Creating Science – Studying Insects with the Bug Sukka

How can we safely capture some bugs for study?

We can learn a lot about life from one of its most successful organisms. #CreatingScienceBugSukka

Suggested Outcomes

(NOTE: This is by no means an exhaustive list of possible outcomes, neither is it intended that ONLY these outcomes can or should be met. Science is a deeply interrelated activity, and you may find cross curriculum links you can and should use.)

Science understanding

Biological Sciences 1: Living things have a variety of external features

- Year 5 Living things have structural features and adaptations that help them to survive in their environment
- Year 8 Multi-cellular organisms contain systems of organs that carry out specialised functions that enable them to survive and reproduce

Science inquiry skills

- Processing and analysing data and information 4: Use a range of methods including tables and simple column graphs to represent data and to identify patterns and trends (ACSIS068), including pictures.

Science as a human endeavour

- Use and influence of science 4: Science knowledge helps people to understand the effect of their actions (ACSHE062) as we use today's knowledge to explore changes to life.

Science vocabulary words

Tier 1 (Everyday words)

- Ants, insects, trap, danger, release, life.

Tier 3 (Specialised vocabulary)

- Exoskeleton – the outside armour of ants, which also function as bones, keeping their shape.

Warning

- Insects can be dangerous. Apply all appropriate safety precautions when approaching and studying them.
- You will probably be outside. Be prepared.

Preparation

- A clear, dry, empty soft drink bottle for everyone with the label removed. 1.5 to 3 litres are good.
- Straws for everyone. Thick shake straws tend to be larger and thus better suited to sucking bugs up.
- A means of drilling holes in soft drink lids (you may forgo the holes and straws with enough blue tack / plastic to make a small hole in the bottle, but it's not as 'cool'.)
- A means of fixing the straw, air tight, into the lid of the bottle. Blue tack will do it.

Suggestions for other year levels

Younger:

This activity is well suited to this age group, although working the Bug Sukka will take some practice beforehand, and some children will simply not get it during the time you have. We advise working in groups, and having an adult with each group to ensure children do not suck up bugs they should not, or look in places you have told them not to.

Middle:

An excellent activity for this age group if all safety instructions are followed.

Teen:

You may aspire to killing and mounting your insects for deeper study using such things as a microscope.

Learning Intent (student friendly)

'We are learning to' (WALT) – safely study bugs.

Success criteria

'What I'm looking for' (WILF) – a good, clear image of the bug being studied. Extra points for clear labelling of parts, with question marks for those parts students don't have a name for.

Student learning goals

Help students make a self-monitored learning goal for this lesson, such as 'learn how legs ants have' or 'see what ants do once they're captured'.

Evidence of learning

How will you know when the learning goal is achieved? What EVIDENCE do you have that your students have met or exceeded the learning expectations?

- Students will build and successfully use a bug sukka, and then draw and label a diagram of it.

Engage

Ask – what insect species outweighs all other insect species on earth?

[If you did quadrats previously: what creature did we find more than any other creature last week? (see "Quadrats") Answer – ants. (Well, most likely in most places on earth, anyway)]

- ⇨ Share some interesting facts about ants (see end of the document or add your own).

Ask – is it enough to see something in order to know all about it? What must you do?

Explain – today we're going to explore ants[1], but first we'll have to catch some!

Explore

- ⇨ Build the "Bug Sukka".

* Be careful to explain the dangers associated with hunting for insects. These should include but are by no means limited to:

- o Don't lift up or move rocks and leaves. There are plenty of ants right there on the surface. You may accidentally find a dangerous spider!
- o Wear hats and sunscreen if you're going outside!
- o DON'T head for an ants' nest. They may attack you to defend their home. Look for the wandering forager ants.
- o Don't forget to pinch closed (or use a paperclip) the lid once you have an ant. The chance of it escaping to bite you are very small, but it's still nice to be prepared.
- o DON'T TOUCH ANY INSECTS. We can study them quite safely without touching them.

Explain

Once you have caught at least one ant, draw your experimental subject.

The ants will usually run around as if confused or worried for about five minutes, then settle down as if waiting for fate to decide what happens to them next. They stop sooner, and appear more comfortable, if there's a little something from their home environment.

For younger groups:

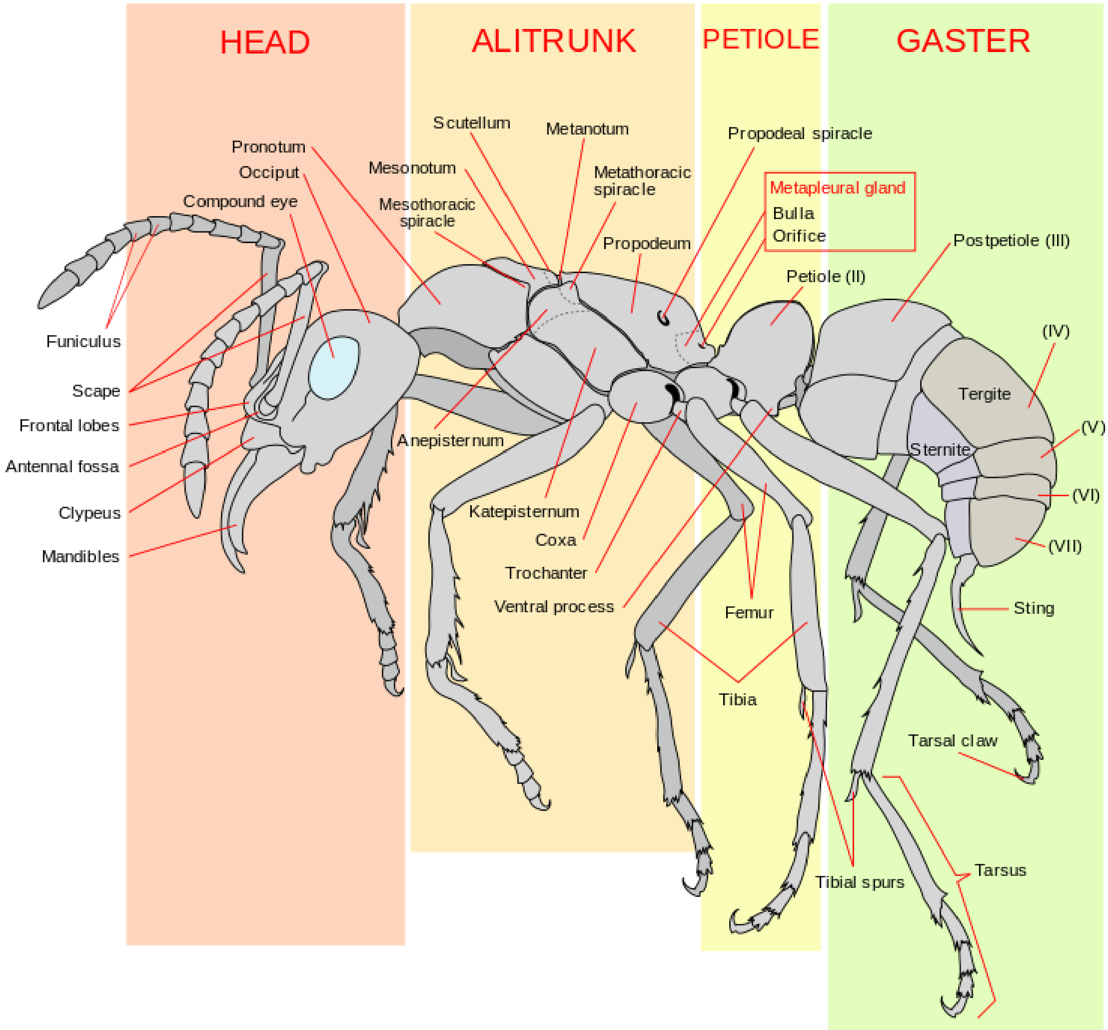
- Ants traditionally have three body sections. Many scientists find it more useful to talk about four. How many sections do you think your ant has?
- Ants have hinged antenna, which is one way to easily recognise them. Their antennae are a little like their noses, and they use them to smell friends and enemies, or to follow scent trails left by other ants.
- All six legs are attached to the middle section of the ant. Double check, are yours?

[1] We *could* explore other insects, but the danger level is too random to risk it. Ants are… safer (usually).

Elaborate

[Additional information on internal organs for upper year levels – from Wikipedia 'Ants' 18 March 2015]

- Like other insects, ants have an exoskeleton, an external covering that provides a protective casing around the body and a point of attachment for muscles, in contrast to the internal skeletons of humans and other vertebrates.
- Insects do not have lungs; oxygen and other gases such as carbon dioxide pass through their exoskeleton via tiny valves called spiracles.
- Insects also lack closed blood vessels; instead, they have a long, thin, perforated tube along the top of the body (called the "dorsal aorta") that functions like a heart, and pumps haemolymph toward the head, thus driving the circulation of the internal fluids.
- In terms of DNA, each worker is a 'clone' (almost) of the queen, so they are protecting their own chance to perpetuate their DNA by protecting the entire nest.



Ant images taken 18 march 2015 from http://upload.wikimedia.org/wikipedia/commons/thumb/8/8d/Scheme_ant_worker_anatomy-en.svg/800px-Scheme_ant_worker_anatomy-en.svg.png

⇨ Given these facts, redraw your picture of the ant

Finally: PUT THE ANTS BACK ALIVE AND WELL RIGHT WHERE YOU FOUND THEM!!!

⇨ No need to traumatise the little folks any further.

Evaluate

⇨ Review with students what they felt they learnt from this lesson. Did they have any questions at the start that they feel were answered?

This information could lead to a discussion of:

⇨ Tradition versus observation – which is more accurate?
  - Do ants have three body parts?
  - Which body part do the legs come out from?

⇨ [older groups] How are ants internally different from humans?
  - Do they have stomachs? Intestines? A heart and a brain?
  - Why can't insects be more than a centimetre thick? It is probably because they have no lungs, so air can't get any further in!

Success criteria

⇨ Review the Learning Intentions of this lesson with students. Were they met?

At the end of each class, review the learning objective and see how we did. Ask:

- What did you learn?
- (If needed) where can you go for extra help or information?

Assessment ideas

Prior learning

- Discuss with students, and share (positive) experiences with insects. Have any of your students captured an insect before?
- Find out what students know about ants. What is an exoskeleton? What do a Queen and a Worker ant do?

Formative:

- Have students demonstrate correct 'bug sukka' technique.
- Allow students to present their image of their ant to the group.

Summative:

- Have students present a poster of ant facts, including their drawings before and after in order to demonstrate learning.
- Help students to discuss or write up how their knowledge of ants CHANGED because they 1/looked at one and 2/ learnt about it from experts as well.

Creating science

- Ant facts; safe handling, capturing, anatomy and behaviour
- How observation and information can improve our understanding and perception.

Science understanding

- Biological Sciences: Living things have a variety of external features

Science inquiry skills

- Processing and analysing data and information 4: by capturing, studying, and drawing ants.

Science as a human endeavour

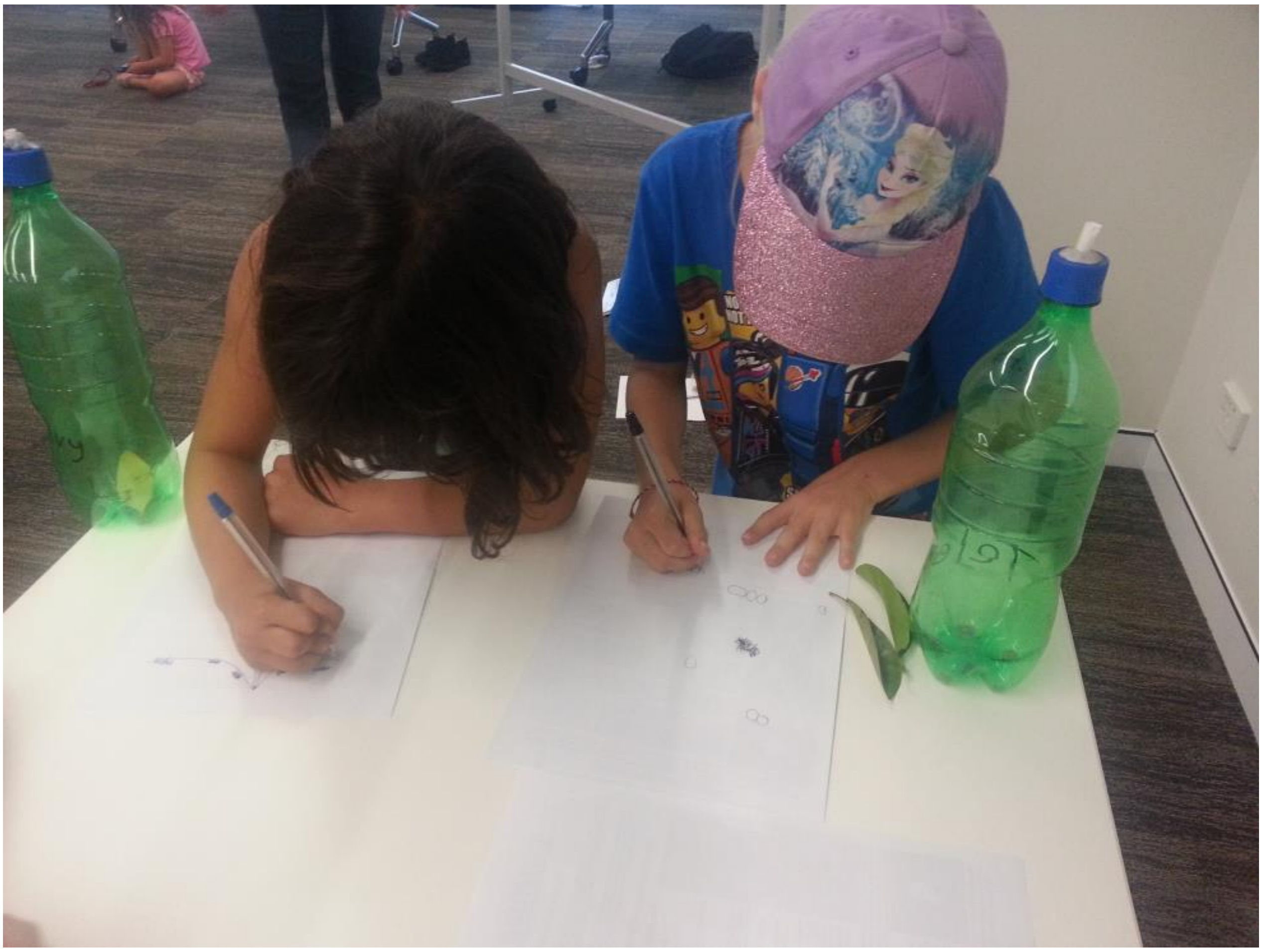
- Use and influence of science 4: Science knowledge helps people to understand the effect of their actions (ACSHE062) as we use today's knowledge to explore changes to life – we learn about how COMMON ants are in our world, and how important managing them can be to life and safety.

References

"Scheme ant worker anatomy-en" by Mariana Ruiz (User:LadyofHats) - Own work (data from Bert Hölldobler and Edward O. Wilson, The ants, along with following websites: [1], [2], [3] and [4]). Image renamed from Image:Ant worker morphology.svg (see below). Licensed under Public Domain via Wikimedia Commons - http://commons.wikimedia.org/wiki/File:Scheme_ant_worker_anatomy-en.svg#mediaviewer/File:Scheme_ant_worker_anatomy-en.svg

Tips from the masters


Get down low and go, go, go!


Draw what you see, not what you THINK you see!


Study carefully!


And don't forget to PUT THEM BACK!

Cool ant facts from http://insects.about.com/od/antsbeeswasps/a/10-cool-facts-about-ants.htm **taken 18 march 2015**

1. Ants are capable of carrying objects 50 times their own body weight with their mandibles.
Ants use their diminutive size to their advantage. Relative to their size, their muscles are thicker than those of larger animals or even humans. This ratio enables them to produce more force and carry larger objects. If we had muscles in the proportions of ants, we'd be able to heave a Hyundai over our heads!

2. Soldier ants use their heads to plug the entrances to their nests and keep intruders from gaining access.

In certain ant species, the soldier ants have modified heads, shaped to match the nest entrance. They block access to the nest by sitting just inside the entrance, with their heads facing out like a cork in a bottle. When a worker ant returns to the nest, it will touch the soldier ant's head to let the guard know it belongs to the colony.

3. Certain ant species defend plants in exchange for food and shelter.
Ant plants, or myrmecophytes, are plants with naturally occurring hollows where ants can take shelter or feed. These cavities may be hollow thorns, stems, or even leaf petioles. The ants live in the hollows, feeding on sugary plant secretions or the excretions of sap-sucking insects. What do the plants get for providing such luxurious accommodations? The ants defend the plant from herbivorous mammals and insects, and may even prune away parasitic plants that attempt to grow on the host plant.

4. The total biomass of all the ants on Earth is roughly equal to the total biomass of all the people on Earth.
How can this be?! Ants are so tiny, and we are so big! But scientists estimate there are at least 1.5 million ants on the planet for every human being. Over 12,000 species of ants are known to exist, on every continent except Antarctica. Most live in tropical regions. A single acre of Amazon rainforest may house 3.5 million ants.

5. Ants sometimes herd or tend to insects of other species, like aphids or leafhoppers.
Ants will do just about anything to get the sugary secretions of sap-sucking insects, called honeydew. To keep the sweet stuff in close supply, some ants will herd aphids, carrying the soft-bodied pests from plant to plant. Leafhoppers sometimes take advantage of this nurturing tendency in ants, and leave their young to be raised by the ants. This allows the leafhoppers to go raise another brood.

6. Ants will enslave other ants, keeping them captive and making them do work for the colony.
Quite a few ant species will take captives from other ant species, forcing them to do chores for their own colony. Some honeypot ants will even enslave ants of the same species, taking individuals from foreign colonies to do their bidding. *Polyergus* queens, also known as Amazon ants, raid the colonies of unsuspecting *Formica* ants. The Amazon queen will find and kill the *Formica* queen, then enslave the *Formica* workers. The slave workers help her

rear her own brood. When her *Polyergus* offspring reach adulthood, their sole purpose is to raid other *Formica* colonies and bring back their pupae, ensuring a steady supply of slave workers.

7. Ants lived alongside the dinosaurs.
Ants evolved some 130 million years ago during the early Cretaceous period. Most fossil evidence of insects is found in lumps of ancient amber, or fossilized plant resin. The oldest known ant fossil, a primitive and now extinct ant species named *Sphercomyrma freyi*, was found in Cliffwood Beach, NJ. Though that fossil only dates back 92 million years, another fossil ant that proved nearly as old has a clear lineage to ants of present day. This suggests a much longer evolutionary line than previously thought, leading scientists to estimate the appearance of ants on Earth as somewhere around 130 million years ago.

8. Ants started farming long before humans.
Fungus farming ants began their agricultural ventures about 50 million years before humans thought to raise their own crops. The earliest evidence suggests ants began farming as early as 70 million years ago, in the early Tertiary period. Even more amazing, these ants used sophisticated horticultural techniques to enhance their crop yields. They secreted chemicals with antibiotic properties to inhibit mold growth, and devised fertilization protocols using manure.

9. Some ants form "supercolonies," massive communities of ants that can stretch for thousands of miles.
Argentine ants, native to South America, now inhabit every continent except Antarctica due to accidental introductions. Each ant colony has a distinctive chemical profile that enables members of the group to recognize each other, and alerts the colony to the presence of strangers. Scientists recently discovered that massive supercolonies in Europe, North America, and Japan all share the same chemical profile, meaning they are, in essence, a global supercolony of ants.

10. Ants follow scent trails laid by scout ants to gather food.
By following pheromone trails created by other ants from the colony, foraging ants can gather and store food efficiently. A scout ant first leaves the nest in search of food, and wanders somewhat randomly until it discovers something edible. It will then consume some of the food and return to the nest in a straight, direct line. It seems these scout ants can observe and recall visual cues that enable them to navigate quickly back to the nest. Along the return route, the scout ant leaves a trail of pheromones, special scents that will guide her nestmates to the food. The foraging ants then follow her path, each one adding more scent to the trail to reinforce it for others. The workers will continue walking back and forth along the line until the food source is depleted.