Overwintering Honeybees

Some Dynamics of Overwintering

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THE Beekeeper's CORNER PODCAST

INTRODUCTION – Kevin Inglin

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Topic Groups

- Introduction to Overwinter: Objectives
- The bees in winter
- Keys to Successful Overwintering

This Years Projection: Are you READY?

Winterization

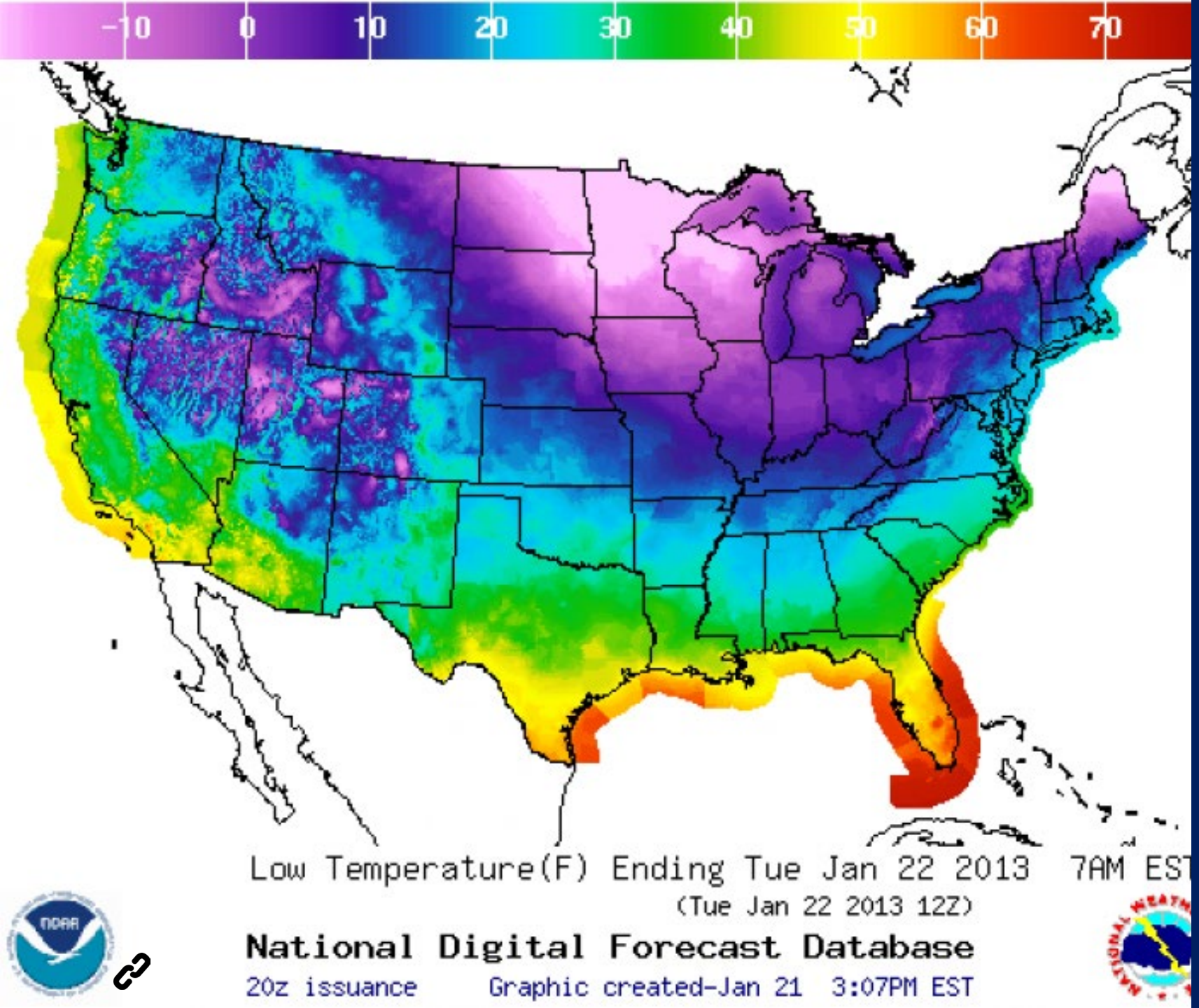
- When we cease day-to-day operations in the fall, we have ‘winterized’ our apiaries.

Is there a proper way to do that?

- In Beekeeping, to prepare is to:
  - *Know the weather*
  - *Follow the biology of the bees*

Definition

Winterize: adapt or prepare something, for use in cold weather.



To prepare for winter…

Alberta Clipper Weather Pattern

- *Common polar air mass movement during the U.S. Winter*

Bees in Winter

- **Bees on the Cluster**
  - *At 50° Bees will gather*
  - *At ~45° Bees will cluster*

45°

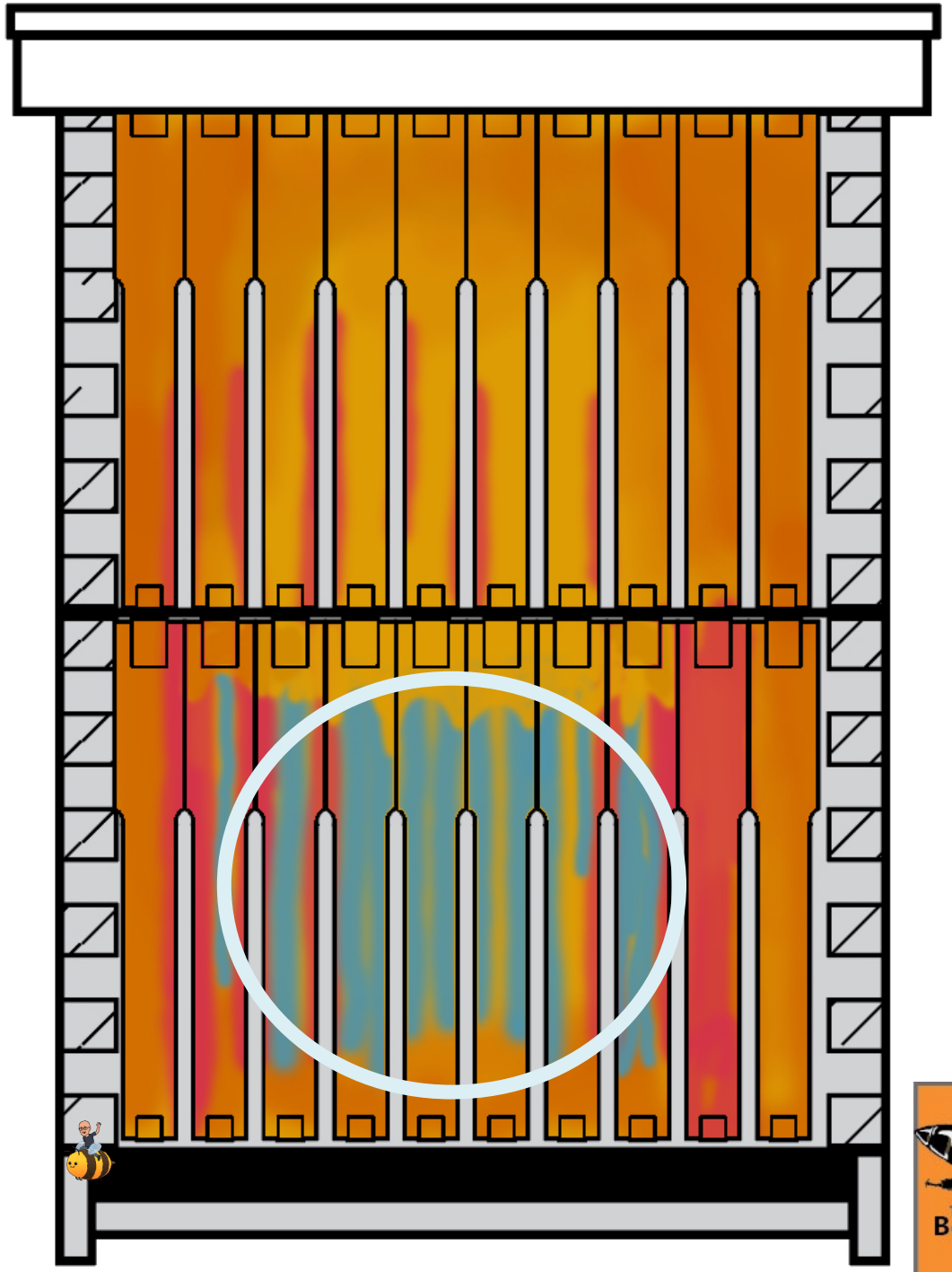
- **Ranges Vary Year-on-Year**
  - *Sometimes cold weather comes early*
  - *Sometimes it comes late*
  - *Same with spring; sometimes it warms up early or it stays cold longer into the season*

Bees will likely Cluster together in these months

- SEPT: 78/54°
- **OCT:** 65/41°
- **NOV:** 50/29°
- **DEC:** 37/18°
- **JAN:** 33/14°
- **FEB:** 37/17°
- **MAR:** 51/28°
- **APR:** 63/39°
- MAR: 73/51°

Late Fall Arrangement

- Brood in the center bottom
- Pollen in and alongside
  - *Possibly some in the top frames*
- Honey left and right
- Honey above

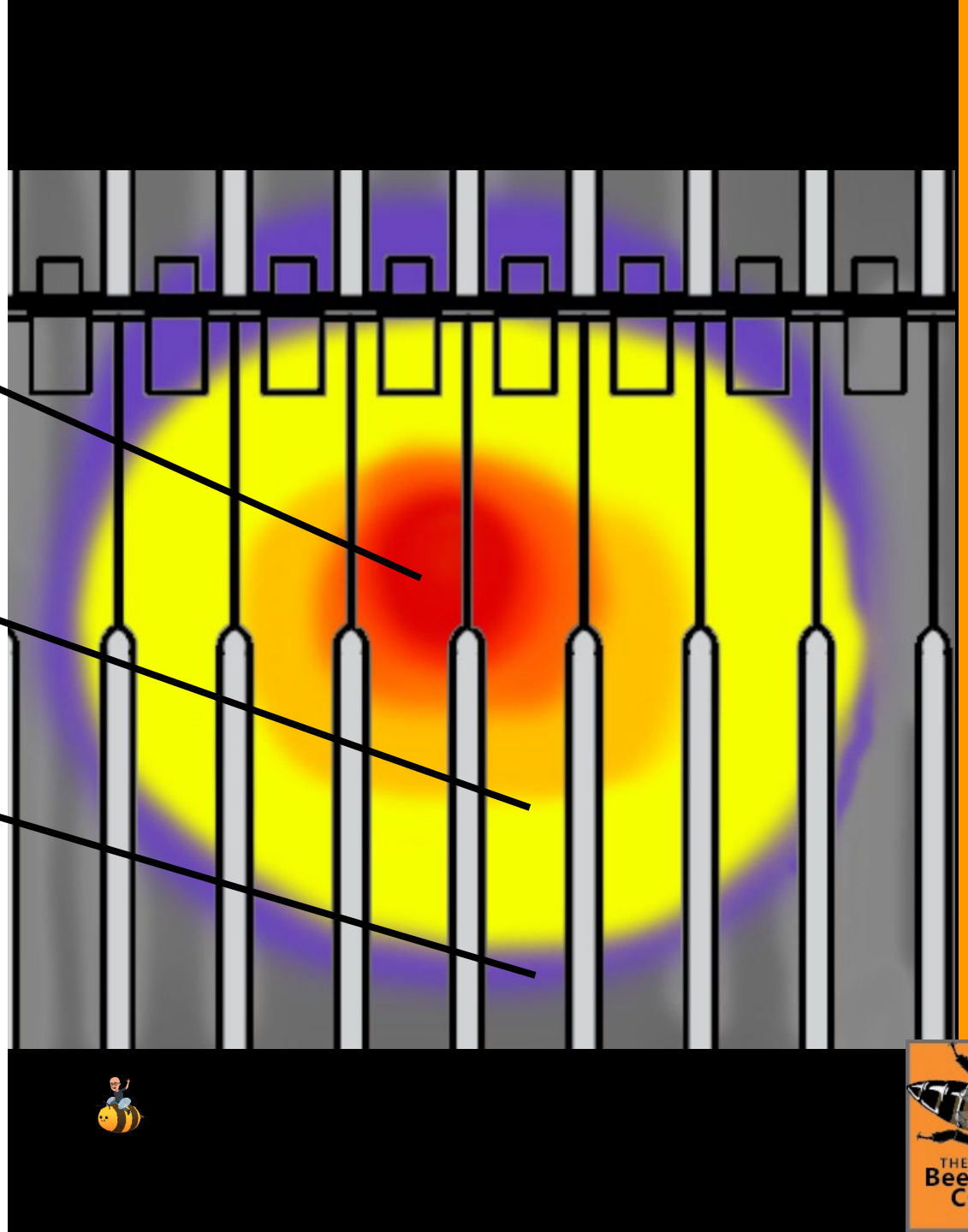


The cluster

Brood Nest - 90 to 95°
Queen, Nurse and Heater Bees

Core Bees - 65 to 85°

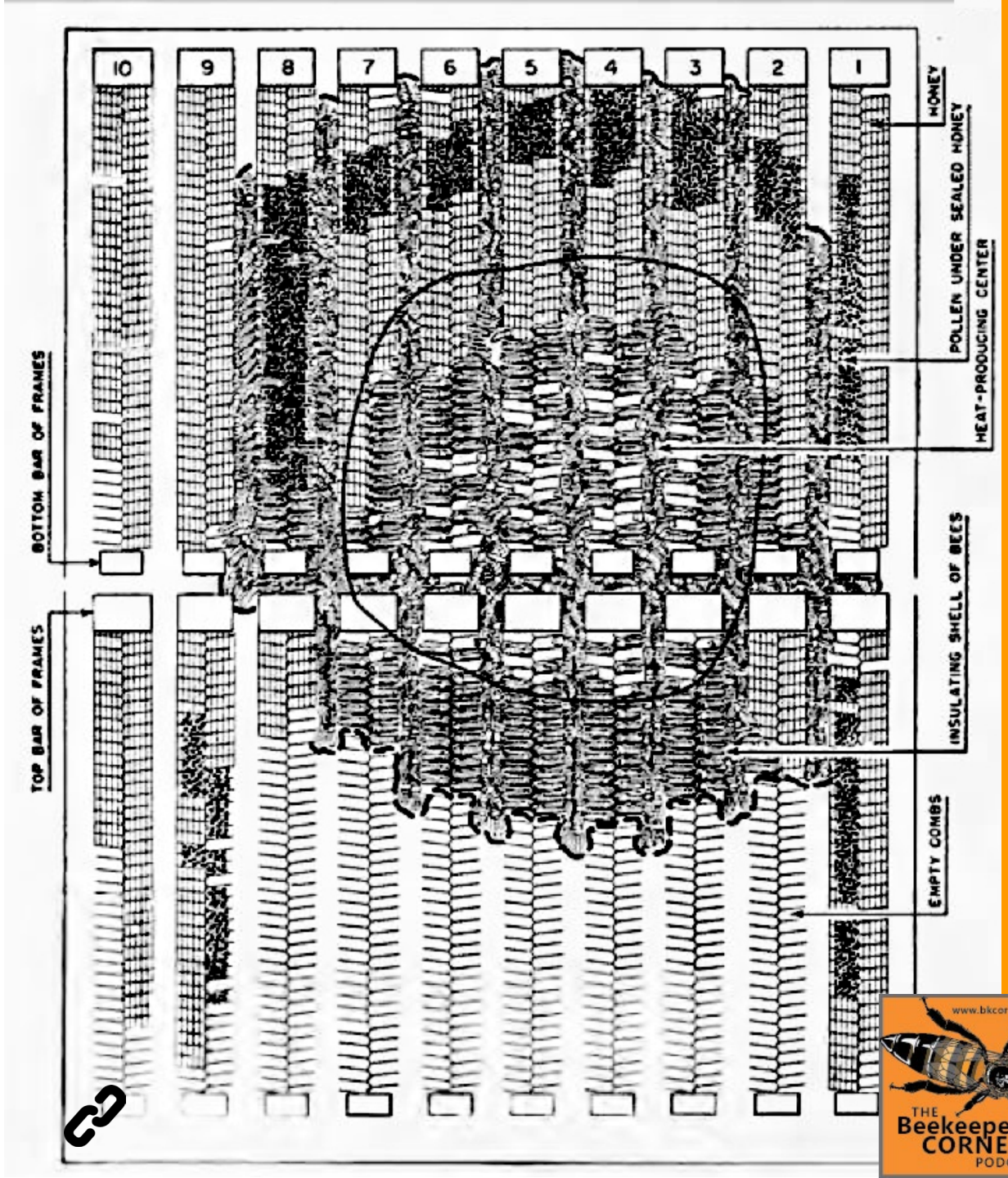
Mantle Bees - 50 to 65°



Cluster Render

❑ Use of Cells

- *The visual here demonstrates how the bees occupy the space*
  - Bees occupy empty cells
  - They gather together in the gaps
  - In the center they can move around
  - At the shell they form a tighter outer barrier as a tactic to reserve heat radiating off the bees



A picture is worth…

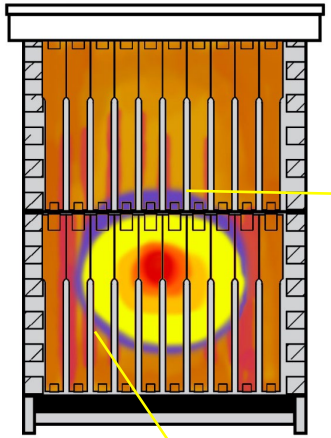
- A thousand words

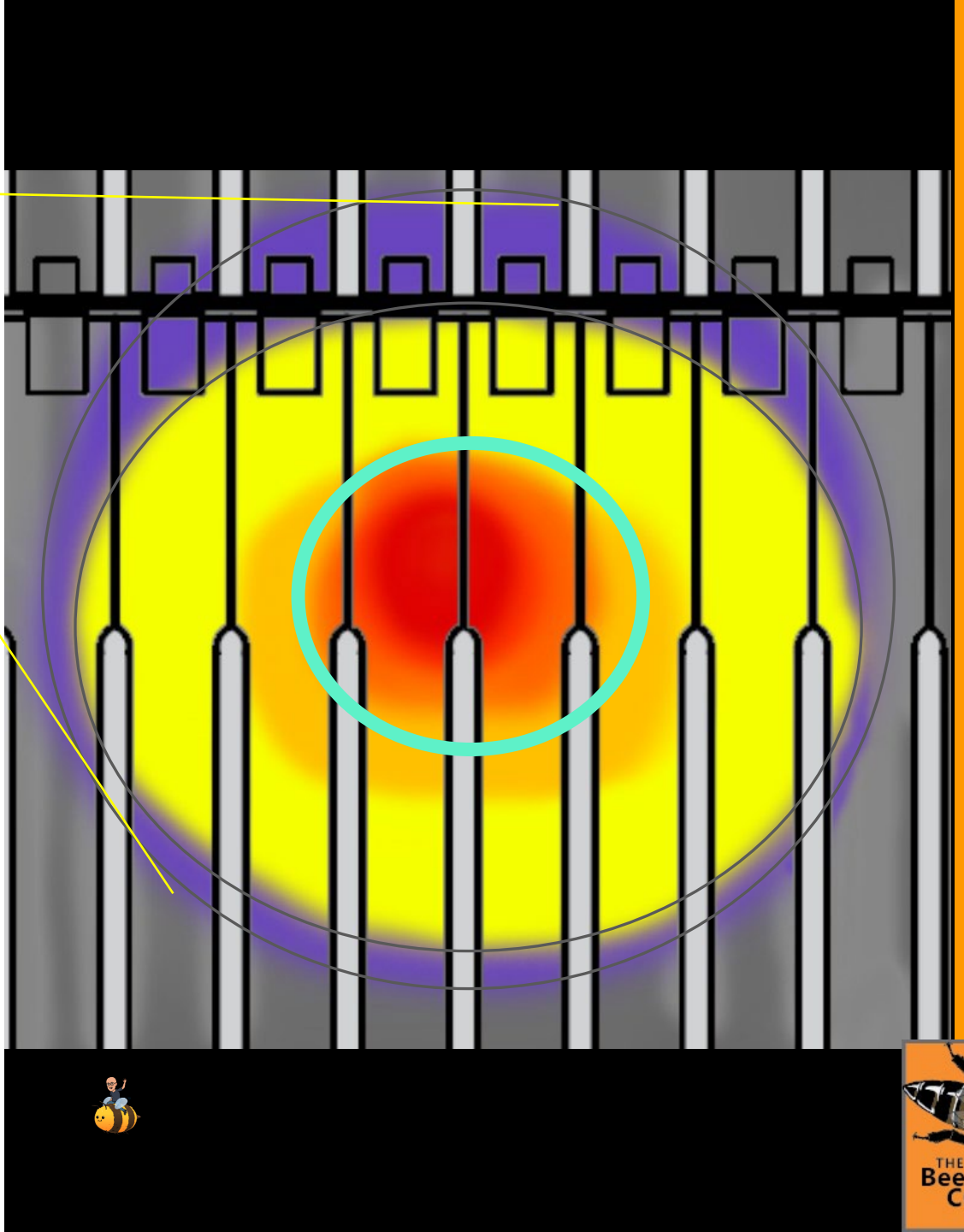
Cluster formation

- *Note:* ***Do not do this;*** *this is extremely detrimental to a cluster.*
  - Disturbing a large, tight cluster can result in extreme stress to the colony, and sometimes sudden death. (Randy Oliver Comment)

Photo Credit Randy Oliver

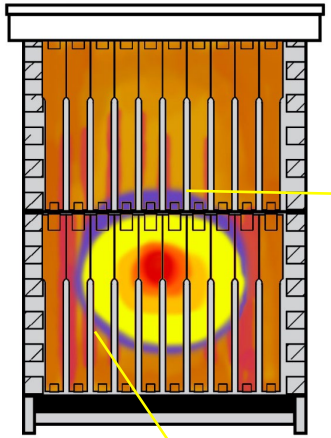
The cluster

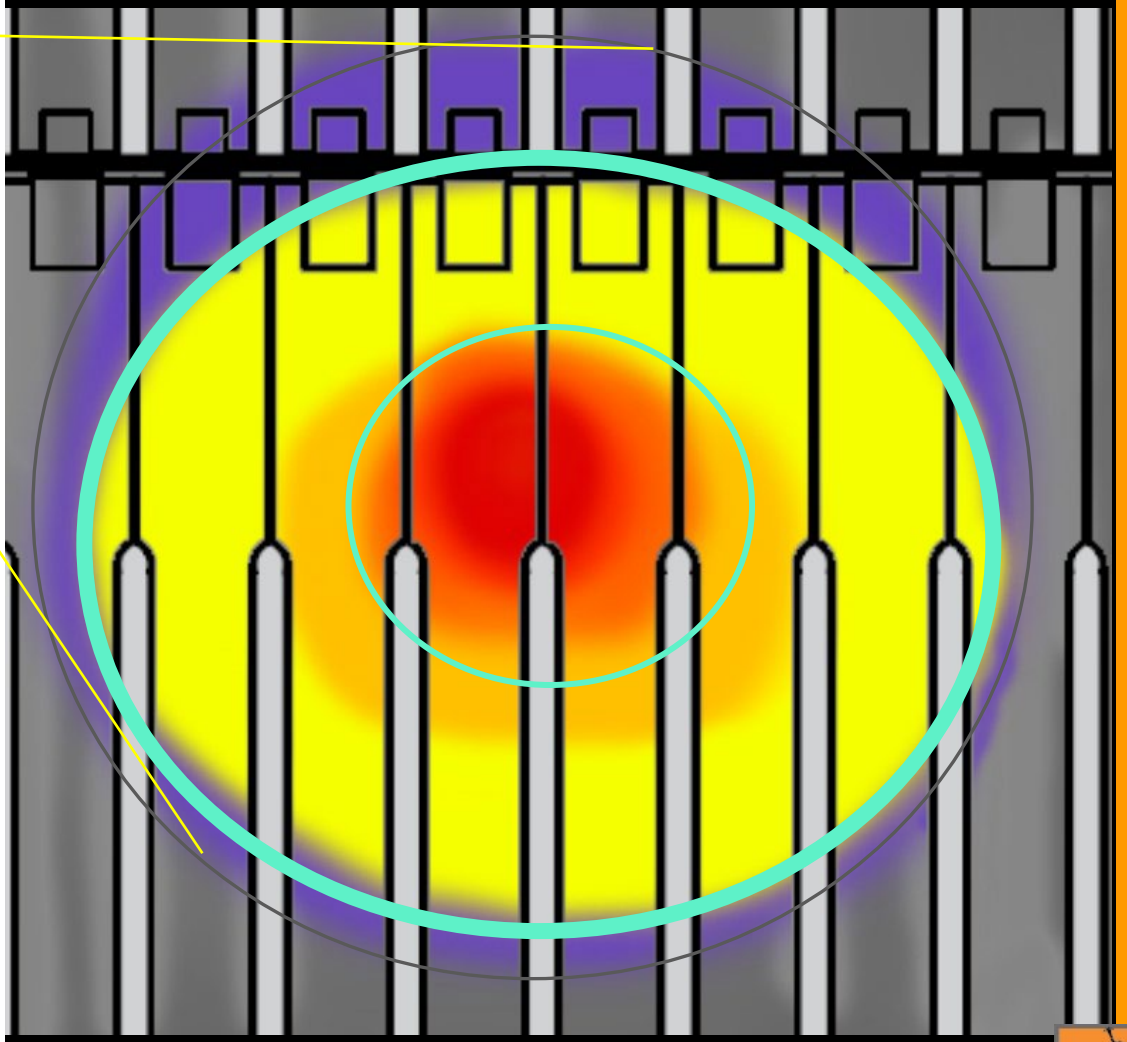




- Nest
  - *Nest includes the queen and the Nurse bees, as well as brood*
    - They will maintain a small space for brood rearing through part of winter
  - *In the core, the queen will lay eggs and the nurse bees will care for the new bees*
    - Nest bees can move around as necessary

The cluster

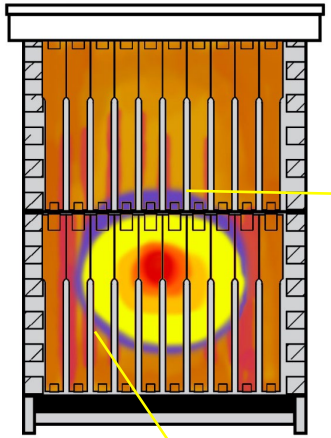


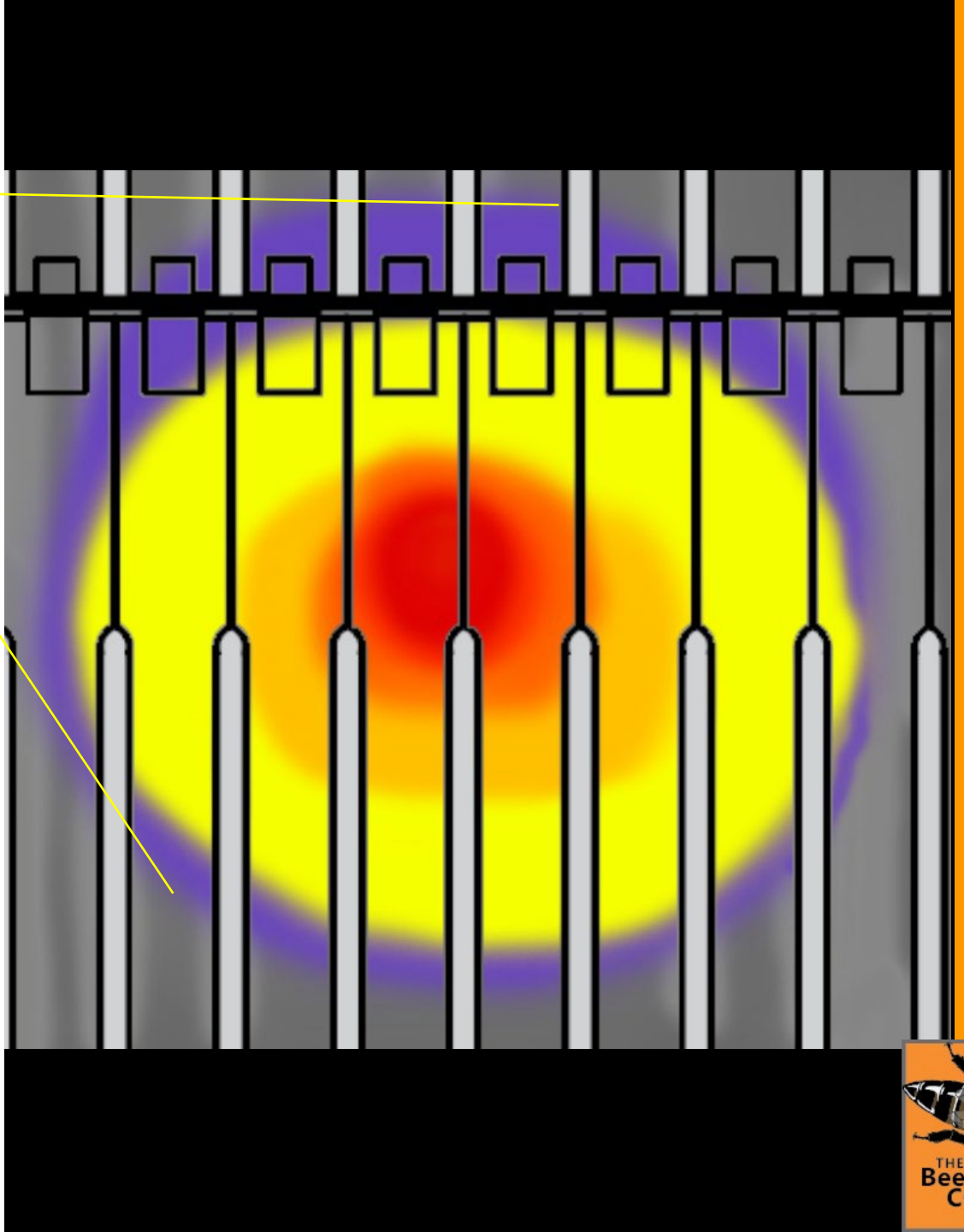


Interior bees

- *Interior bees are a combination of spare bees and heater bees*
  - The interior bees also cluster together body to body
  - They will go inside cells and radiate heat into the wax
- *Given the warmth, interior bees can also move around to sustain operations inside the cluster*

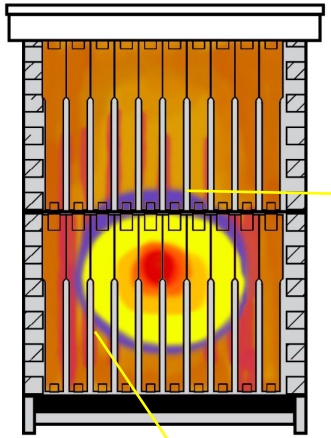
The cluster

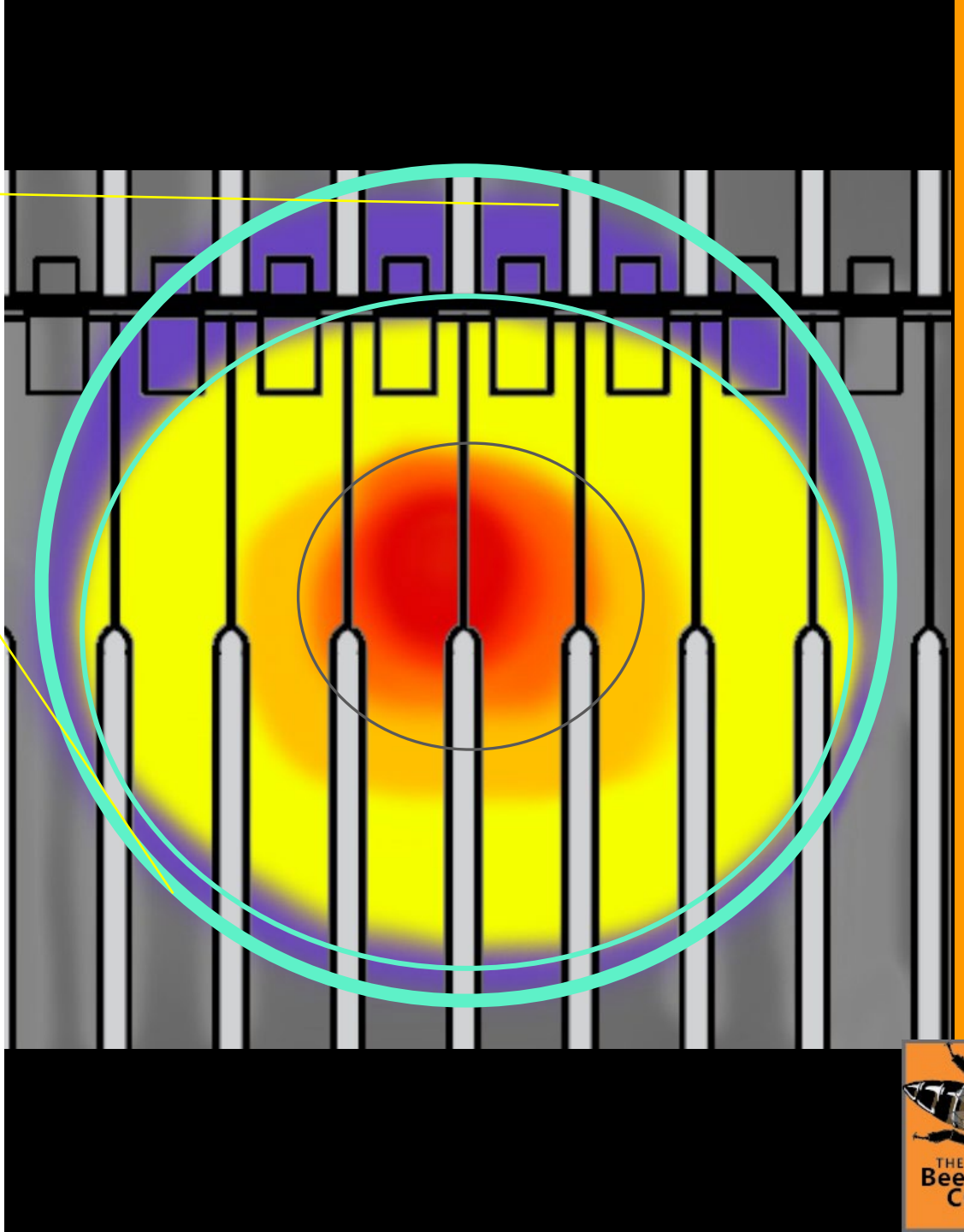




- Outer Shell
  - *The outer bees are tight to each other and/or in the cells tight.*
    - The outer shell are bees that are head in, body to body

The cluster





- Outer Shell
  - *The bees on the shell are thicker on the top*
    - Dr. Farrar's sketches of cluster cross sections in Wisconsin winters snow nearly twice the thickness of the insulating band at the top.
  - *In doing so they do more to keep the heat from escaping the mass*

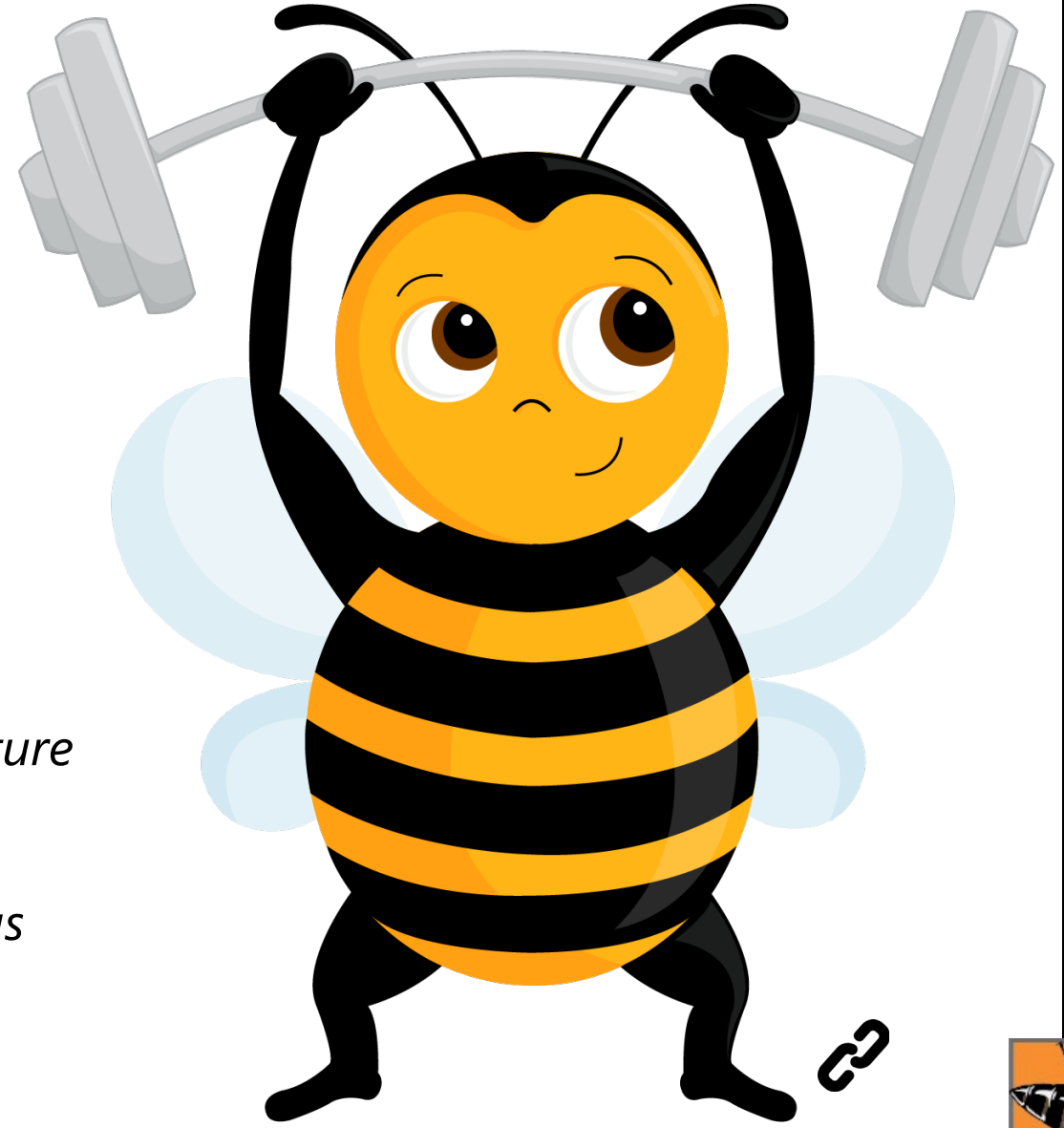
Landmark USDA Study Data

Bees in cells

- Visualizing how they might look…
  - *This is unfortunately a shot of a 'dead out' after starvation.*
  - *It does however give a sense of how the warm bees might go into the cells and radiate heat to the comb and each other in times of clustering.*

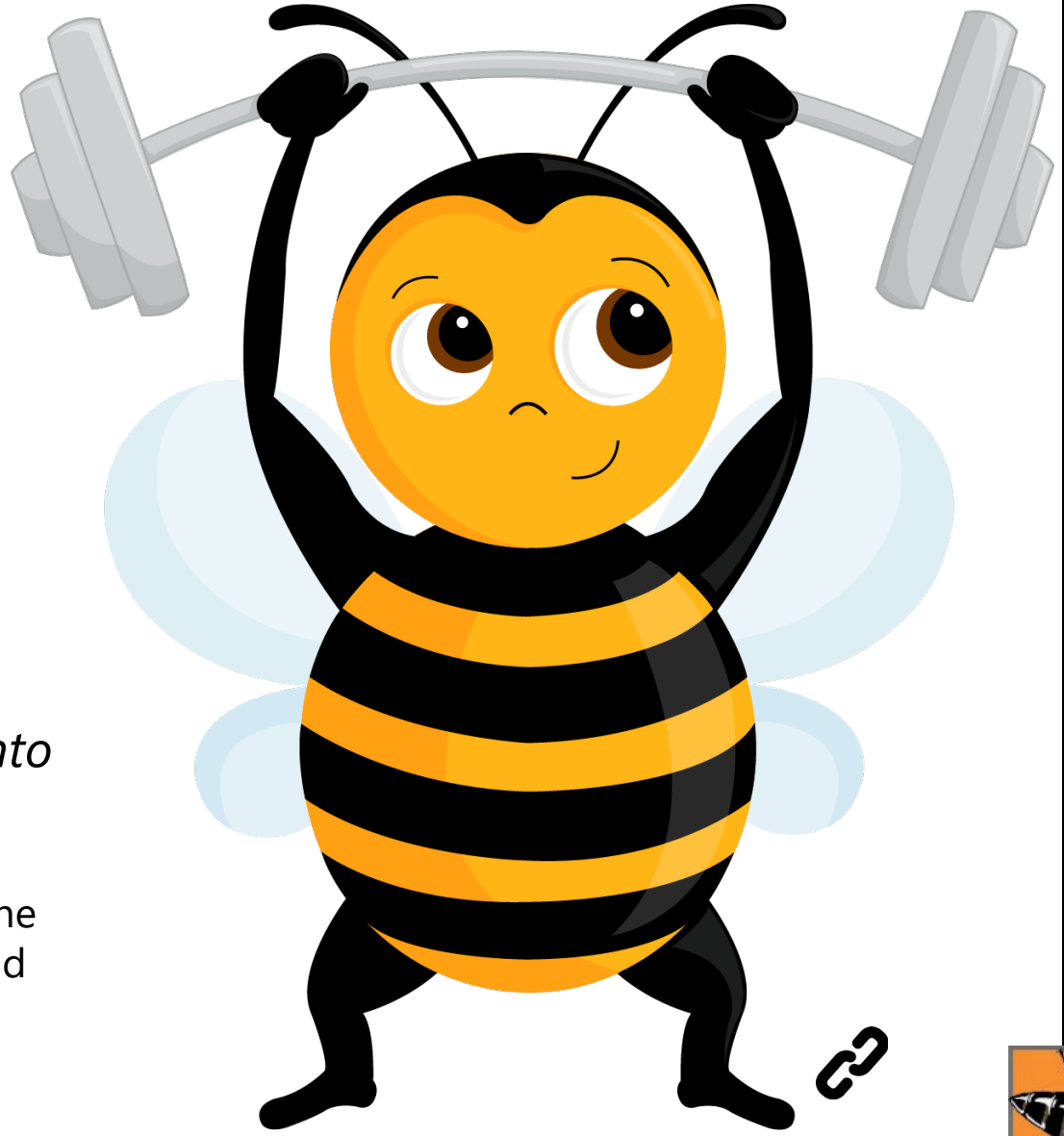
‘Bee Aerobics’

- How do bees generate heat?
  - *Through their flight muscles*
    - (Kind of like our shoulders)
  - *They can relax part of the musculature that connects to the wing*
  - *They are flapping their wings, minus the flapping*



‘Bee Aerobics’

- How do bees generate heat?
  - *Like us, when they move the muscle group, they heat up*
  - *This heat radiates off the bee and into the mass*
    - While we are enjoying the holidays, the bees are out generating heat 24x7 and dreaming of spring



Heater Bees and Shell Bees

- **Heated through movement and circulation**
  - *As noted, heat is generated at the thorax*
  - *The narrow passage of the waist, coupled with the fact that the circulator system of the bee pushes fluid forward, means the front half of the bee is heated.*
    - There is virtually no heat made at the back of the bee – the abdomen
- **Shell Bees**
  - *Shell bees face inward, tail out.*
  - *Any heat generated from the center mass is trapped by the downy hairs that cover the body when the cluster together in the shell.*

Active vs. Inactive Winters

- Some winters are milder
  - *Bees will attempt to operate if temps get to 40° and above*
    - Good for cleansing flights.
    - Bad for wasteful, fruitless foraging (some pollen)
  - *If below 40° consistently (assuming a flight day periodically)*
    - The bees will go into a **torpor** state
    - Many of the cluster will slow down, and get into a quiescent state
    - They will **subsist** off of their internal stores

Definition

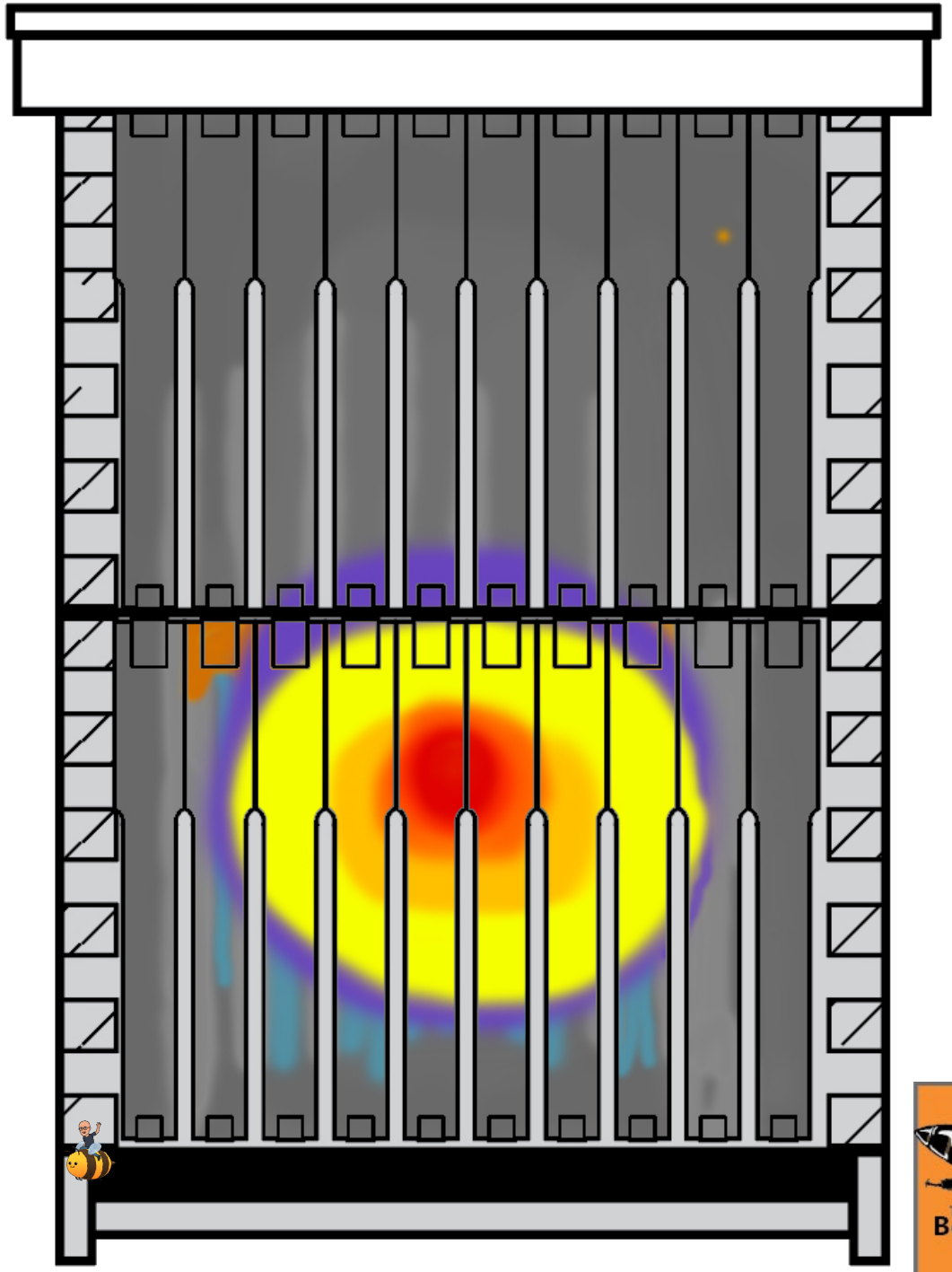
Torpor: a state of physical or mental inactivity; lethargy.

Definition

Subsist: maintain or support oneself, especially at a minimal level.

Interior Warmth

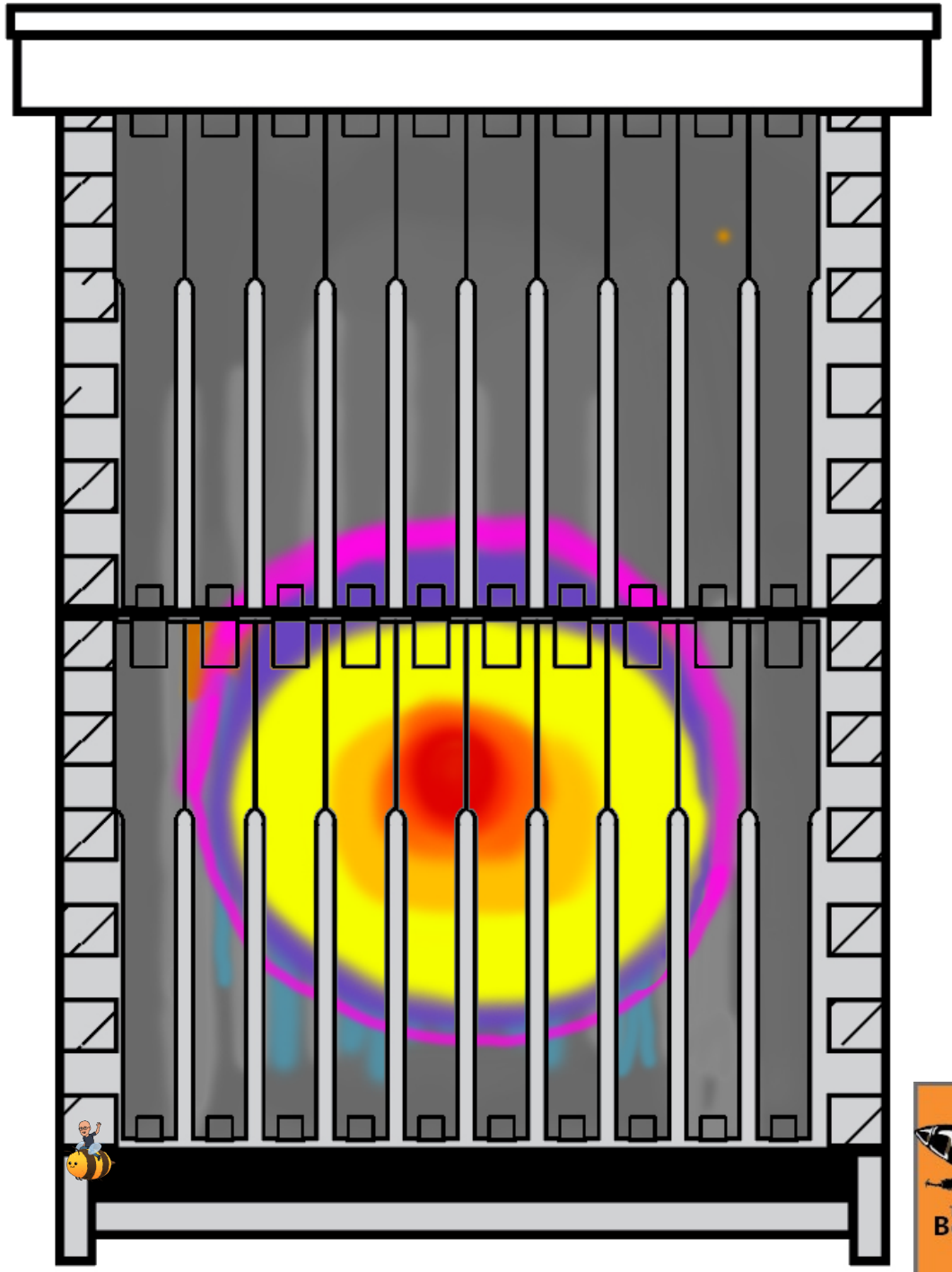
- Heat Dynamics
  - *Brood rearing temperature in the center*
  - *Heater bees in the middle*
  - *Tightly clustered bees form the shell*
- The hive interior is not heated (Gray Tones)



Warmth Envelope

Surrounding Air

- *Heat radiates off the cluster*
- *This warms some of the air around the cluster*
- *But mostly the interior hive temperature is only a few degrees warmer than the outside air*
  - Some warmed air will collect at the top of the hive.



Heat Rising

Rising Over the Cluster

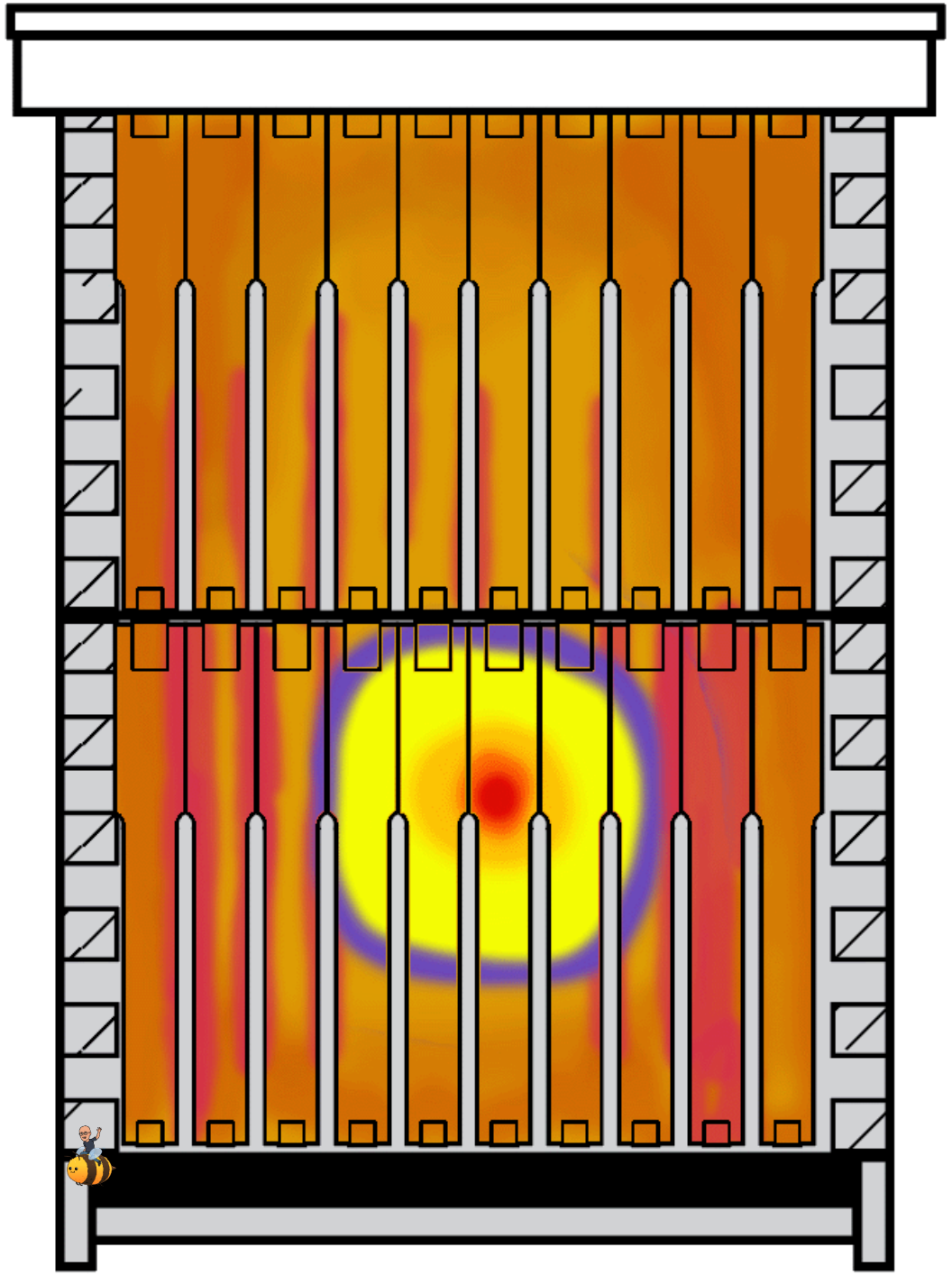
- *Heat will come up and over the cluster – heat rises*
- *It will center itself over the cluster*
  - Much like a fire comes together to form a pillar.

Scientists say: Heat rising near the outside edges of a heat source will fold inward and concentrate toward the center of the mass.

Stretch to food

Reaching for food

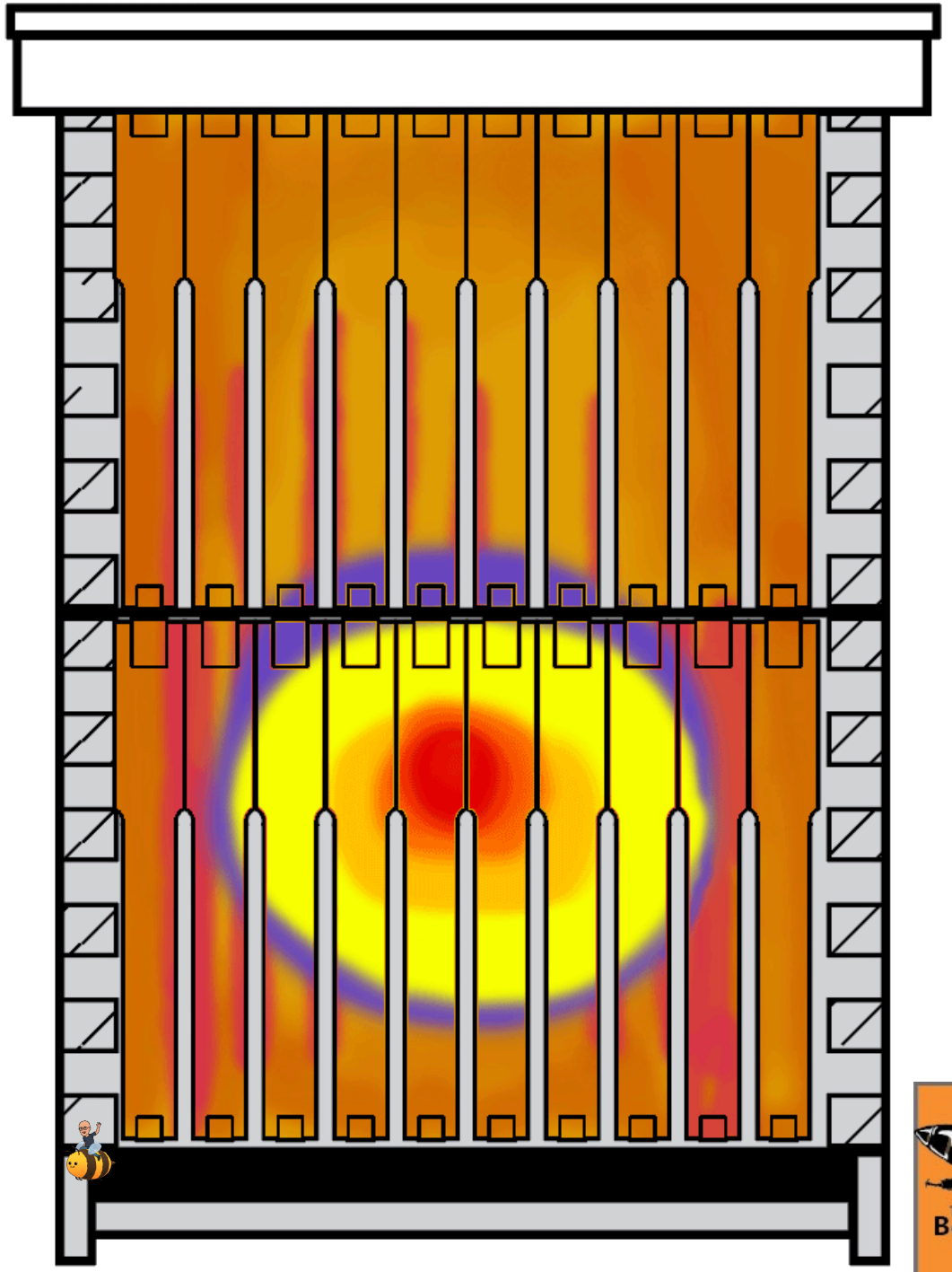
- *Sometimes colonies change the shape of the cluster to reach for food.*
  - The colony will make short-term shifts to food or space
  - The likely objective of moving resources into the clustering area.



The Progression

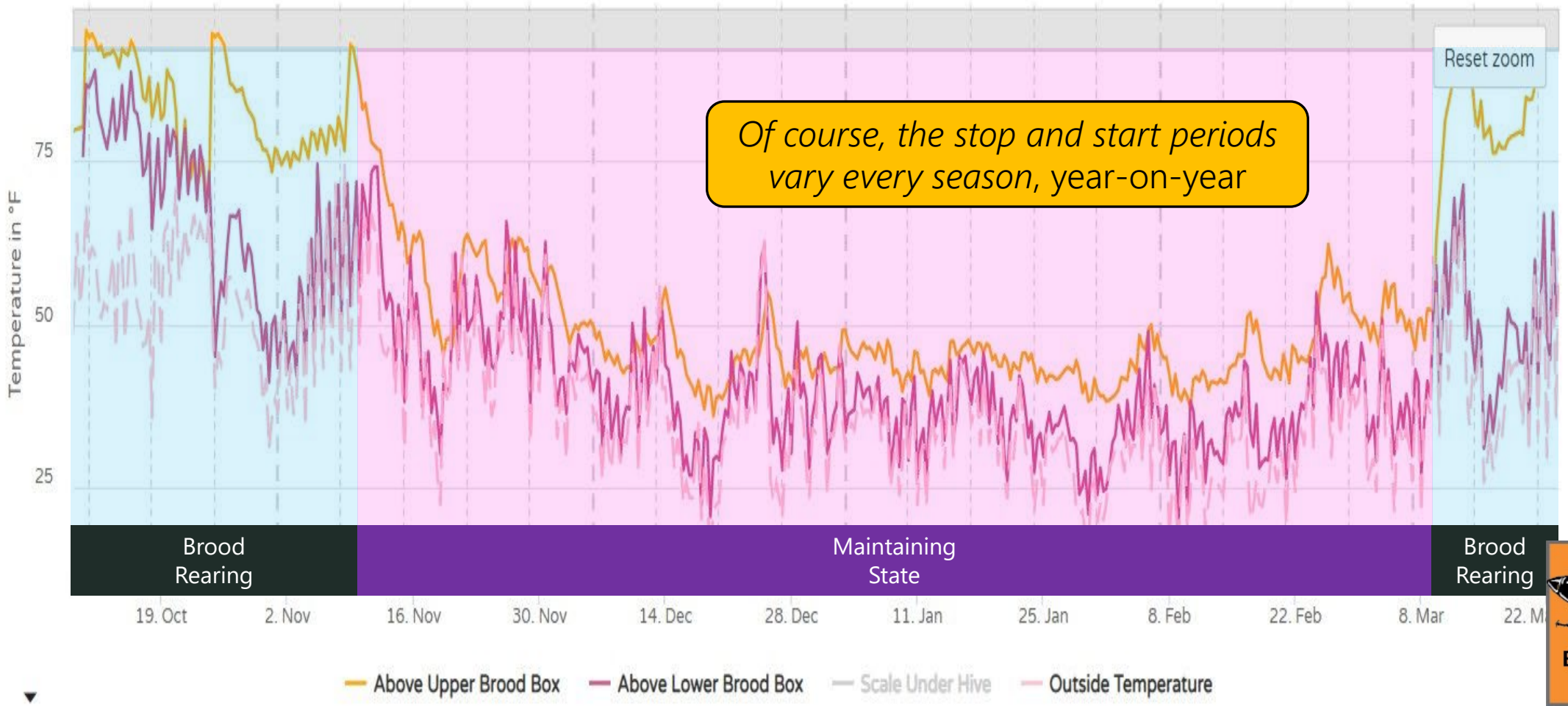
One imagined example

- Cluster in the bottom
- Move left and right
- Then steadily upward
  - *Brood production slows*
  - *Then they cease brood production altogether*
  - *Return to brood production*



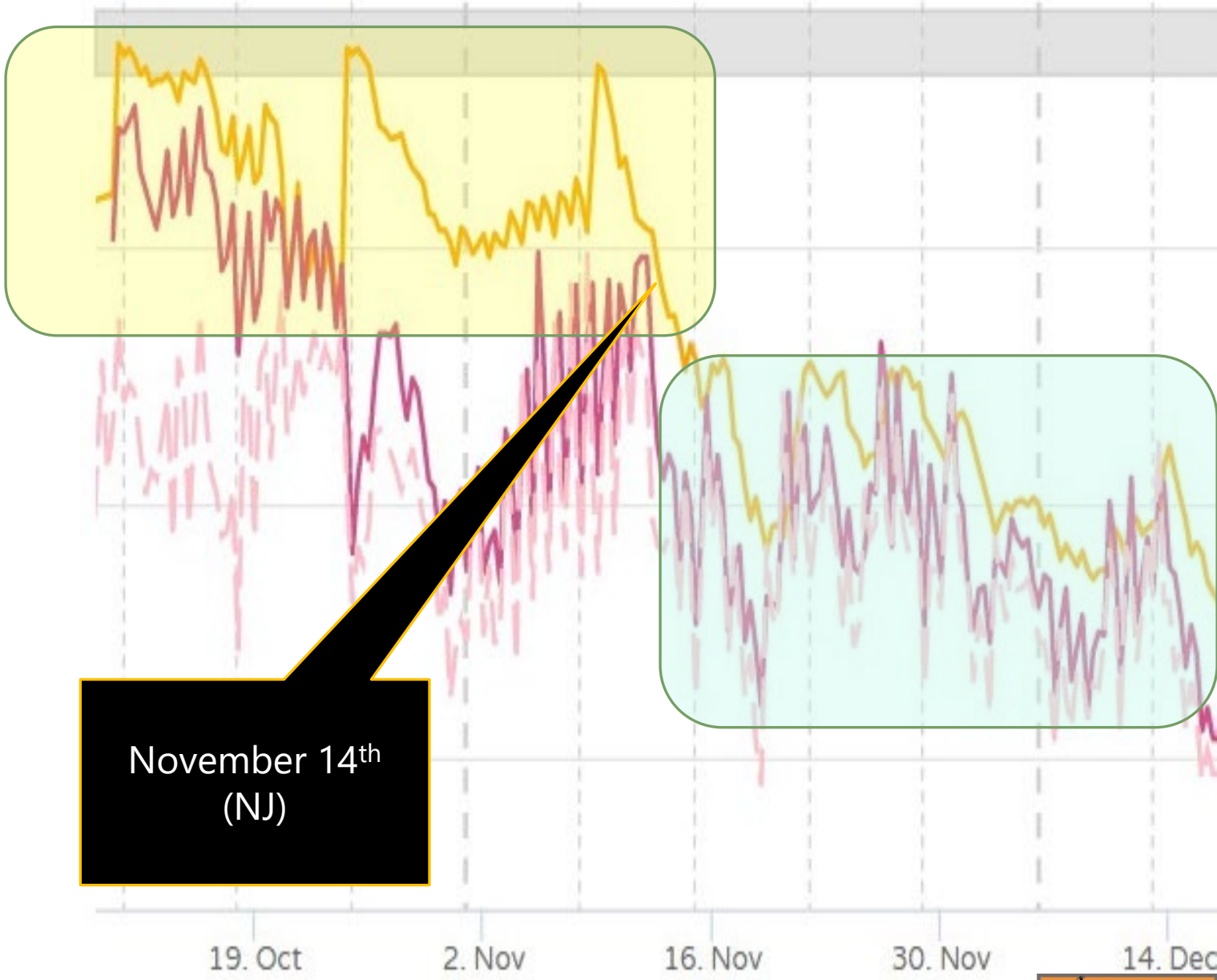
Brood Rearing / Torpor / Brood Rearing

- This chart shows when they ceased and continued
  - *These sensors are not representative of the heat inside the cluster, but it does show the heat generation adjacent to the cluster*



Fall Shut Down

- For this hive
  - *On November 14th they stopped conventional brood rearing*
  - *The temperature got below the threshold to operate normally, and they formed a cluster*

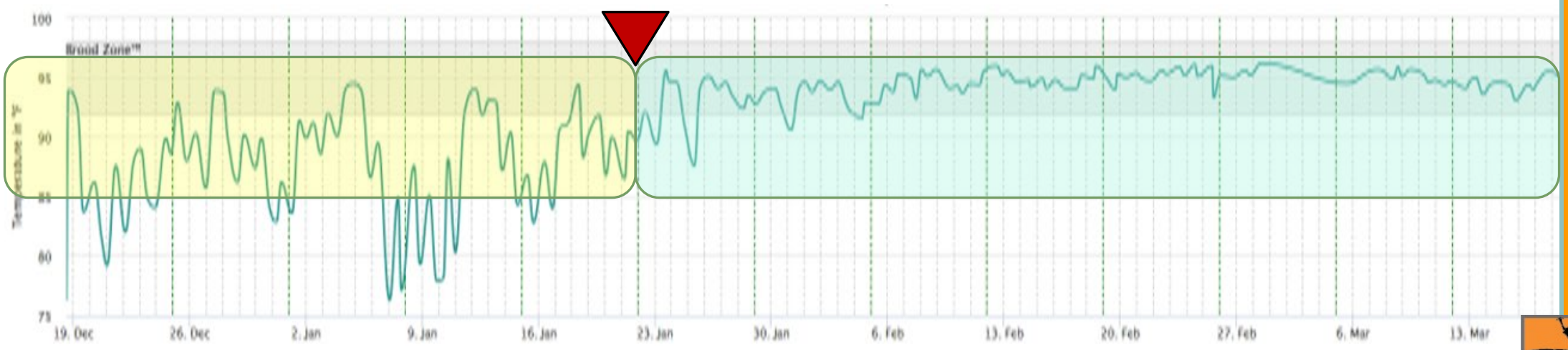


Spring Ramp Up

Cluster populations continued to decrease during December and reached a minimum around mid-January, when they started to increase as brood emerged. [Thermology / Owens]

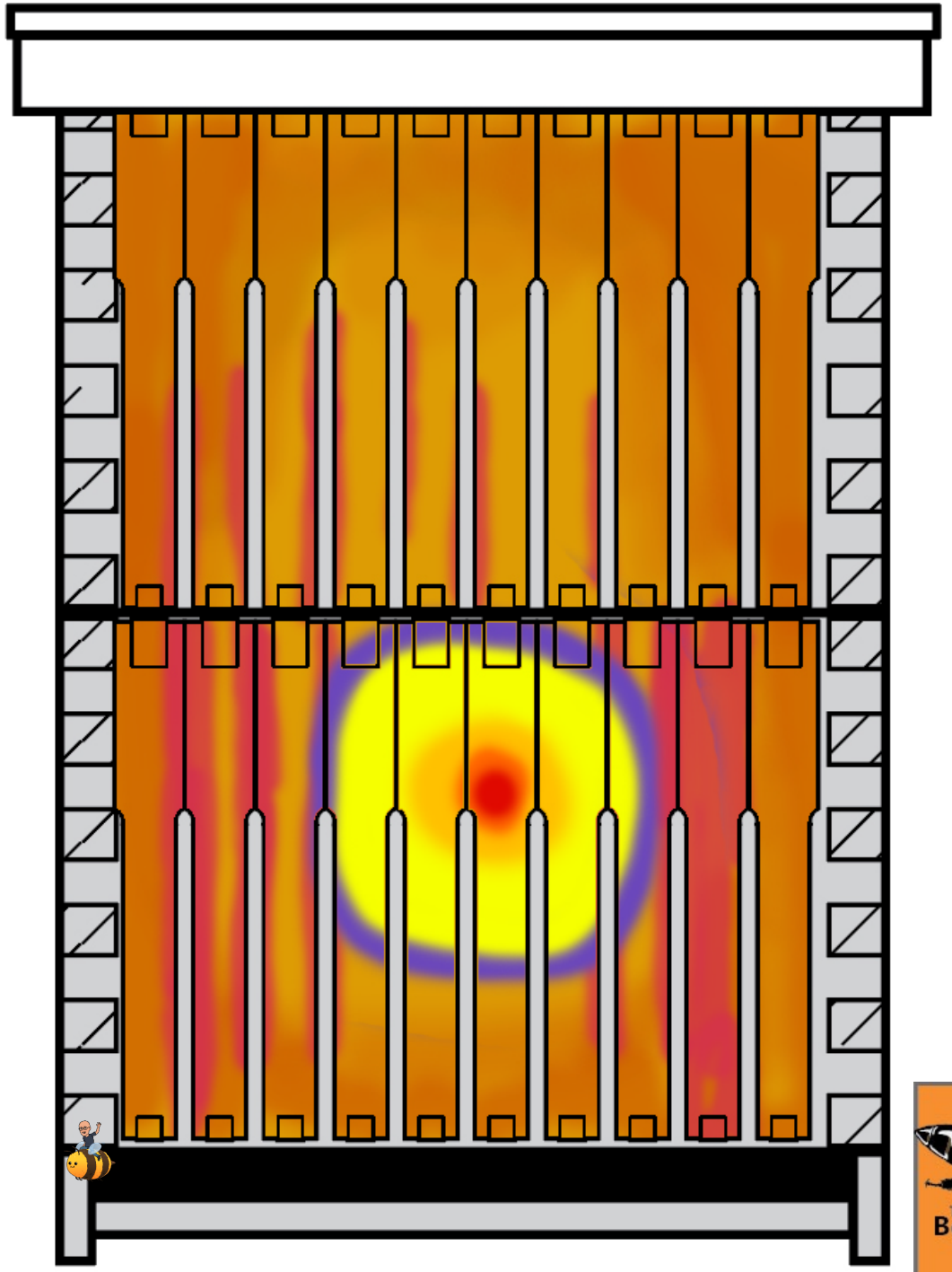
This is a normal condition throughout North America. [Ferrar]

- For this hive
  - *On January 23rd this colony resumed conventional brood rearing*
  - *The temperature returned to the threshold to operate normally, and they broke cluster*



Progression 1

- The Fate of a Small Cluster
  - *Small clusters can get by for a period of time*



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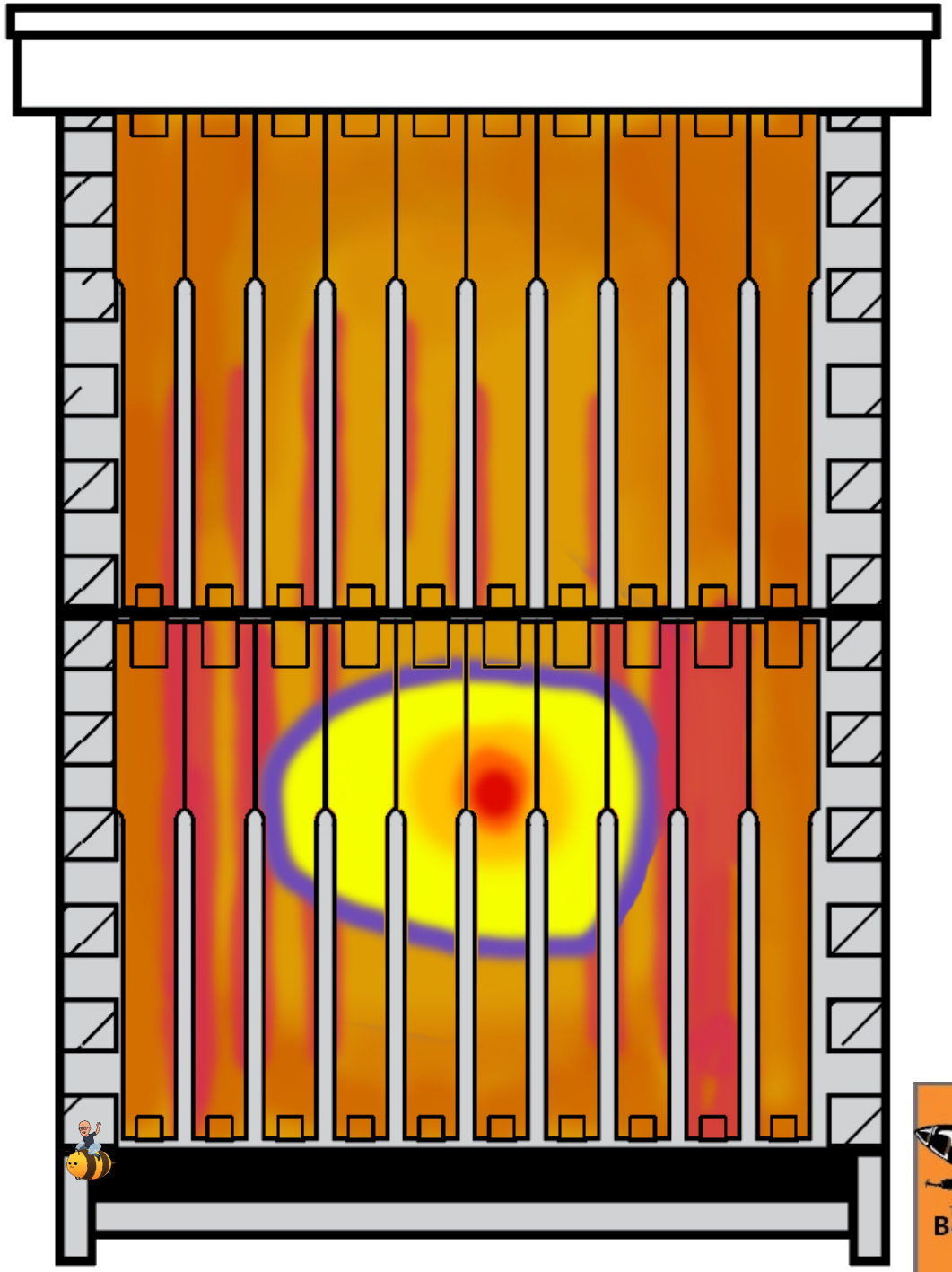
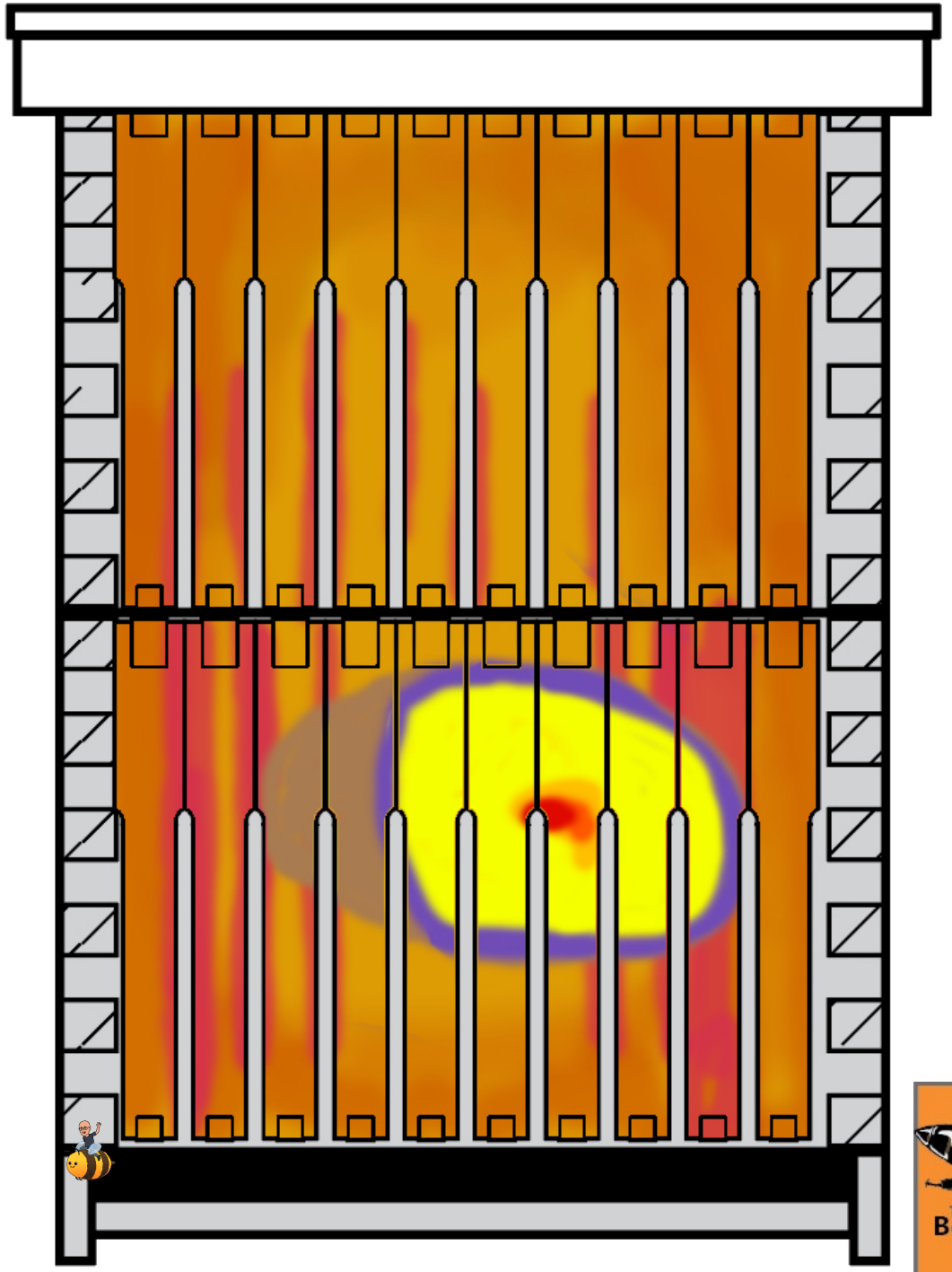
Progression 2

- Small Cluster
  - *Like big clusters, they can move side to side when it is not terribly cold*
  - *Small clusters covering only the depth a frame or two can move only under very mild temperatures.*



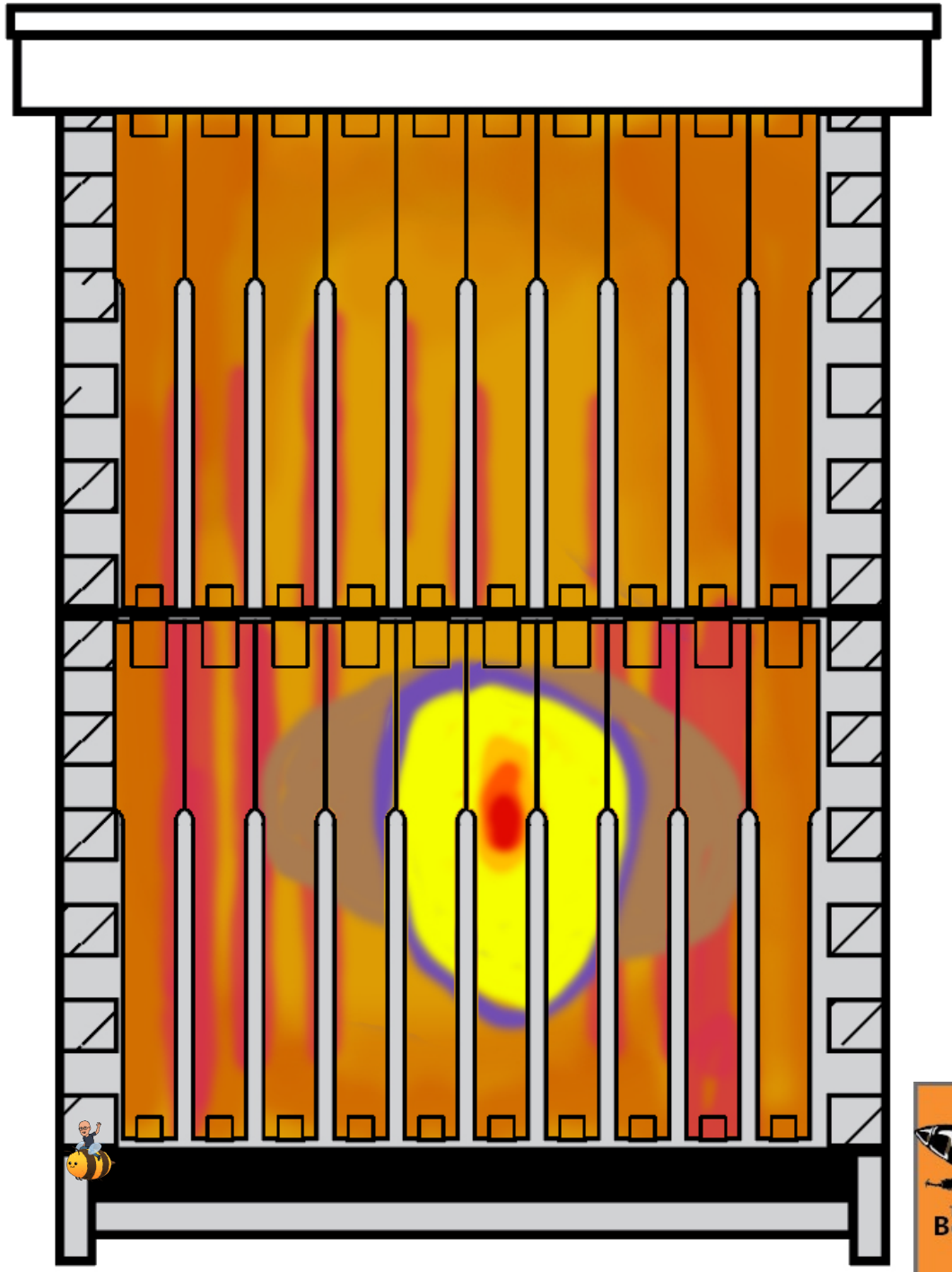
Progression 3

- Small Cluster
  - *They might get by, and move left and right.*



Progression 4

- Small Cluster
  - *Sooner or later though, they cannot, stretch, or reach for resources.*
  - *Resources within reach are consumed.*



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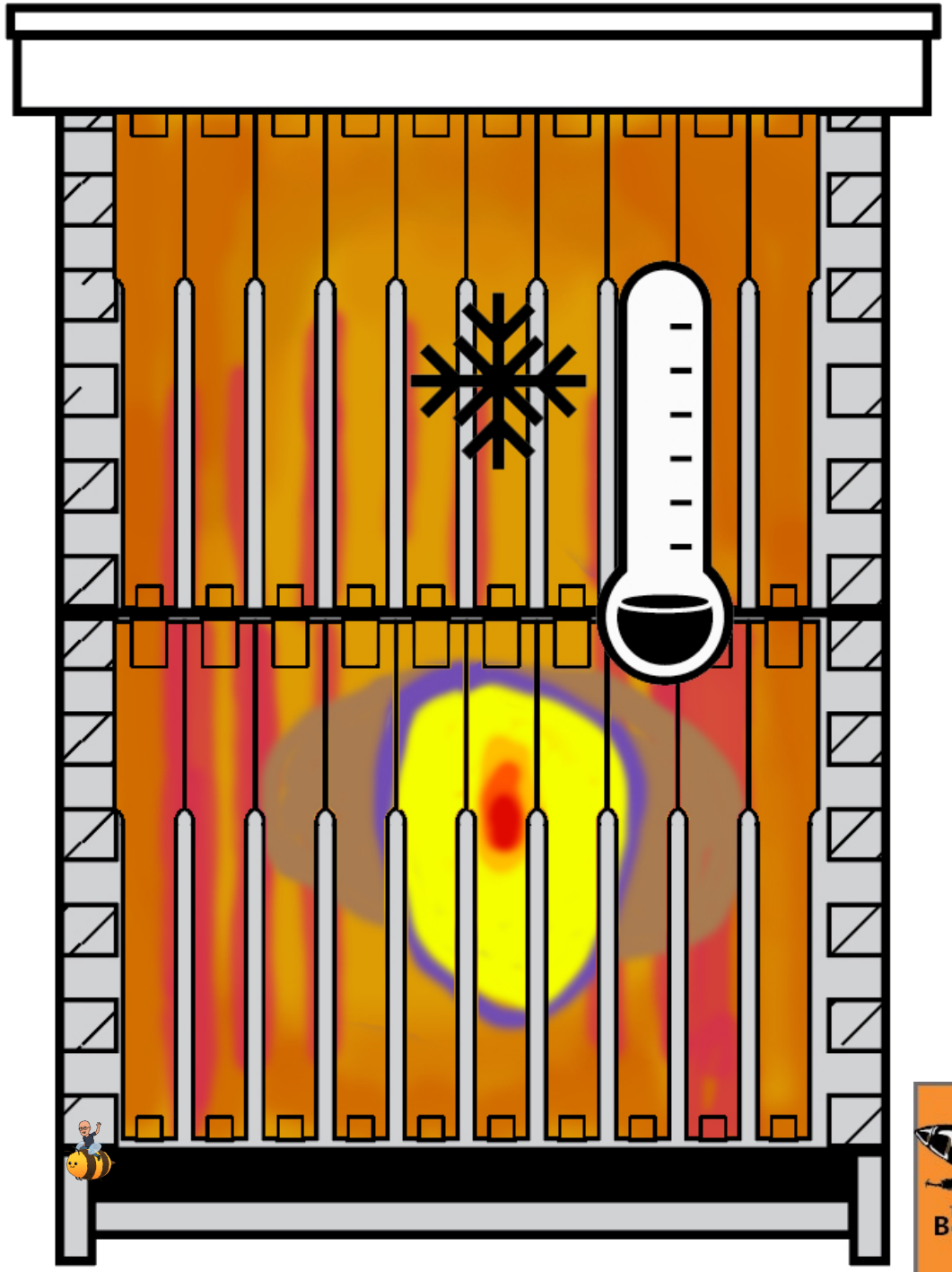
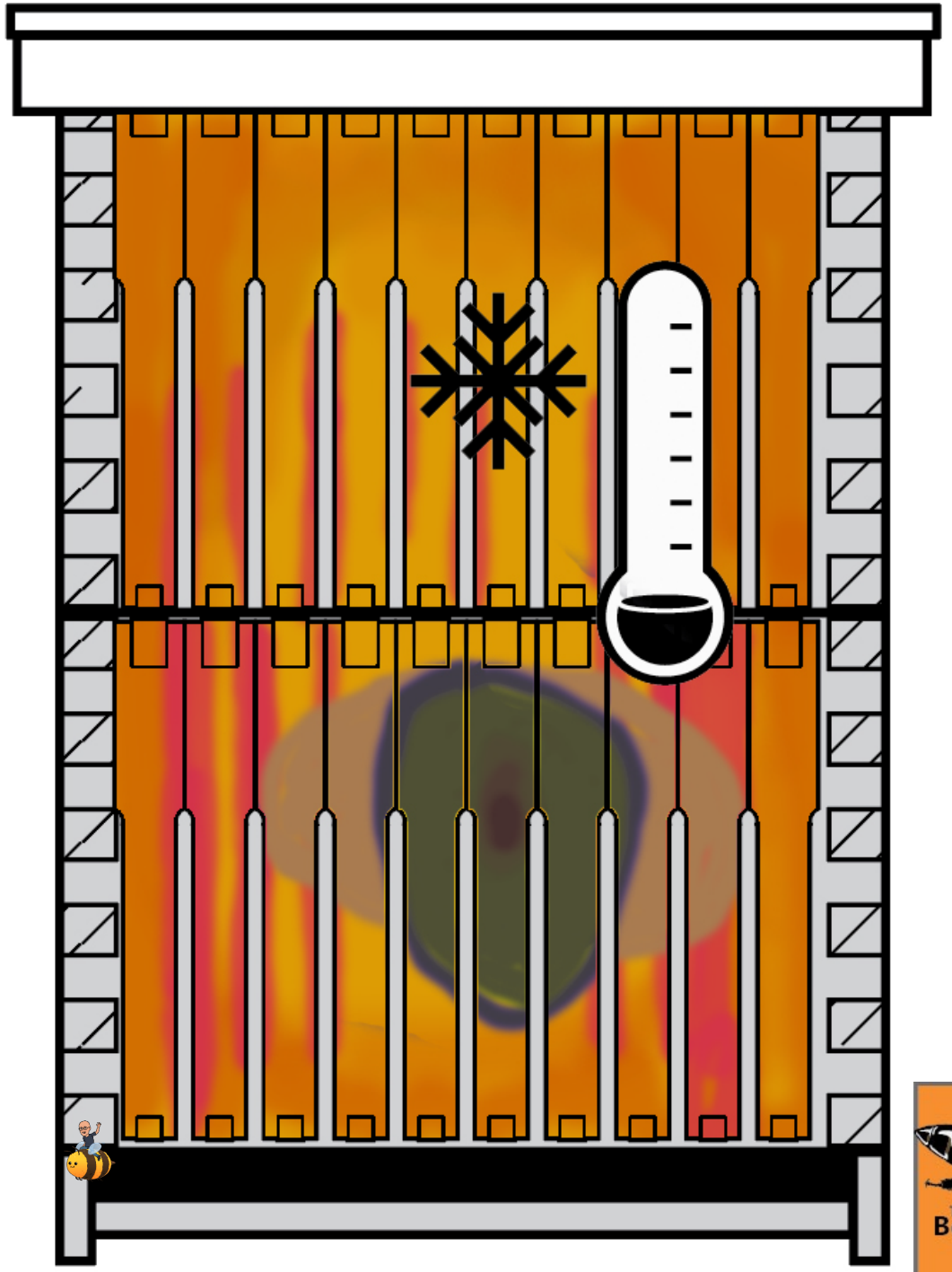
Progression 4

- Small Cluster
  - *They are restrained from moving away from any brood that is underway.*
  - *A cold period comes, and they simply cannot move.*



Progression 4

- Small Cluster
  - *Without food, and subsequent brood they will perish*
  - *They will sometimes starve with food just inches away.*
  - *If the body temperature of a bee falls to 42° it loses the power of motion and will drop.*
    - To maintain life, the temperature of the shell bees cannot go below 43°F.



Disease Dead Out

- Hives Sick, and Under Stress
  - *If a colony is not healthy going into fall. They may have enough bees but it is a false sense.*
  - *The sick bees do not make it through winter. They dwindle.*
  - *Dead bees fall off and the colony perishes mid-winter.*

Demise of strong hives

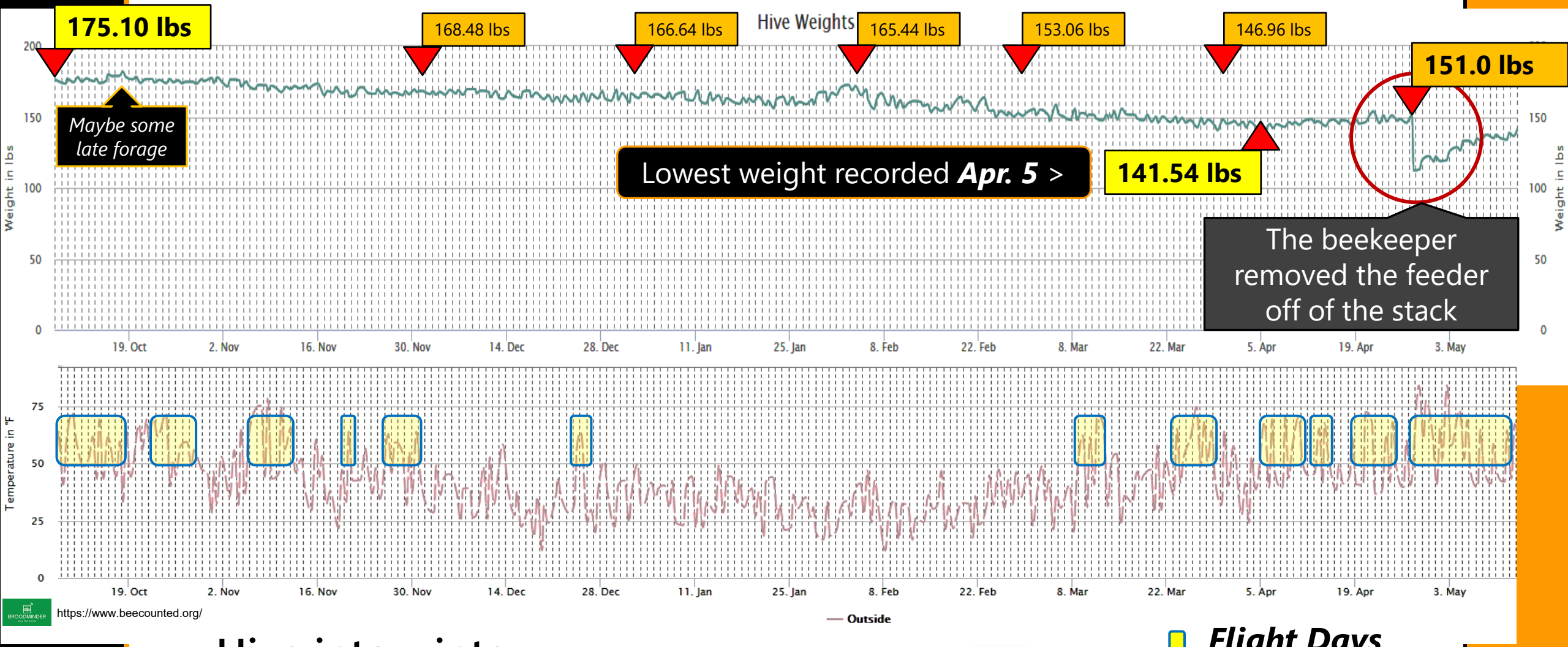
- Big *(Supreme)* Hives
  - *They are good at making bees and honey*
  - *They are also varroa mite factories*
    - IMO, these mite building machines are hard to fix through treating
    - The mites overwhelm the large population
    - Through winter they bees die off because the larger population is mite impacted

Lately, I have taken to breaking large hives up, and I do not allow them to become so big

Have you heard?

My Best Colony has Died!

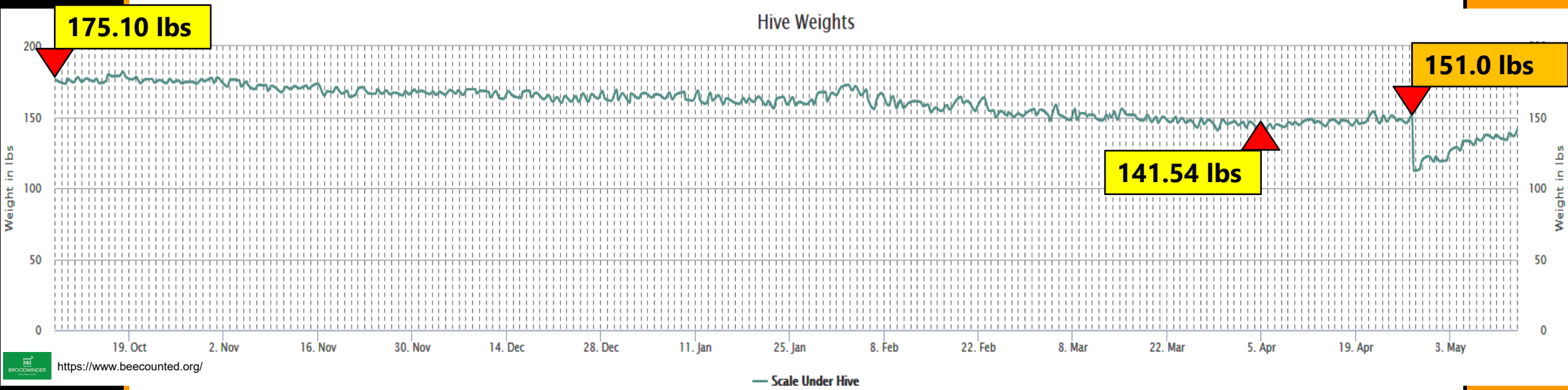
How much do bees eat? [NJ Example]



- Hive into winter
  - *Two deep hive, with a top feeder OVER the inner cover (for storage)*

Flight Days

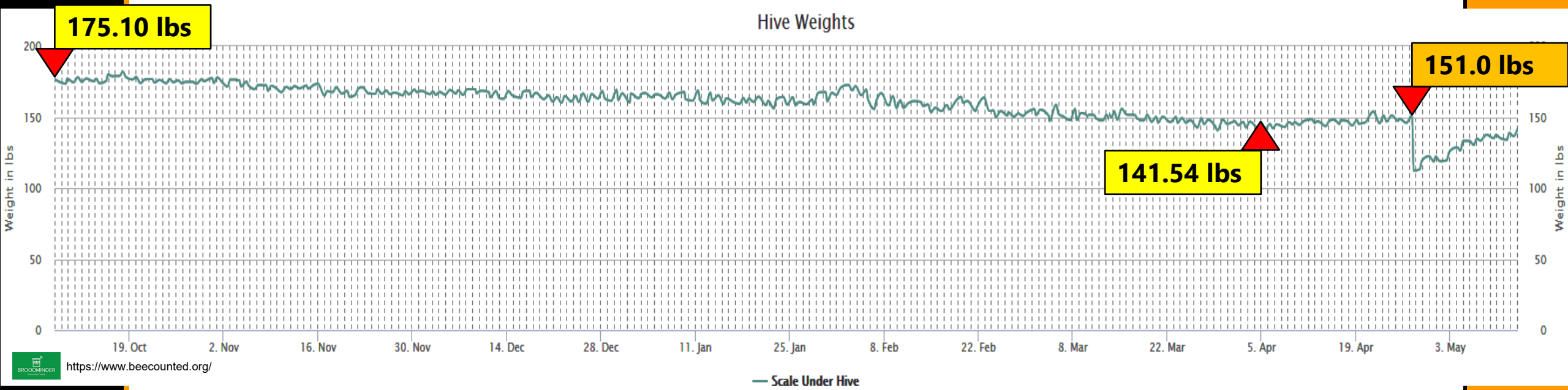
How much do bees eat? [NJ Example]



❑ Weight Loss

- *Primary loss is two things > Food consumed, and bees that perish*
- ***Math:*** *October 8th to April 5th: 25 Weeks (179 days)*
  - **34-pound** weight loss **over 25 weeks**
  - That equates to **1.36 pounds a week**.

How much do bees eat? [NJ Example]



- **1 to 1 ½ pounds a week consumption/loss**
  - *We have been measuring this year on year.*
  - *Mild winter or harsh winter; the consumption rate does not vary as much. It is generally a little over 1 pound a week.*
    - This loss goes from late fall (clustering) until early forage

Overwintering Success Basics

Successful Overwintering is a “Combo Package”

- It is a mix of conditions and practices
  - *Proper colony development*
  - *A quantity of healthy, adapted, quality bees*
  - *Operating in a sound location with suitable nutrition*
  - *Appropriate Stewardship* ***on a proper timeline***

Let's start with what they need

We will also talk about what they don't need and few other points

- Quality Queen
- Adapted Healthy Bees
- Quantity of Bees
- Water
- Propolis
- Quality Comb
- Reserves of Pollen, Nectar (early) and Honey, Water, Propolis
- Proper Cavity Space
- Suitable Location
- Pest Protection Measures

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COMPONENTS to OVERWINTERING

Young queens are helpful for overwinter

- Why?
  - *Young queens of the current year will lay eggs (and more of them) later into the fall than old queens.*
  - *Older queens do not lay as vigorously throughout the season*
    - Net, net of this is higher ratio of older population in the workforce going into winter.
    - Older bees do not have as much vigor to survive and work.

Old Queen Populations

- They can deceive you
  - *When this situation occurs, the population size may look adequate in late fall*
  - *However, as winter progresses, the population may shrink faster than winter brood-rearing can compensate.*
  - *This could be so bad as to lead to a colony loss. [Ferrar]*

Locally Adapted Bees

- Acclimated to the climate
  - *It stands to reason that bees that are suitable for colder climates will do better in cold conditions*
  - *The common recommendation is to source bees that are survivors for the local conditions*
    - At minimum, say with a package, they were started early in the season and can acclimatize to the area as best as possible.
    - It is established that southern bees, reared in warm climates, simply do not overwinter well if they did not start with some genetics that would help them compensate

Locally Adapted Bees - Genetics

- Certain races of bees are…
  - *Selected because they came from cold climates*
  - *Exhibit traits that coincide with the weather*
    - Fly in colder weather… Use less resources… Hold a tighter cluster…Manage food stores more efficiently
- When it comes to genetics
  - *Due diligence, but know that there are no magic pills*
    - Most bees are mutts and IMO locally sourced stock is better than genetics

Quantity of Bees in the hive

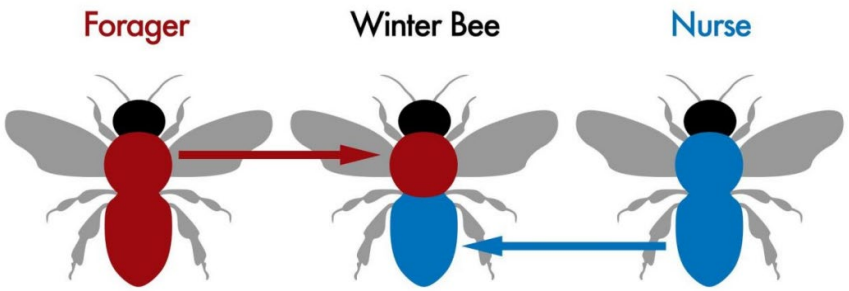
❑ More is Generally Better

With the caveat that resources need to match the size of the cluster

A larger colony will:

- Have more of a workforce seek out resources in the late summer, and further into the fall
- Can run brood rearing if they need to build more bees
- Can ramp up earlier in the spring and be better equipped to deal with fluctuations coming out of winter
- Have more bees to spare to attrition; this equates to more bees to do the jobs required and less stress overall on the populous
- As demonstrated earlier, bigger clusters can generate required heat and can move around to resources

Winter bees are different



- They are a different phenotype
  - *You will find that the winter bee can be thought of as a mix of a nurse and forager*
    - Winter bees resemble nurse bees in **fat body tissues**
    - Winter bees resemble forager bees in **flight muscle tissues**.

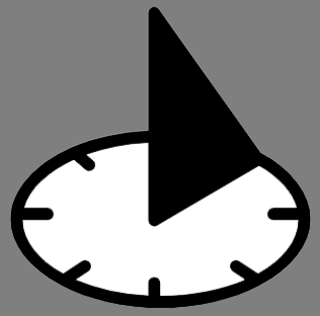
    The hypothesis is that winter bees are using tissue-specific genetic toolkits

    - It is a bit of a mix-and-match molecular and physiological traits strategy for adapting to winter conditions in temperate environments

Definition

Phenotype: observable traits or characteristics.

Can be appearance or physical traits – driven by genes and environmental factors



summer solstice
June 20th, 2021

Winter Bees

- **Winter bees start in summer**
  - What you do in spring and summer impacts survivability for winter
  - Winter bees are thought to start on the journey to switch over after the summer solstice
- **Months, not weeks**
  - Fair weather bees live for weeks
  - Winter bees have to persist for months
    - *And they are doing hard work in generating heat for the colony during the duration – which means they have to be healthy*

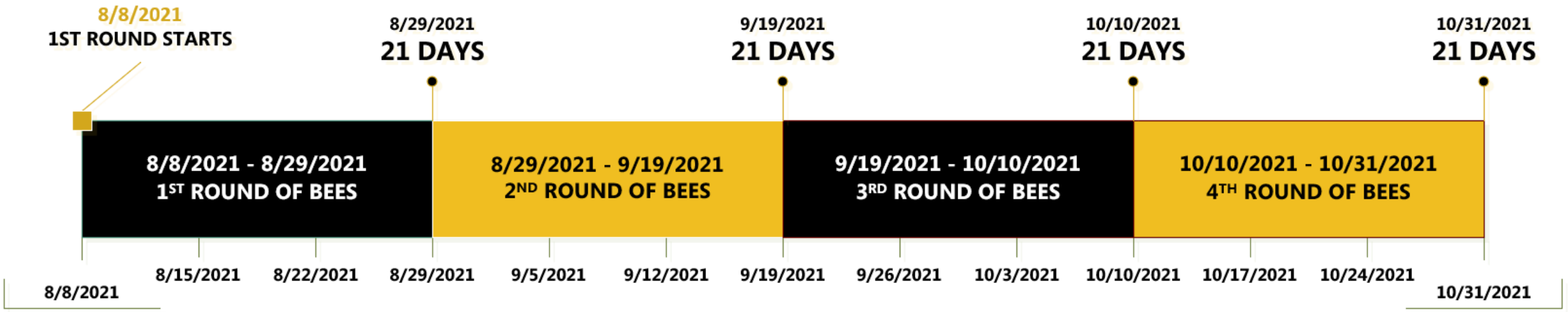
Winter Bees

First frosts in Maryland (Easton) is November 2nd.

This year, it was 70°+ on 11/2

Early November is typical

- **4-Cycles (of 21 days)**
  - In NJ our first frost can come as early as Nov 1.
    - *Some years it is Nov 1, other years it might be Thanksgiving*
    - *Since we cannot tell, we plan for Halloween (Oct 31)*
    - *By Halloween, we want our bees are fat and happy*
      - And we want all of our honey ripened and pollen stores flush throughout the comb.
  - We want a cycle of 4 generations of *CLEAN* Bees to overwinter, and that starts August 8th.



Complete Treatments before winter bees

❑ July & August for Clean Bees

- *The 4 generations of bees will be well served if varroa impacts are mitigated **prior** to August 8th*
- *Treating bees prior cleans things up; Otherwise*
  - Bees are wounded from Varroa Mite punctures
  - Bees are sick and virus laden, which will not bode well for rearing new workers post August 8th
  - The colony will be stressed and varroa impacted colonies are not healthy which means the workforce for **winter gathering is compromised**.

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3/20
What do you think of this comb?
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Honeycomb

❑ Comb is important

- *Clean, quality comb;*
  it deserves more attention
  - Clean, in that it is not that old, and it is not laden with nasties
  - Quality, in that it is well formed > all the way from frame 1 to frame 10
  - Speaking of 10 frames; Running 9 frames in your brood box?
    - This is 10% less comb for the bees to use.
    - Does it matter; hard to say, but it sure seems like it would factor.

Rotate old comb out of service

❑ Move it to the fringes

- *Move old comb, malformed comb, comb not built out to the outside during the bee season.*
  - If you cannot get them to build comb to replace it, move it to 1 and 10 in the bottom box. When the bees move up, that comb will be the first to cull in the spring.
- *Better yet, focus on getting good comb built in the spring.*
  - Idea: Put a full-size box for a **honey deep**. After harvest you have 10 frames of perfect comb to fix any comb problems in your operation.
  - Suffer for working with the weight, ***but*** treasure the clean well formed comb.


Frame Game 2020
I went through 95% of all of my frames
Broken and/or loose frames were repaired or discarded
All Plastic went in the bin
Frames from as far back as 1995!
Maria Kondo and I were on the same wavelength
Thank you for your service. Thank you for your service....
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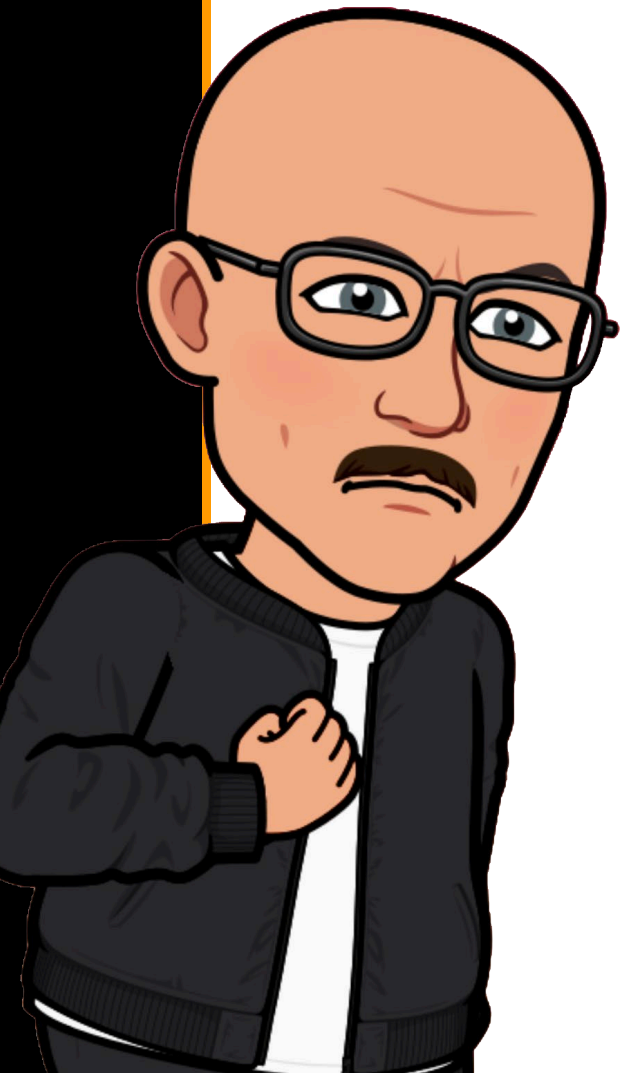
INSULATION

Discussion: Do You Need to Insulate?



❑ Makes for an interesting discussion

- *Do you need to insulate? > Factually – No*
  - The fact is hives survive winter in Canada without insulation.
  - Some have a strong aversion to the cost and effort – and will defer the practice
  - This means that the practical answer is – **No,** you really do not have to insulate.
- *Dabbling in Insulation?*
  - We just reviewed some of the advantages – and what if you wanted to try?
  - At minimum, it is simple to insulate the top of the hive.
  - Putting insulation under the roof is simple, **and very beneficial**.

Discussion: Is insulation worth it?

❑ Full (or Partial) Insulation Benefits

Research and real-world experience has taught us that

- *Reduction of heat loss*
- *Reduction of heat infiltration (Especially on cold & windy nights)*
- *Allows more ability for bees to move to resources*
- *Reduces the consumption of honey*
- *Aids in earlier build up*
  - Bees can take advantage of early forage by having a larger workforce

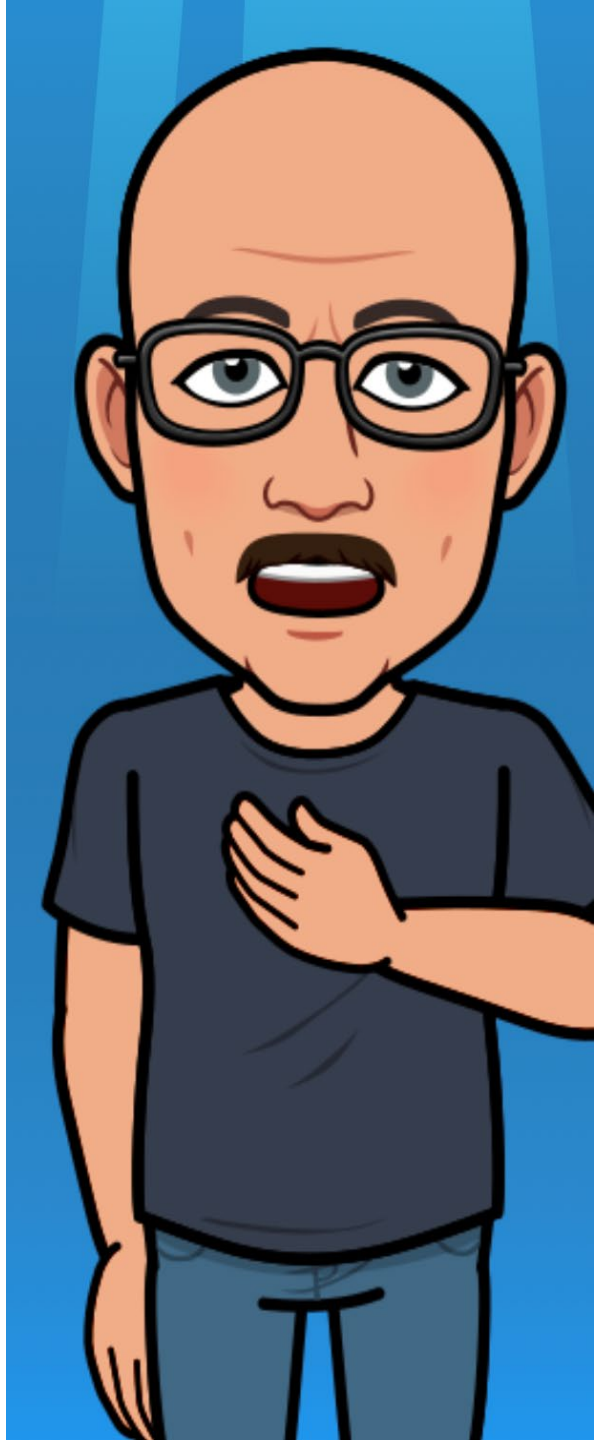
Kevin Moment: My Personal Take

❑ Insulation

- *I like what insulating does based on experience, but it is a lot of work (And it costs money)*
- *At minimum, I have Insulation on the top of my Langs 24x7*
  - I find it beneficial for winter *and* summer

❑ Poly

- *I love these hives, and when I use them, I do not have to insulate*
- *Putting my money where my mouth is and have invested in 6, 8, and 10-Frame equipment.*
- *My 10F has been my best performer for the last 3 seasons*



FOAM Choices

❑ XPS Foam

- *Most beekeepers that I know have settled on XPS foam*
  - Typically, these are panels sold at big box stores that are 2" thick
  - They are rigid, easy to cut, and provide an R-factor of R6 for each inch so they have more than enough insulation to do the job

Consider storage
When not in use, insulation takes up quite a bit of space.

Insulation & Odds and Ends

- What about?
  - ***Tar Paper or Wraps:*** *Sure why not.*
    - *Tar Paper and Wraps perform better than one might think.*
    - *I think it has a lot do with preventing wind penetration and escape*
    - *Simplification > Tape the seams*
      - Simple painter's tape on seams will also benefit.

Insulation & Odds and Ends

- What about?
  - ***Homasote:*** *Meh.*
    - Used for collecting and giving off moisture.
    - I think they absorb outside moisture if they are exposed to the outside.
    - Not for me; but there are some that swear by them

Insulation & Odds and Ends

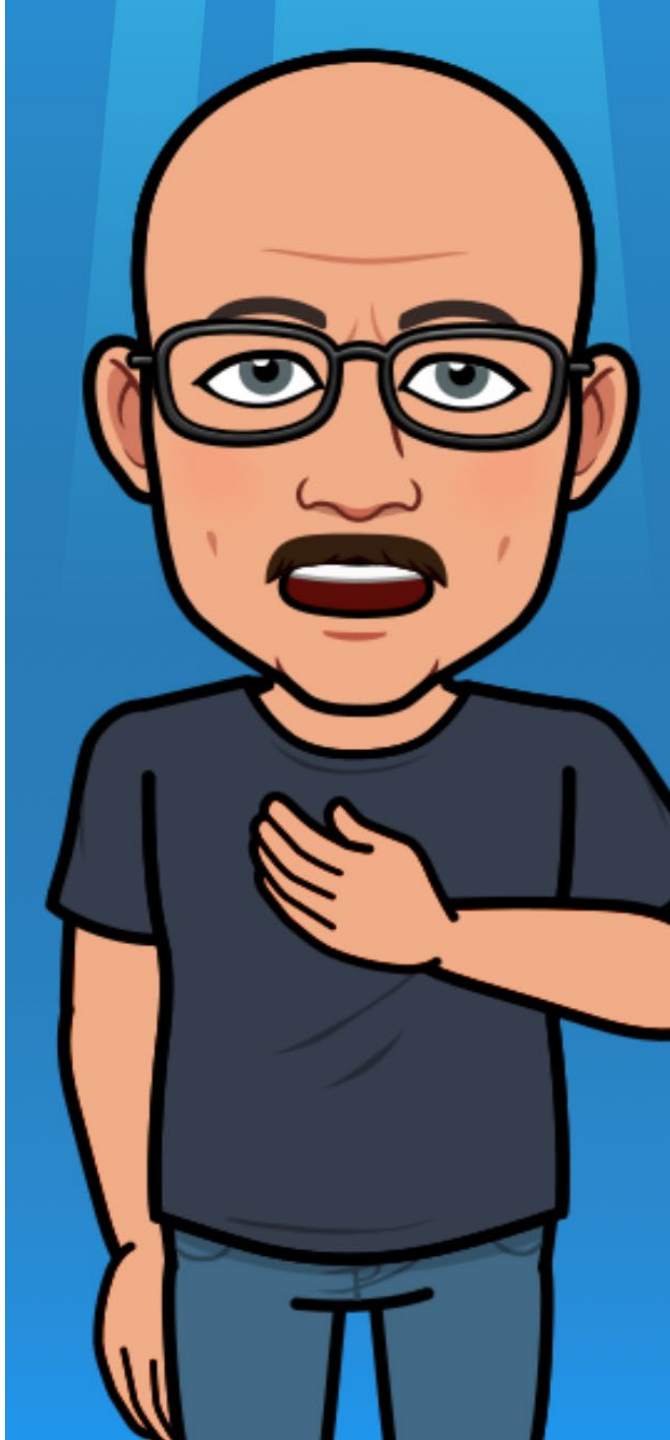
- What about?
  - ***Quilt Boxes:*** *Tried them, didn't see the value.*
    - Didn't see evidence of moisture collection.
    - Like a honey box on top, they create space to collect in the box, up and away from the brood nest.
    - My hives did not thrive with them after 3 seasons.
    - Moved on; Progressed to top foam insulation covered earlier
  - *While playing with this I also tested various differences with ventilation – Open vs. Closed*

Kevin Moment: Ventilation

To Ventilate or not to Ventilate

- *Most debates stem from "Moisture kills bees, not cold"*
  - Some suggest that ventilation is the proper way to allow moisture to escape, and therefore is imperative
  - Others follow the bee tree model and that small entrances allow the bees to determine the moisture levels
- *What I believe…I like to emulate the bee tree model if possible*
  - I think moisture plays a role, and coupled with the belief that insulation helps to maintain more stability in temperature, I have joined the camp of moderate to low ventilation is best for my climate.
  - We close down our entrances and leave a small upper entrance via a notched inner cover (to the front to avoid chimney effect).
    - I have observed that - *even with a small upper entrance*, bees will propolize this closed which means they are choosing to close it off even further

Beekeeping is Local



MANAGEMENT SUGGESTIONS

Statistics*: For those who need numbers

❑ Honey

- *60-80 pounds*
  - 40 to 45 pounds of honey in the uppermost hive body
  - 9 full deep frames equivalent

❑ Pollen

- *Several frames adjacent to the brood nest, and in the top box*
  - A minimum several frames of stored pollen, as noted in the earlier slide

❑ Bees

- *Ideally: 15 Frames of bees*
  - Equal to or greater than (15) Frames where bees cover the face of the frames.
- *Like to see a "2" or "3" scale* (on the face of each side)*
  - "2" = 2/3rds of face covered
  - "3" = fully covered
- *Factoring Capped brood*
  - Lots of capped brood can be factored into the assessment

These values can be a guide for the colder northern U.S. States

*Suggested Values sourced from the Mid-Atlantic Apicultural Research & Extension Consortium (MAAREC) Fall Management Fact Sheet

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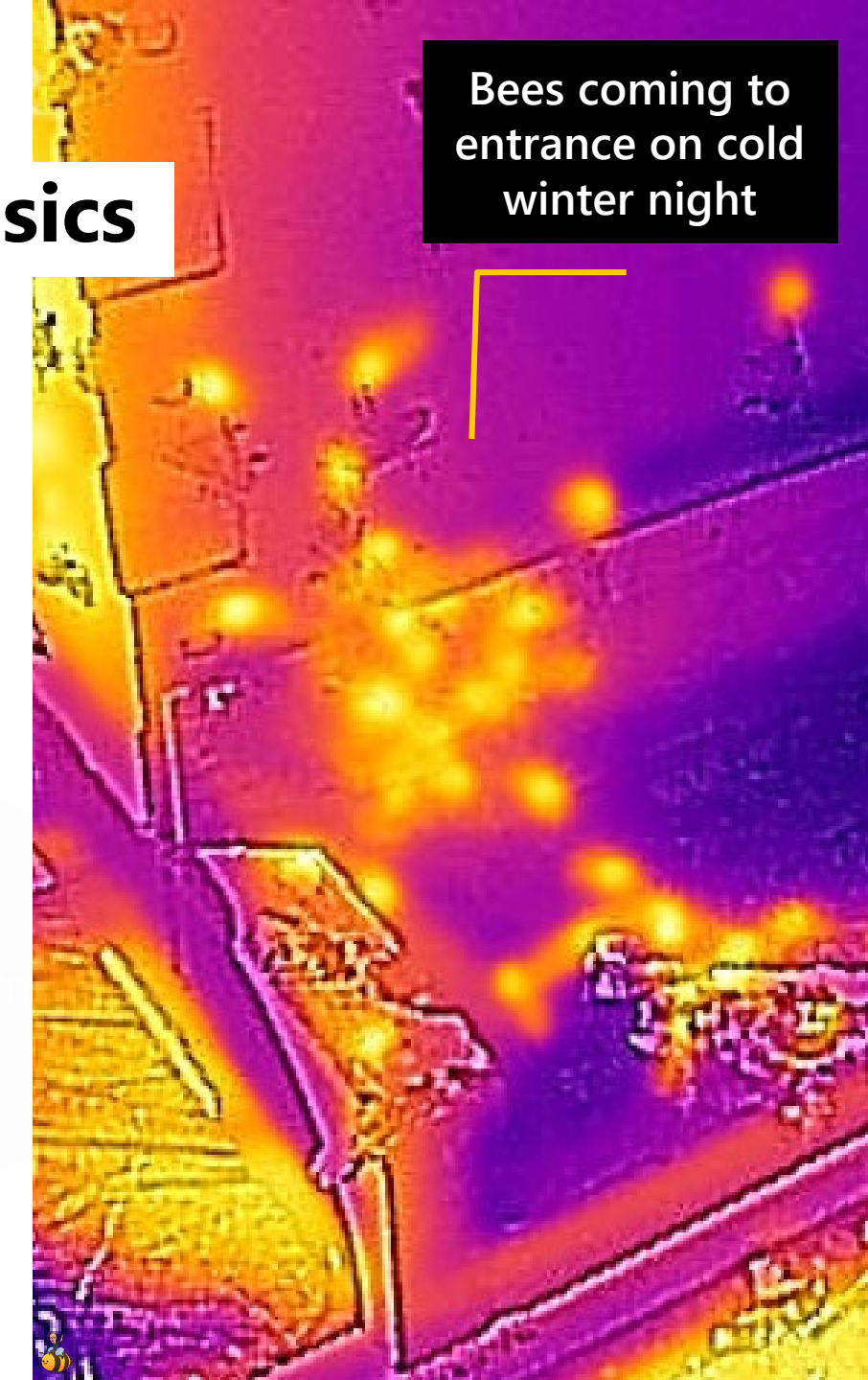
Management: Winter Prep and Basics

- Do not open hives prematurelyBreaking propolis seals is impactful to colonies
  - In late fall, winter, and early spring, be done. The best offense is a good defense.
  - Avoid any reasons for you having to open your hives and breaking apart hive bodies.
  - If the bees have sealed things up with propolis, you are undoing their work.
  - They cannot break cluster to patch up what you have undone.
- *Be done with your management by first frost*
  - GOOD OFFENSE: If you do it well, they will not require any manipulations
  - Emergency feeding (fondant, etc.) is not something to do if you are prepped

Management: Winter Prep and Basics

- Do not open hives prematurely
  - *Do your best not to disturb hives in winter*
    - Bees will come to the entrance in defense of the hive.
    - Some perish when this occurs because they chill and do not make it back.
    - Not a fan of banging on hives to see if they are still alive.



Bees coming to entrance on cold winter night

Management: Winter Prep and Basics

- Weekly Winter inspections
  - *Look for cleansing flights on warm days*
  - *Keep entrances closed, but* ***make sure they are not plugged***
    - Check that the hives are clear of debris, some air movement is required
    - Hives with closed entrances can suffocate – and **for that reason I always leave my hives with top entrances**.
      - Inner covers with a notch. The bees will close them if they want.
      - Does not seem to compromise ventilation, and is a good insurance policy

Dead Cluster – Bottom Box

No top entrance, bottom entrance clogged

Management: Winter Prep and Basics

Consider a Windbreak

- *Protect from North and West*
  - Keep hives out of underbrush; underbrush promotes vermin coming to the hive
- *Options:*
  - Fence posts with a burlap wrap around
  - Windbreaks of corrugated plastic
  - Straw bales; again, be careful with this as it too promotes vermin coming to the hive

Management: Winter Prep and Basics

❑ Entrance Reducers

- *Protect from Yellow Jackets and other predators*
  - Do this before they present themselves as a threat
- *Options:*
  - Traditional wooden cleats are just fine.
  - I prefer stamped metal ones; I close them down to the amount I desire with 3M Blue Painter's Tape.

Let it Snow, let it snow, let it snow

- **What about Snow?**
  - Clear entrance, *or not…*
    - *Keep in mind that hives in Vermont are under snow for months.*
    - *This does not cause problems, and some say is advantageous*
- **When it snows:** Take Winter Photos

Lip Balm and Paste Wax

Making Mocha Mint Lip Balm &
Polishing Paste Waxes

Lip Balm is Easy

- *Total cost to get started <$100.00 + Wax*
- *Will make 250+ tubes*
- *Chapstick = ~$2.00 a tube.*

Easy to Make

- ❑ Weigh out a handful of ingredients
- ❑ Melt some wax
- ❑ Melt the butters & Vitamin E Oil and add to wax
- ❑ Take off the heat and stir in the scent of your choice
- ❑ Pour in the molds and let cool
- ❑ Close off tubes and apply stickers if you desire.

Lip Balm Filling Tray

- At $28 this device is a little Pricy but sure beats trying to pour a hot liquid into little tubes.
- You'll have it forever.

Lip Balm Tubes

- Spare tubes - $13 for 50

Cocoa Butter

- Unrefined Cocoa Butter $12.50
- Different kinds are available. This particular one has a chocolaty scent and is all natural.
- You can buy other refined ones that do not impart a smell.

Shea Butter

- Shea Butter – $11.50
- Shea butter is an off-white or ivory-colored fat extracted from the nut of the African shea tree. It is widely used in cosmetics as a moisturizer, salve or lotion.

Almond Oil

- Almond Oil – $11.80
- This is a refined for high heat version.

Vitamin E

- Vitamin E Oil - $9.50
- Used as a preservative, it is optional in the recipe.

Lip Balm Labels 50 Pack

- $13.00

Flat Lip Balm Containers

- $9.00 for a 50 Count

Recipe based on one from Landi Simone

Ingredients

Note! Follow the grams version.
The imperial measurements are an approximation, so you have a sense of the volume that is more familiar to you.

Imperial Measure

- 2 5/8 ounces beeswax
- 1 3/8 ounces cocoa butter - 'deodorized' variation
- 2 1/8 ounces shea butter
- 1 7/8 fluid ounces coconut oil
- 20 drops essential oil*
- 1 3/8 teaspoons vitamin E Oil, [Optional]

Metric Measure

- **74 grams beeswax**
- **46 grams cocoa butter**
- **58 grams shea butter**
- **58 grams coconut oil**
- **20 drops essential oil***
- **1 3/8 teaspoons vitamin E Oil, [Optional]**

*Optionally - If you want an add in flavor/scent, add an essential oil. The quantity of drops is to your preference. Different oils are weaker or stronger, so use some judgement here.

Directions

Ingredients	Directions
❑ **74 grams beeswax** ❑ **46 grams cocoa butter** ❑ **58 grams shea butter** ❑ **58 grams coconut oil** ❑ **20 drops essential oil** [Optional] ❑ **1 3/8 teaspoons vitamin E Oil,** [Optional]	❑ Melt the beeswax in a double boiler ❑ Once melted stir in the cocoa butter, shea butter, and coconut oil. Stir until all are melted and combined. ❑ *Removed from heat* and stir in the essential oil and Vitamin E Oil (if using) ❑ Pour mixture into prepared lip balm containers.

Paste Waxes

Beeswax Pastes

Boiled Linseed Oil
Olive Oil
Mineral Oil

Boot Scootin'

4:1 Mix

Consistency

- The linseed oil and olive oil mixtures resulted in a firm paste.
- The mineral oil one resulted in a loose gel similar to the consistency of softened butter.

Some Notes:

- Choose the **boiled linseed** oil vs. plain linseed oil; it dries faster
- Test First - almost universally darkens whatever is being treated
- Wax is highly combustible. Use a double boiler and avoid heating wax directly in a pan on the stove.

Making Pastes

How to Make Paste…

- Put the oil of your choice in the final container.
- Melt the beeswax
- Add to the oil.
- Stir to combine and let it cool

- You can use wax in different formulations to create furniture polish, leather treatment, wood restoration, metal tool preservation, drawer slide lubrication, fabric waterproofing, skin cream, waterproofing matches, fire starters, and even more
- If you get it wrong, reheat it and mix in more oil or wax; it is very forgiving.

Going even farther

More Ambitious Additives

- You can prep leather by buying leather cleaner or add stuff into your paste, like mineral spirits, ammonia, alcohol, or other distillates that help the process along.
- You can add almond butter in order to replace lost natural oils in the leather.
- Coconut Oil is another *nutritive* additive that is used.
- You can add castor oil to provide a certain shine or sheen if you will.
- You can also add propolis to mixtures for a waterproofing aspect.

All kinds of beeswax paste recipes are available on the web…

Questions

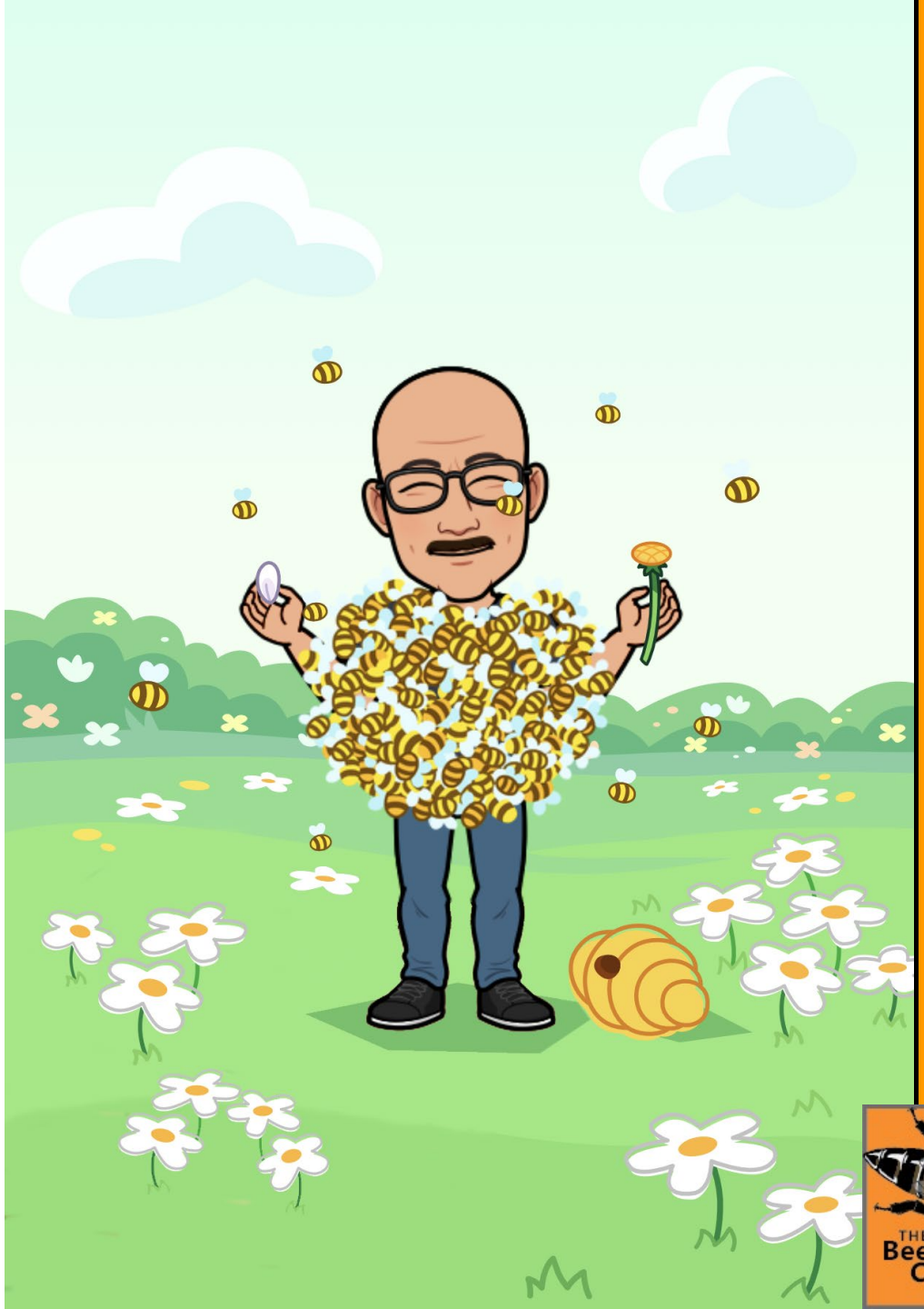
- Note: This presentation is available for download

  https://www.bkcorner.org

  - *Search for presentations, it will appear in the search results*

- Kevin Inglin

  - *kevin@bkcorner.org*



Resource Links to Learn More

- **THE THERMOLOGY OF WINTERING HONEY BEE COLONIES: USDA study**
  - https://naldc.nal.usda.gov/download/CAT72345678/PDF
  - https://www.beesource.com/threads/the-thermology-of-wintering-honey-bee-colonies.365933
- **NORTH OF 60 Beekeeping (Work from Etienne Tardiff)**
  - https://www.northof60beekeeping.com
- **[BEESOURCE] Walt Wright Articles** (several have insights on overwintering)
  - https://www.beesource.com/threads/walt-wright.365657
- **[BEE CULUTRE] THERMAL EFFICIENCY: Derek Mitchell**
  - https://www.beeculture.com/thermal-efficiency
- **ScientificBeekeeping: Randy Oliver**
  - https://scientificbeekeeping.com/understanding-colony-buildup-and-decline-part-13a/
- **Colony Size Drives Honey Bees' Overwinter Survival**
  - https://entomologytoday.org/2019/01/09/colony-size-drives-honey-bees-overwinter-survival
- **[BEE CULUTRE] WINTER MANAGEMENT: William Hesbach**
  - https://www.beeculture.com/winter-management

Image Credits

- Slide 06: Winter Weather Link
  - *https://www.reddit.com/r/weather/comments/plp1q7/cold_winter_for_the_us_do_you_take_stock_in_the/*
- Slide 08: Alberta Clipper Link
  - *https://www.almanac.com/winter-extended-forecast-farmers-almanac*
- Slide 14: B&W Cluster Illustration Link
  - *https://www.beesource.com/threads/productive-management-of-honey-bee-colonies-support-material.365942/*
- Slide 15: Oliver: Cluster Formation Link
  - *https://scientificbeekeeping.com/understanding-colony-buildup-and-decline-part-13a/*
- Slide x: Bee lifting weights Link
  - *https://imgbin.com/png/XwmjsZGV/honey-bee-fitness-centre-exercise-physical-fitness-png*
- Slide 63: Tardiff: Bee Phenotypes
  - *Wintering in the Yukon*
- Slide 66: Teutuls Panel Comic
  - *Found on Facebook. Source undocumented.*
- Slide 78: Tardiff: Bee Phenotypes
  - *Wintering in the Yukon*
- Slide 94: Doug/Tammy Horn Potter Hives
  - *Shared with me personally from Doug Potter*
- Slide 95: Doug/Tammy Horn Potter Study Diagrams
  - *Shared with me personally from Doug Potter*
- Slide 99: XPS Wrapped hives
  - *John Gaut Presentation:*
- Slide 100: Slide Wrapped in Tarpaper Link
  - *Foud on Pintrest*
- Slide 101: Homasote Link
  - *https://thehoneyexchange.com/products/winter-insulating-homasote-board*
- Slide 108: Mann Lake Feeder Link
  - *https://www.mannlakeltd.com/10-frame-top-feeder-with-super-painted*
- Slide 112: Pollen Feeder Barrel
  - *Imaged shared with me personally from Tim Schuler*