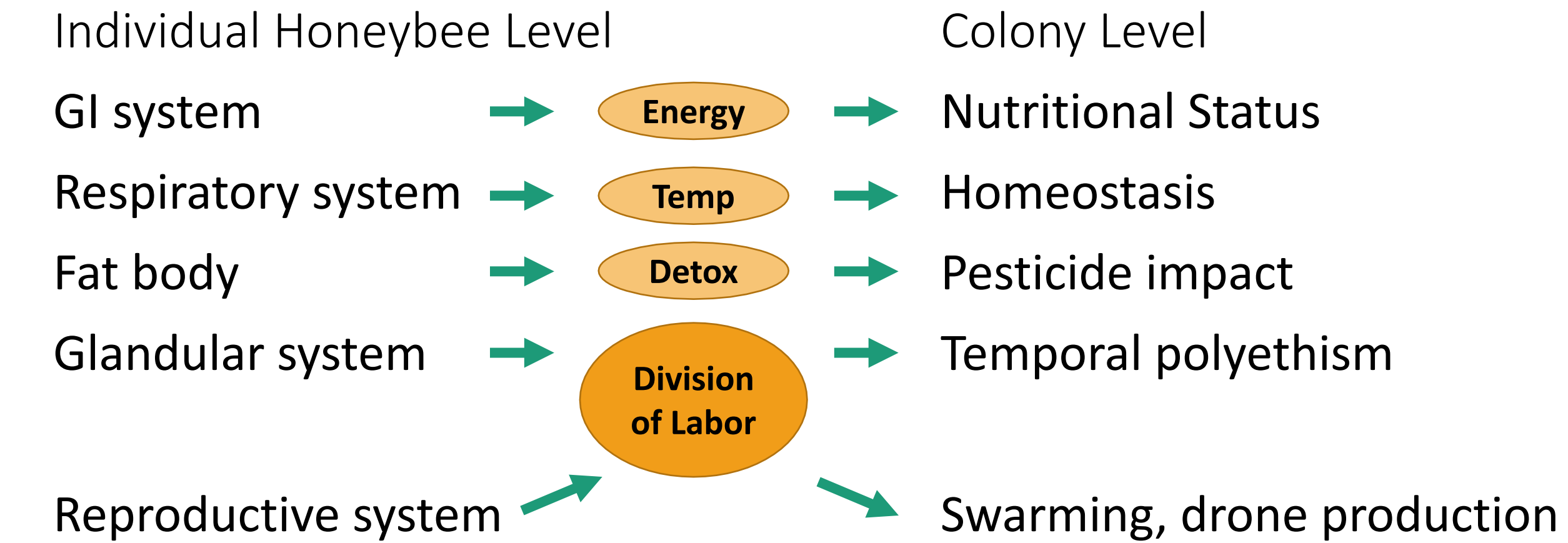
## Individual Honeybee Level

© Ray Tiddy for TPHCo

## Colony Level

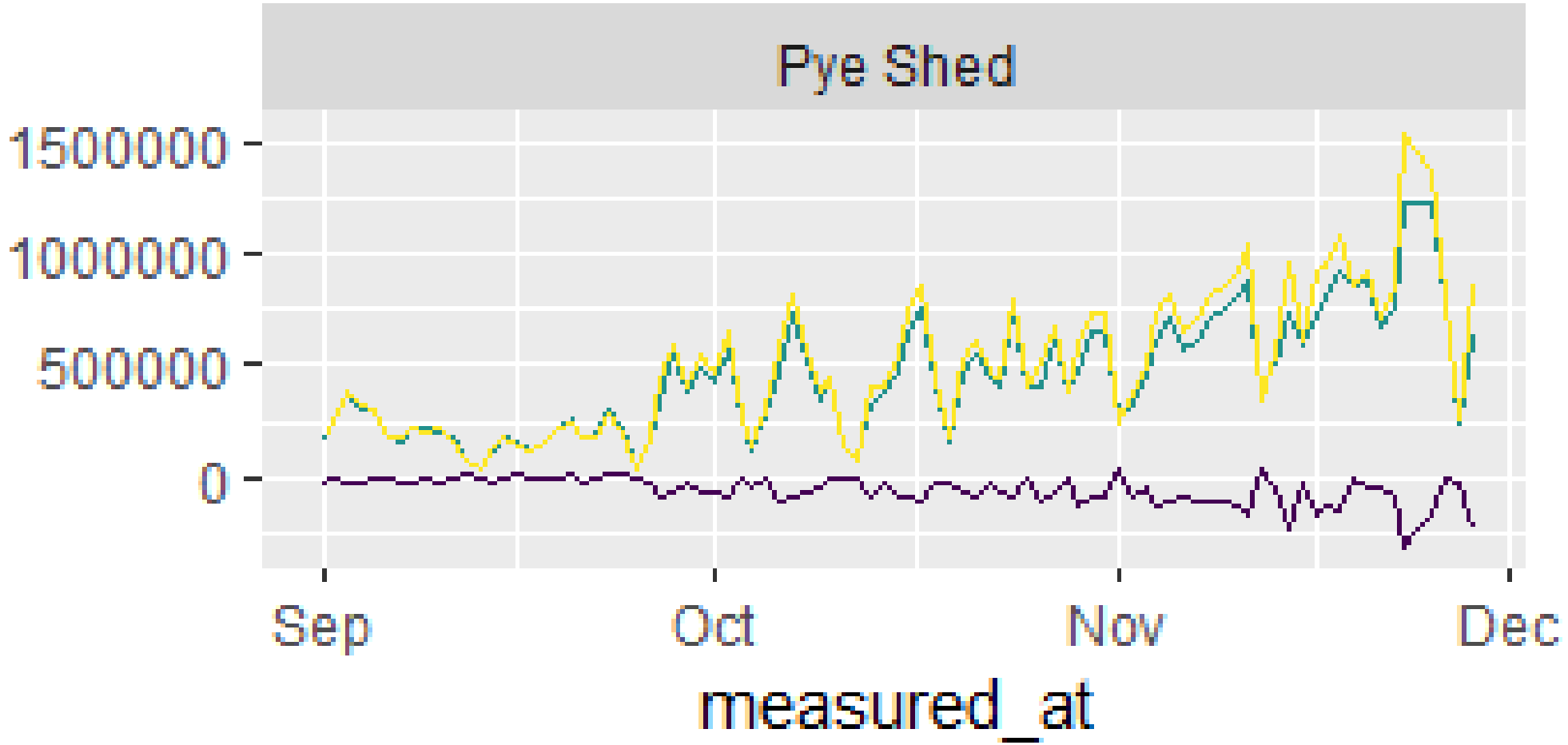
© Firebrand Ltd

# How do we define Honeybee Physiology?

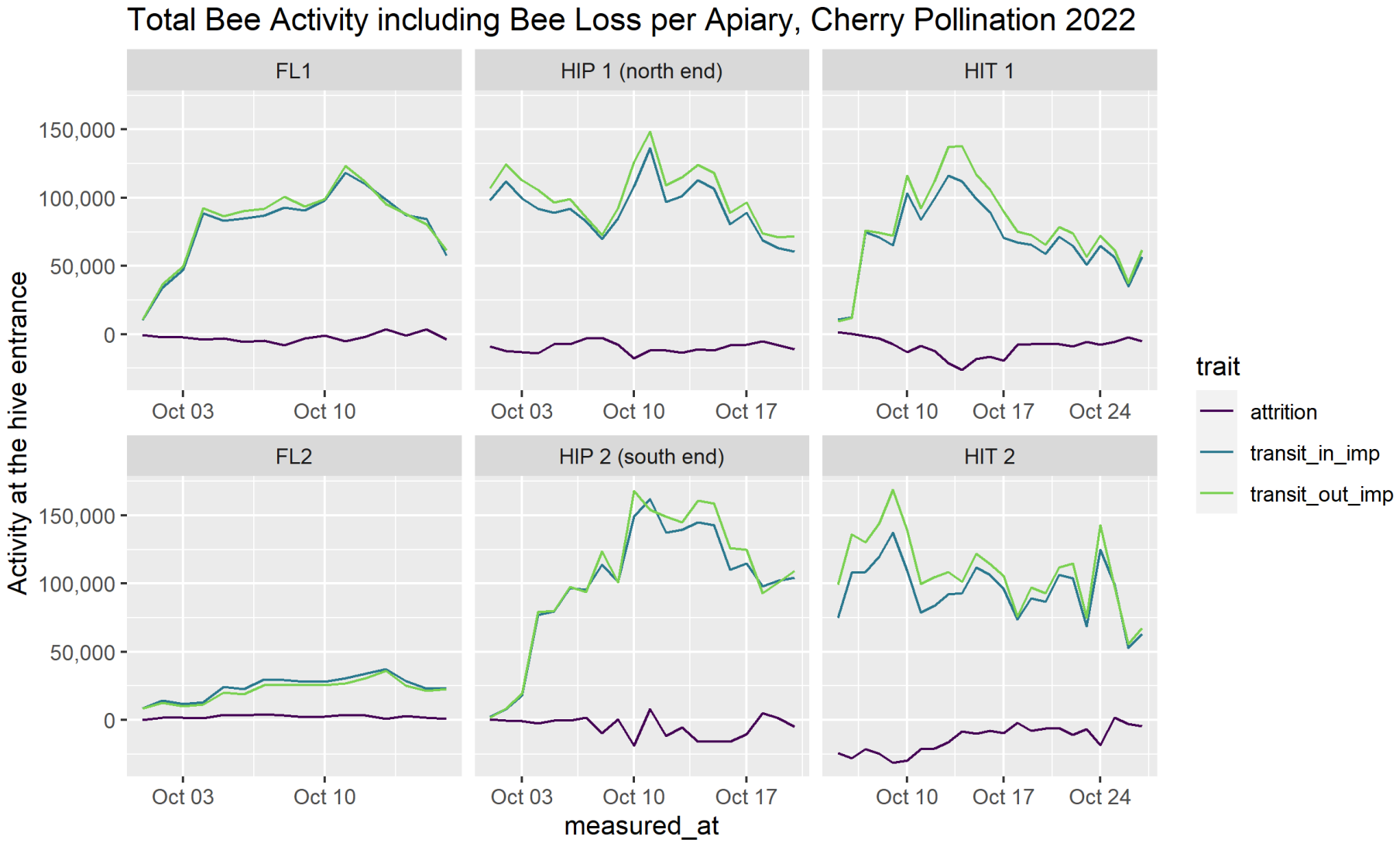



Beshers & Fewell (2001) „Models of Division of Labor in Social Insects“ Annu. Rev. Entomol. 46:413–40

# Understanding activity patterns: Bee attrition



# Understanding activity patterns: Bee attrition

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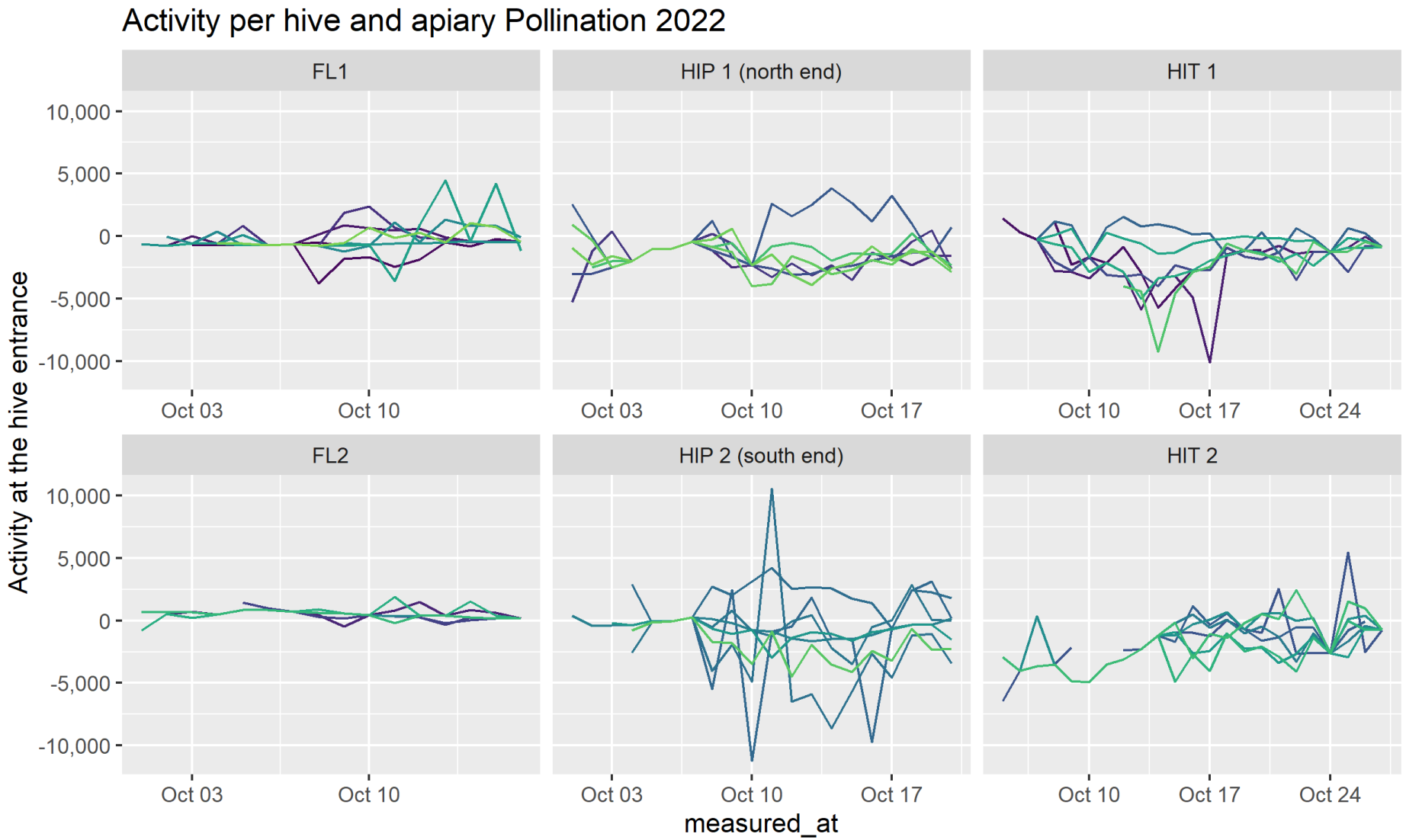
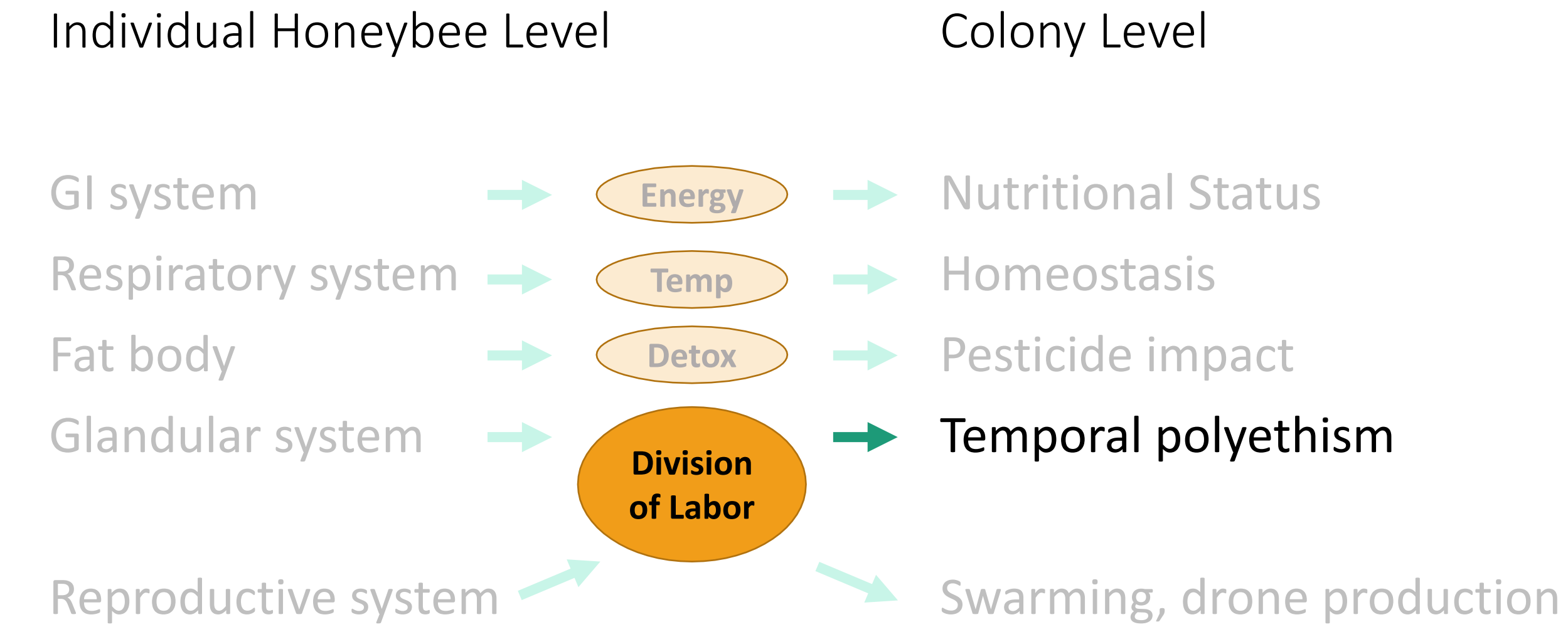
# Understanding activity patterns: Attrition = Drift

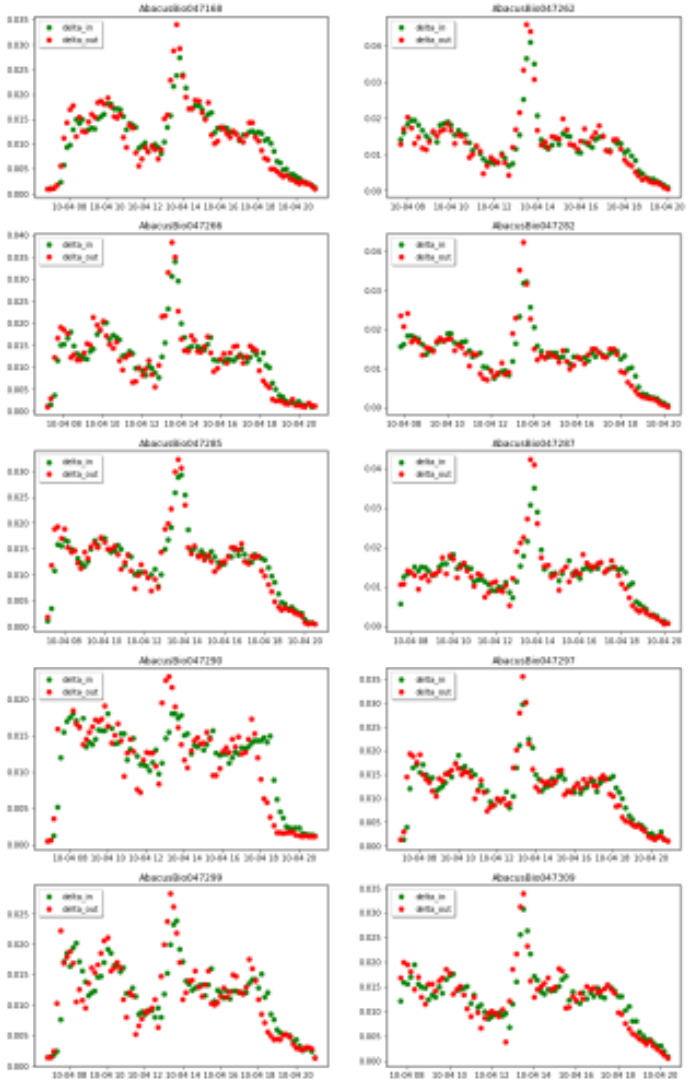


# How does this impact Honeybee Physiology?

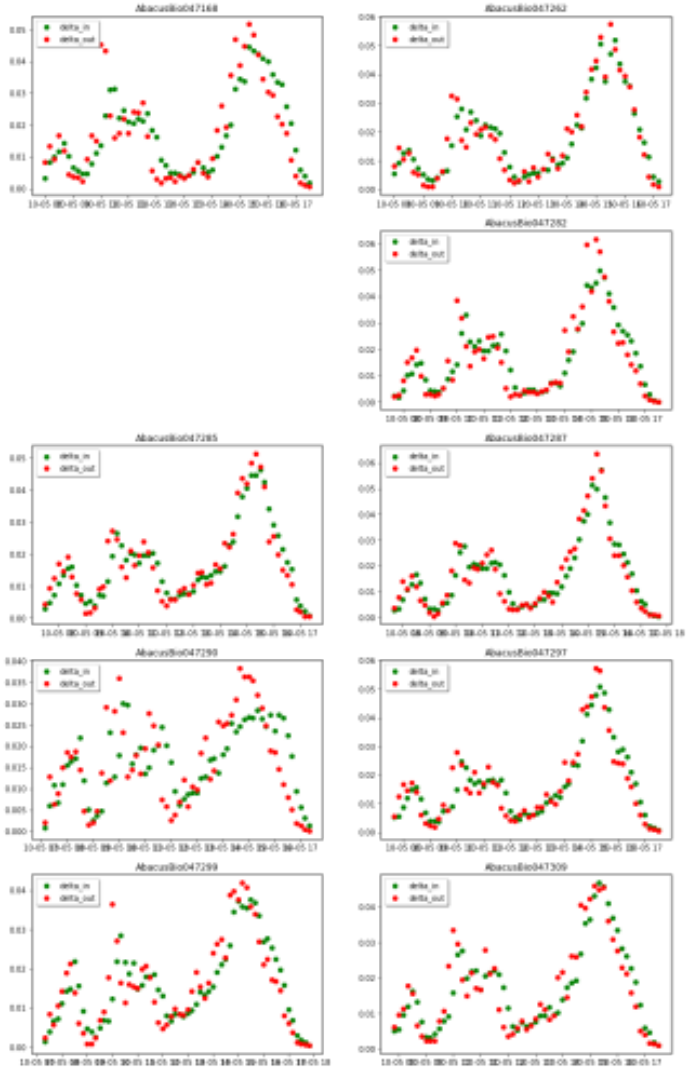


# Understanding bee activity: Activity distribution

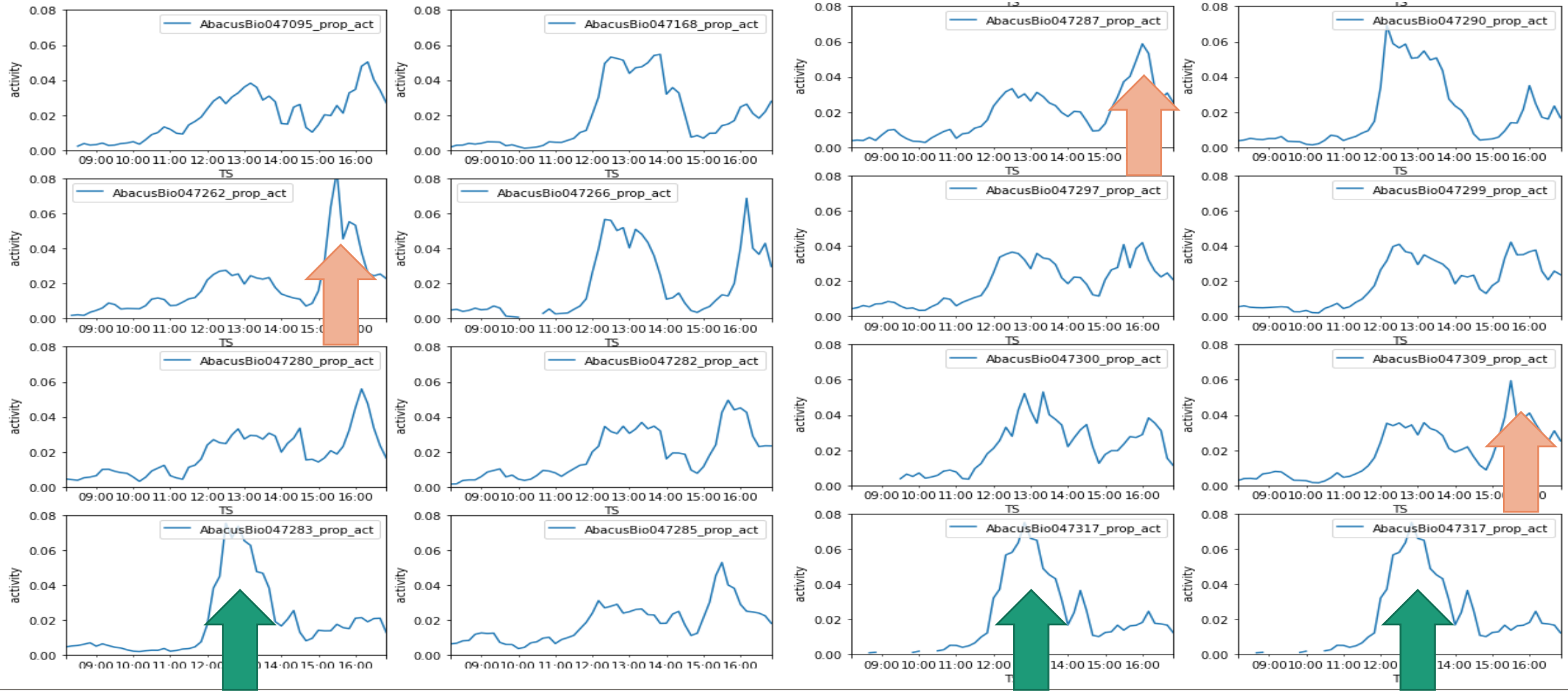
04/10/20



05/10/20



# Understanding bee activity: early vs late activity



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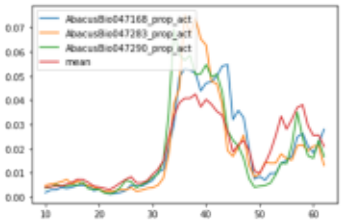
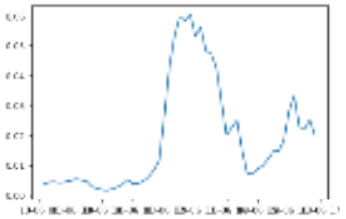


Calculate mean of the activity pattern

Classify the hives using an F Test
Is p value < 0.05?

Yes

Hive activity is **Different**

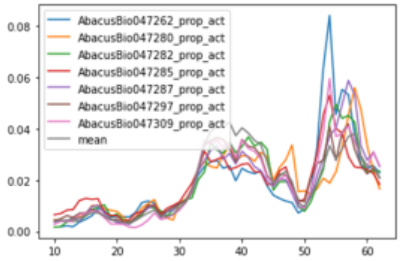
Calculate Mean, Identify Peaks

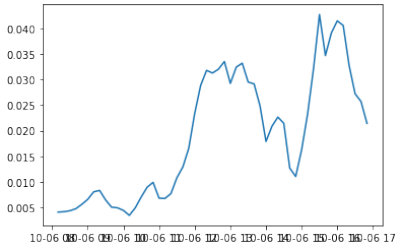
No

Hive activity is **Similar**

Calculate Mean, Identify Peaks

Classify as *early* or *late*

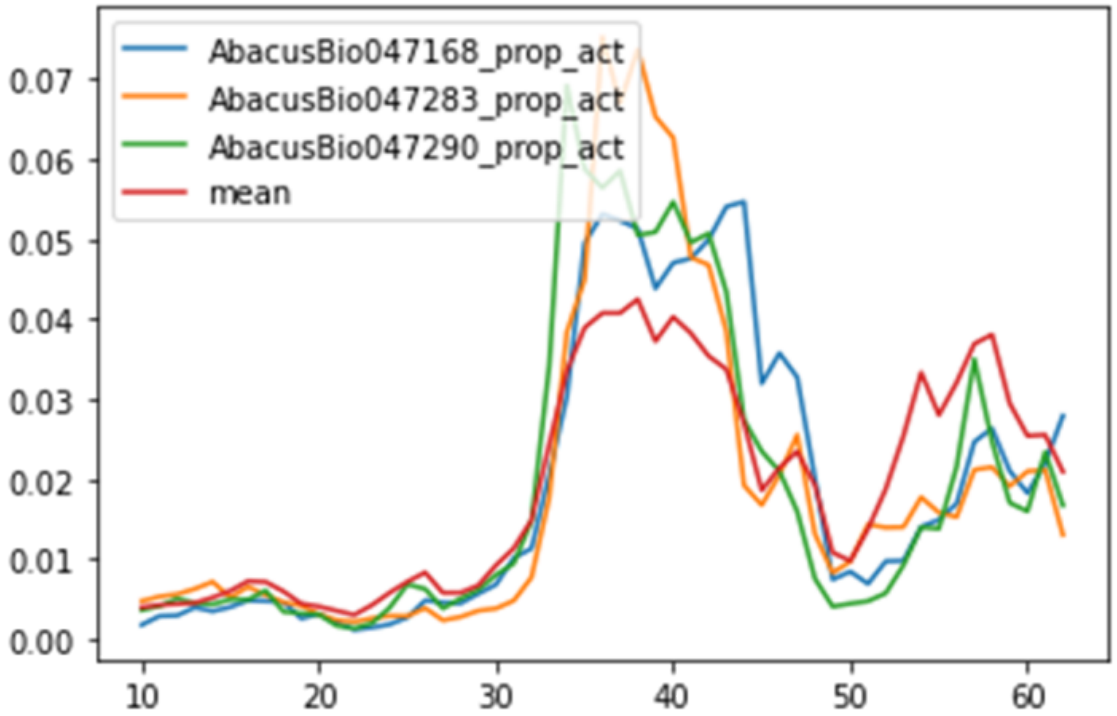


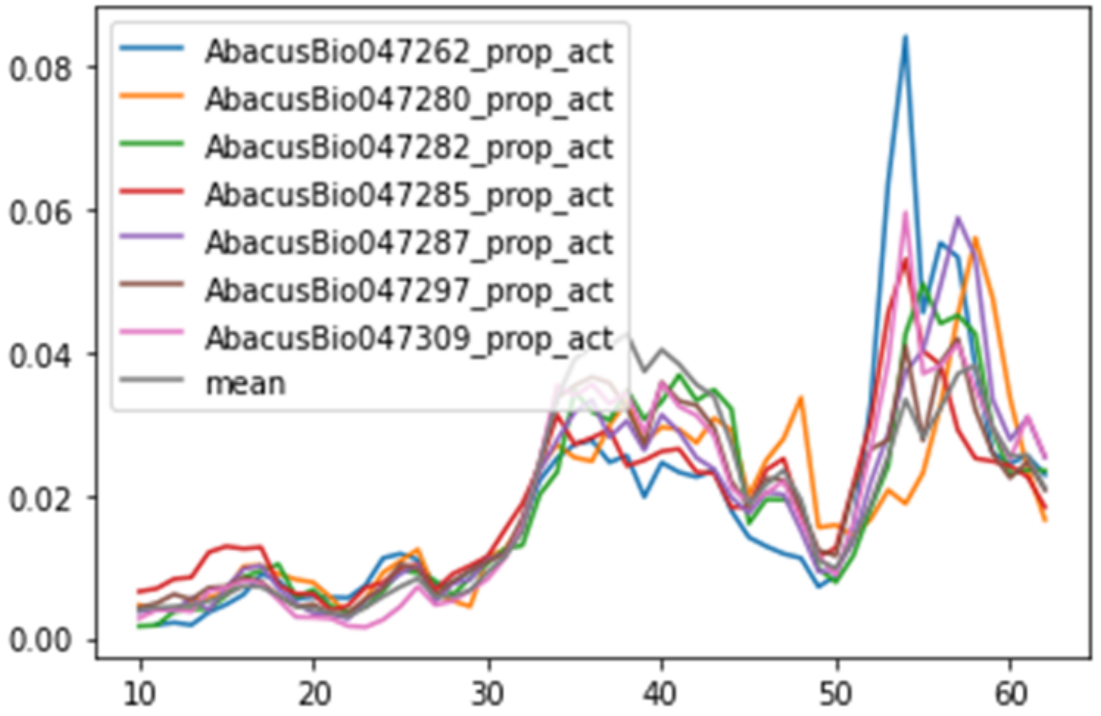
Deepak Gupta, 2021

# Understanding bee activity: early vs late activity

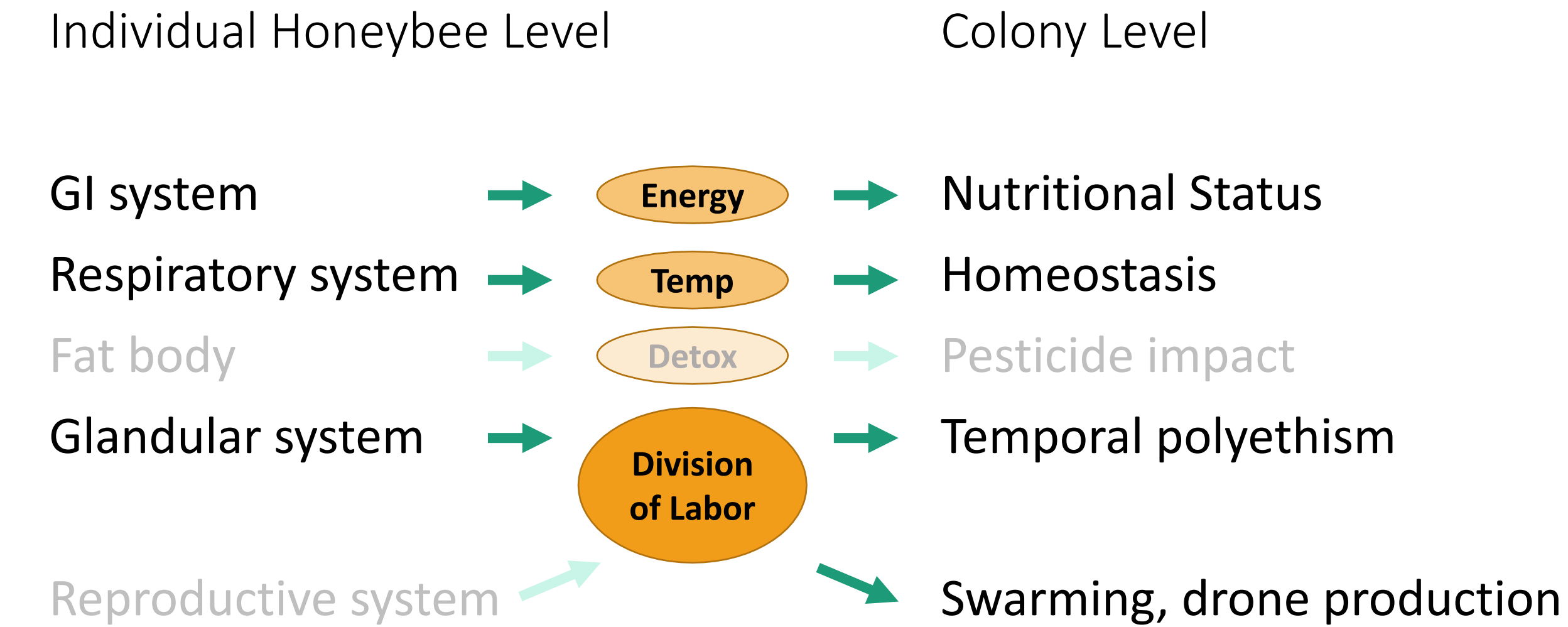
"early risers"



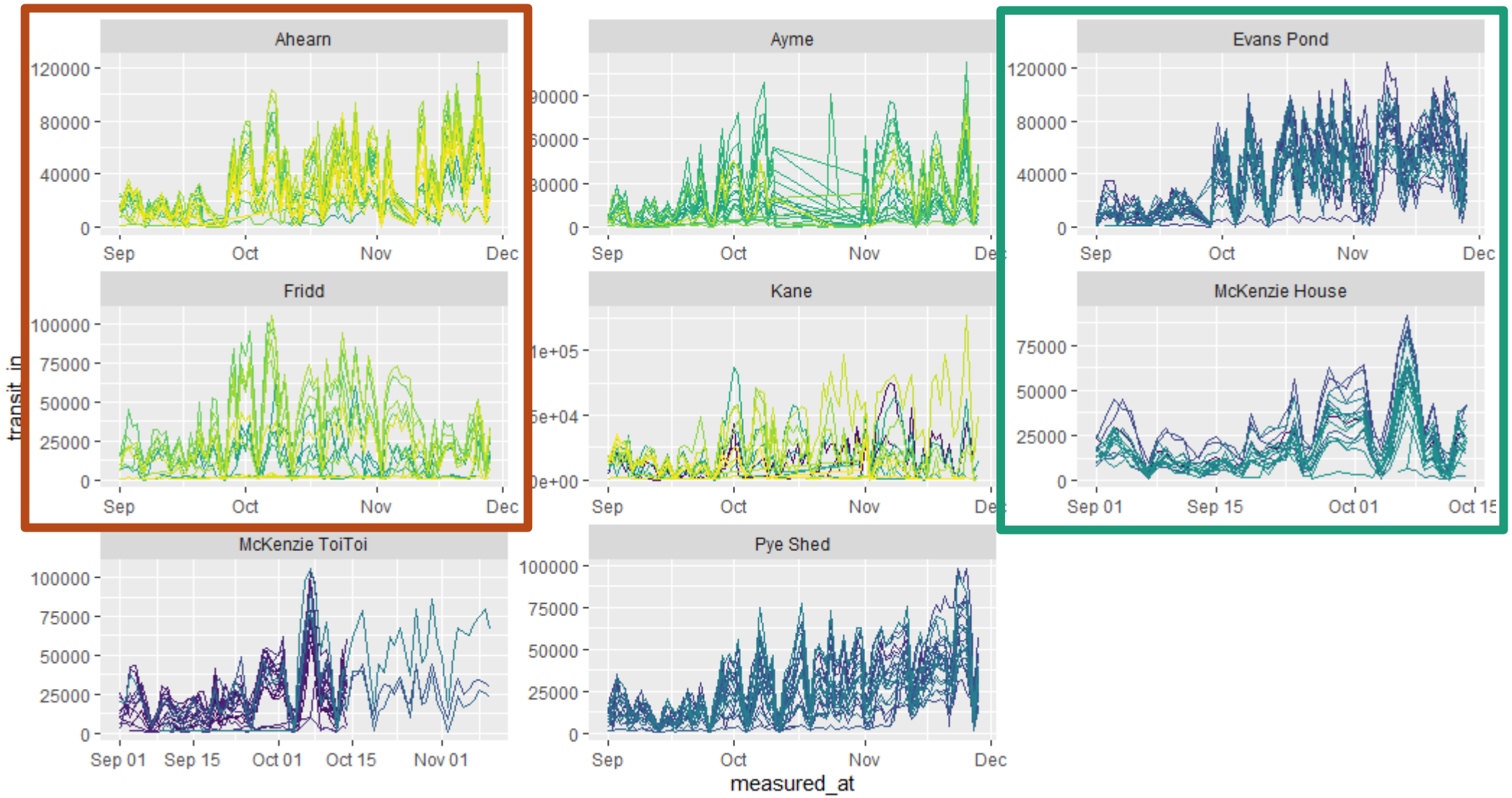

"late risers"



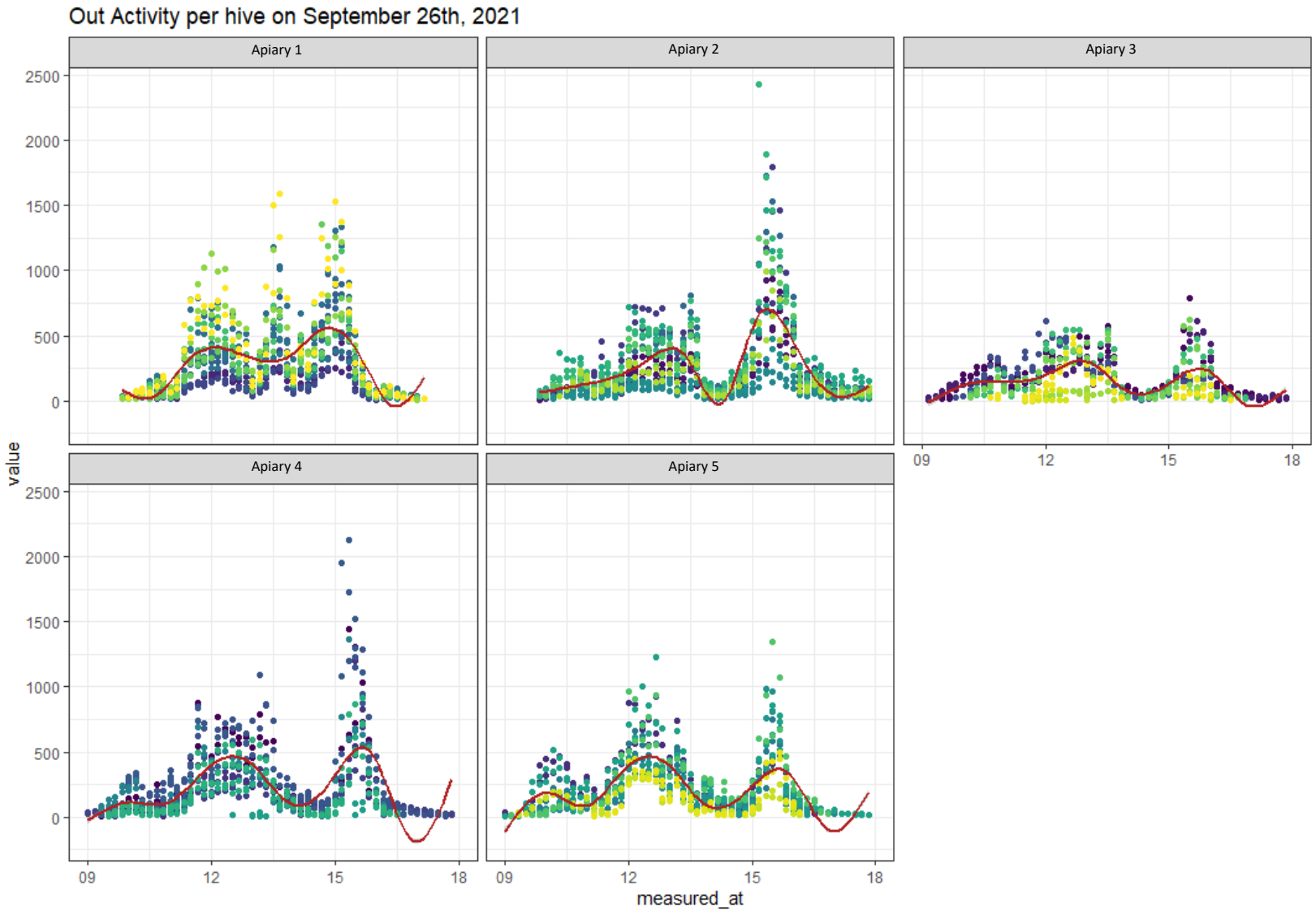
# How does this impact Honeybee Physiology?



# Understanding bee activity: apiary impact



# Automated environmental classification



# What do we need to do next?

## Test algorithms for automated environmental classification

- Use results as fixed effects in Genetic Evaluation and test for accuracy

## Train models to auto-record colony phenotypes

- Phenotypes:
  - Honey yield
  - Colony strength
  - Spring population development

## Explore the link between colony activity pattern and individual physiology

- Damien Fevre's PhD: Nutritional impacts on queen quality

# Thanks to:


## The FutureBees team in New Zealand

- Prof. Peter Dearden
- Pete Fennessy
- Deepak Gupta
- Cherokee Walters & Maddi Post

## The Taylor Pass Honey Co & Midlands Bees

## The team at the LAVES Bee Institute in Celle



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