Education Futures ACADEMY

Mozzie Monitors

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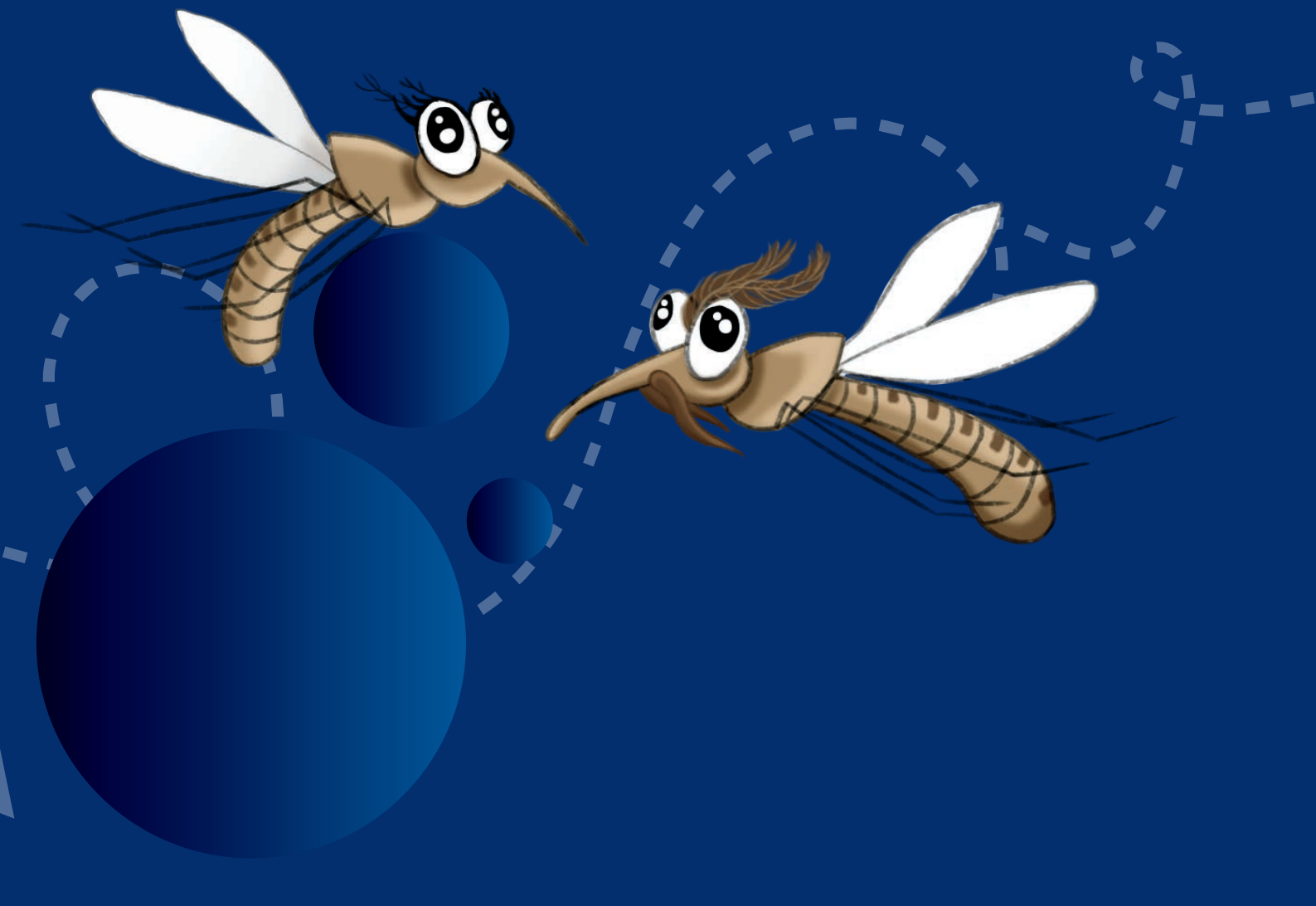
Protecting your local community from disease through Citizen Science

Lesson Plans



Mozzie Monitors: Protecting Your Local Community From Disease Through Citizen Science

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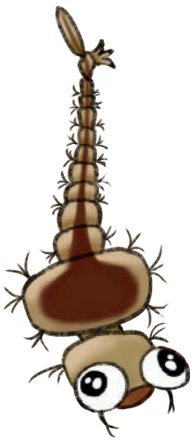

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Dr Deborah Devis
(Research Fellow, University of South Australia; Educational Design Lead, Education Futures Academy)

The Mozzie Monitors Citizen Science programme provides an authentic context for students to engage in sustainability, because they can claim ownership and responsibility over their local environments. But engaging in STEM requires more than inspiration; it requires complex thinking, curiosity, and most of all, motivation.
Motivation is a powerful contributor to participating in STEM, but three basic human requirements must be met to facilitate intrinsic motivation. These needs, as described in Self-Determination Theory, are autonomy, relatedness and actual and perceived competence (Deci & Ryan, 1985).

According to the Australian Curriculum (ACARA, 2024), sustainability requires systems thinking, futures thinking, design thinking and challenging mental models.
We recognise that students are both individuals and part of a society (Kemmis, 2023), so the lesson plans were designed upon the principles of Self-Determination theory and the 4 key skills described in the Australian Curriculum, as a mode of orienting students as valuable, active global citizens with complex capabilities. Excitingly, this means that the outcome of their projects are unknown; just as in 'real' scientific discovery.

We wanted to ensure that the programme was built with a futures-oriented lens, where students will become agents of change in their lives beyond school. Whether it's through a STEM career, environmental advocacy, community engagement or sustainable practices in their everyday lives, we know that change-makers use systems thinking to solve complex problems (Midgley, 2003). For this reason, the Mozzie Monitors lesson plans were designed to achieve the Theory of Change shown in Figure 1.

We also recognise that every class is different. Only you, the educator, can be the true expert on the dynamics and needs of your classroom. We know you will adapt and change the lesson to suit your needs, so we have included pedagogical tips and tricks and information about the design principles of activities so you can make the best pedagogical choices for your context.

Finally, we make what we research and we research what we make. This programme is a component of our ongoing, iterative Design-Based Research projects that explore how students develop complex, critical capabilities, and so may evolve over time.

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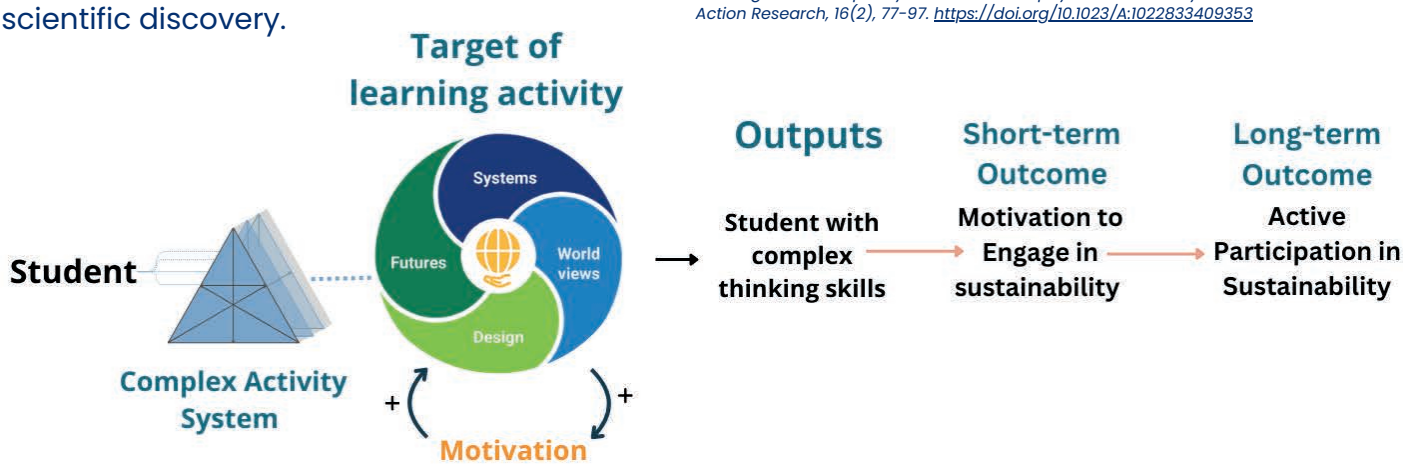

Figure 1. Theory of Change: Mozzie Monitors was designed to develop skills and motivation for sustainability

Professor Craig Williams
(Dean of Programs (Science, Construction & Project Management; Mozzie Monitors University of South Australian

Mozzie Monitors is a citizen science initiative to increase public and environmental health literacy about mosquitoes across Australia.

Mozzie Monitors is a citizen science program on mosquito surveillance which was launched in June 2018 in SA by Professor Craig Williams and his research group Healthy Environments, Healthy People. The project was originally crowd-funded, with a news and fund-raising campaign run by UniSA.

In the first phase, the program involved citizen scientists setting up a mozzie trap in their yards to increase scientific data on mosquito community composition. It also aimed to raise awareness regarding mosquitoes ecology and epidemiological importance.

The project allows participants to set-up Mosquito Traps on their property, and submit photos of mosquitoes they have caught via email or iNaturalist.

This Unit of study was co-created by scientists and educators to ensure the integrity and goals of the Mozzie Monitors Citizen Science Program.

Introduction

Mosquitoes are important; they don't only exist to annoy us! They are vital part of the food chain and are essential to plant pollination in wetlands. Many have also evolved to live in urban environments, making them a common pest anywhere we live that can transmit human and animal diseases.

Learning about mosquitoes can help communities to protect themselves against these insects and the diseases they carry. Because mosquitoes are so widespread, they are also ideal for the study of insect life in the field.

"Mozzie monitors" is a citizen science program that engages people to learn about and share their knowledge of mosquitoes to protect their communities. Participants will join mosquito surveillance programmes to contribute to the work of health and environmental agencies in identifying problem mosquitoes and population hotspots. This is a nationwide project with a real impact.

The following lesson plans outline the biology, diversity and behaviour of mosquitoes as part of a project to protect ourselves and our communities as committed citizens. It can be completed in four sessions with an ongoing project across a school term.

Early sessions explore students' existing knowledge of mosquitoes and their place in our lives. That knowledge will be extended to equip students with the tools and skills to consider how they can intervene and what impact they can have.

Later sessions involve direct participation in local mosquito surveillance, as part of real, scientific data collection through the "Mozzie Monitors" programme from "iNaturalist." Be sure to sign your students up to the Mozzie Monitors programme to make the most of these activities and encourage them to make use of the app outside of school.

Learning Outcomes

Mozzie Monitors

This document contains learning outcomes, Australian Curriculum links, suggested lesson plans with differentiation for each year group from Years 7-10, background information on mosquitoes for students and teachers and printable activity sheets. Further resources are available from the University of South Australia's Educational Futures Academy at efa.unisa.edu.au/

Learning Outcomes

1. Students learn about mosquitoes as living things, classed as insects, their habitats, anatomy and life cycle.
2. Students understand the significance of mosquitoes in terms of their ability to cause illness and how our study of them has public health benefits to them and their communities.
3. Students learn about the differences between species of mosquito and how that further informs both learning outcomes 1 and 2.
4. Students engage in mosquito trapping, collection, observation and reporting
5. Students learn how they can be a part of citizen science initiatives and are encouraged to continue to participate.
6. Students make predictions, form hypotheses, gather data and draw conclusions

Sustainability

"In Science, the Sustainability priority provides contexts for investigating and understanding biological, Earth and space, physical and chemical systems. By investigating the relationship between systems and system components and how systems respond to change, students develop an appreciation for the interconnectedness of Earth's geosphere, biosphere, hydrosphere and atmosphere.

"Students appreciate that science provides the basis for decision-making in many areas of society and that these decisions can impact the sustainability of environmental, social and economic systems."

Australian Curriculum v9

This is a unit that meets the needs of the sustainability curriculum. By looking at the complexity of the relationships between mosquitoes, their environment, humans and disease, students will naturally be looking at large, complex systems. By considering greater complexity, such as the importance of mosquitoes as pollinators or how humans' relationship to mosquitoes is only important to us as vectors of disease, they will be engaging in the kind of **systems thinking** that underpins this incredibly broad curriculum priority.

Learning Outcomes

Mozzie Monitors

Australian Curriculum Content

General Capabilities				
Critical and Creative Thinking	**Ethical Understanding**	**Literacy**	**Numeracy**	**Personal and Social capability**

Scientific Understanding (SU)		
Year 7 - Classification	**Year 8 - Organ Systems**	**Year 9 - Reproduction**
AC9S7U01 Investigate the role of classification in ordering and organising the diversity of life on Earth and use and develop classification tools including dichotomous keys.	**AC9S8U02** Analyse the relationship between structure and function of cells, tissues and organs in a plant and an animal organ system and explain how these systems enable survival of the individual.	**AC9S9U02** Describe the form and function of reproductive cells and organs in animals and plants, and analyse how the processes of sexual and asexual reproduction enable survival of the species (elaboration: examining how the reproductive strategies of multicellular animals are related to their environment and the complexity of the organism, examining how the number of offspring produced by animals is related to the amount of parental care).

Science as a Human Endeavour (SHE)		
	Year 7-8	**Year 9-10**
Nature and Development of Science	**AC9S7H04** Explore the role of science communication in informing individual viewpoints and community policies and regulations.	**AC9S9H04** Examine how the values and needs of society influence the focus of scientific research
Science Inquiry Skills	**AC9S8I03** Select and use equipment to generate and record data with precision, using digital tools as appropriate.	**AC9S9I03** Select and use equipment to generate and record data with precision to obtain useful sample sizes and replicable data, using digital tools as appropriate.

Health and Physical Education (HPE)		
	Year 7-8	**Year 9-10**
Making healthy and safe choices	**AC9HP8P08** Refine protective behaviours and evaluate community resources to seek help for themselves and others	**AC9HP10P08** Plan, rehearse and evaluate strategies for managing situations where their own or others' health, safety or wellbeing may be at risk
	AC9HP8P10 Plan and implement strategies, using health resources, to enhance their own and others' health, safety, relationships and wellbeing	**AC9HP10P09** Critique health information, services and media messaging about relationships, lifestyle choices, health decisions and behaviours to evaluate their influence on individual attitudes and actions
		AC9HP10P10 Plan, justify and critique strategies to enhance their own and others' health, safety, relationships and wellbeing

Contents

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Mozzie Monitors

Session 1

Know Your Mozzies

Session 1

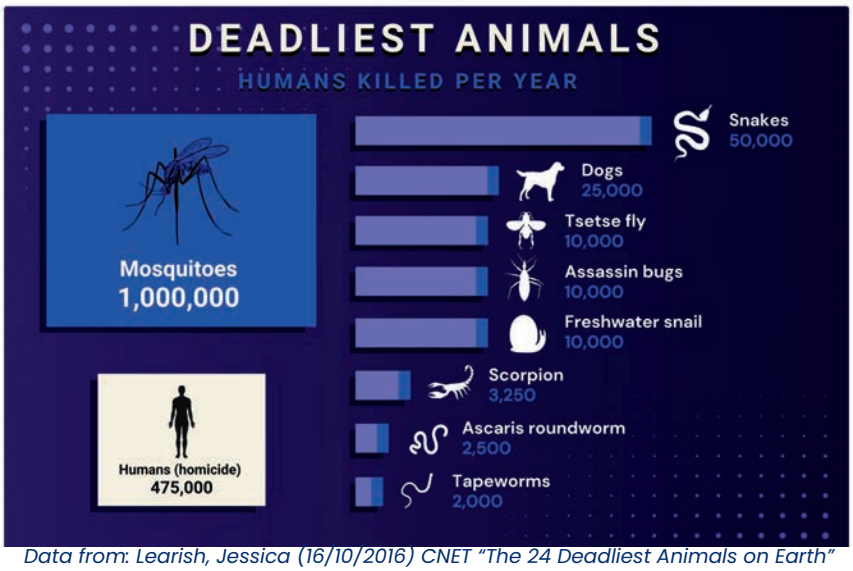
Begin with a whole class question:

"What is the deadliest creature to humans in the world?"

They may already know the answer – it's mosquitoes.

Some will try to be clever and say humans, but humans actually come a distant second to mosquitoes.

Mosquitoes kill more people a year than the rest of the top ten combined.



Data from: Learish, Jessica (16/10/2016) CNET "The 24 Deadliest Animals on Earth"

Many animals we think of as dangerous don't actually kill many people each year. Mosquitoes in 1st place, and 4th to 7th are all deadly thanks to the diseases they transmit. Mosquitoes are partly important to study because the pose a threat to human sustainability (the ongoing well being of all people).

Starter hooks and questions like this build engagement. Students who often feel left out have a chance to get involved early when they are just as likely to have an answer as anyone else. This helps them to feel empowered for longer. Allowing students to question in this way facilitates the ***Generating*** *component of* ***Creative Thinking.***

On to the activities!

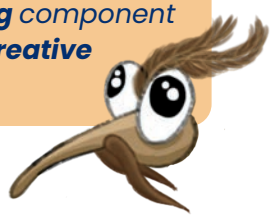
Session 1

Mozzie Monitors

1. *Mosquitoes and non-mosquitoes*

- **Duration**: 5-10 minutes
- **Materials**: PowerPoint slides or printable cards
- **Prior Knowledge**: Basic understanding of how mosquitoes are different to other arthropods
- **Activity**: Students are divided into pairs/threes and the group is shown each image. Teams are challenged to identify it as a mosquito or not a mosquito privately before a show of hands. Teams are prompted to justify their answer, and challenge each other, pointing out aspects of the anatomy that are the same or different to what would be expected.
- **Outcome**: Students demonstrate existing understanding and begin to interrogate anatomy as a classification tool. They are also able to identify mosquitoes as a distinct group of insects.

*Students will often be familiar with what makes a mozzie a mozzie. This activity allows them to retrieve existing knowledge and build a sense of **self-efficacy (belief in their own competence)** in their own understanding.*
This also prompts students to consider what a mosquito is without being asked, so they have more ideas and language for the follow-up question.
*This also helps them engage with the **Inquiring** component of **Critical and Creative Thinking***



*Memorising a list of mosquito facts is insufficient for deep scientific understanding, nor does it demonstrate true **competence.***
However, these facts provide a context in which students can inquire. All hypotheses require some form of factual understanding, but that is only the beginning!

2. *What do you know about mosquitoes?*

- **Duration**: 10-15 minutes
- **Materials**: None, however, you can use an image of a mosquito
  from last activity as a prompt.
- **Prior Knowledge**: Basic mosquito facts. Further facts are available later in this pack.
- **Activity**: Remaining in their teams, students are prompted to list what they can about mosquitoes. After five minutes of discussion, teams are called on in turn to give a fact to the class. Teams continue taking turns until the facts are exhausted.
- **Outcome**: Knowledge sharing and demonstration. This activity serves as both a gauge of student knowledge for the teacher and an opportunity to provide any essential missing information.

See pages 51-57 for a mosquito information pack to review their biology before the lesson.

Key facts to draw out:

- All Mosquitos feed on nectar, but only female mozzies feed on blood, too.
- Because they feed on nectar, mosquitoes are important pollinators for many Australian flowering plants.
- Most females mosquitoes feed on blood to produce eggs.
- Mosquito bites inject saliva before drinking blood.
- The saliva can carry diseases, prevent blood from clotting and trigger the itchiness and swelling associated with a mosquito bite.
- Mosquito eggs are laid in water and hatch into larvae which live in the water.
- The larvae transform into pupae which later emerge as flying adults, much like how a caterpillar becomes a chrysalis and then hatches into a butterfly.
- Mosquitos are pollinators and and a food source in the ecosystem.

3. *Make a mosquito*

- **Duration**: 20-30 mins
- **Materials**: Chenille sticks/pipe cleaners, scissors, labels
- **Prior Knowledge**: Basic mosquito anatomy
- **Activity**: Students make a model of a mosquito. They then label the model they have made based on a displayed annotated image (below).
- **Outcome**: Students engage with the observation of the anatomy of an insect. They can identify and represent its body parts.

*This is an **abstraction** and **pattern recognition** activity, two major components of **computational thinking**. Abstraction draws out only important knowledge, and pattern recognition finds trends, two essential parts of scientific thinking. This facilitates the **analysing** component of **Critical and Creative Thinking.***

Mozzie Monitors all a-buzz for Citizen Science

SCAN ME

Video Link

4. *Watch*

- **Title:** Mozzie Monitors all a-buzz for Citizen Science
- **Duration**: 5 mins
- We are going to use this knowledge and take part in citizen science, contributing to the real work that scientists are doing to keep us safe.

Mozzie Monitors

Session 2

Mozzie Mayhem: A Game-Based Learning experience

Session 2

Mozzie Monitors

This session is all about the relationship between humans and mosquitoes, how humans control mosquitoes, how mosquitoes breed, their life cycle, and what affects them in their environment. It's a lot of information, but it's all been wrapped up into a game!

1. ***Mozzie Mayhem***
   - **Duration**: 30-60 mins
   - **Materials**: Mozzie Mayhem game
   - **Knowledge**: Mosquito life cycle and interventions to prevent mosquito growth
   - **Activity**: Students play Mozzie Mayhem in groups of 2-4. Rules (See following) are explained and demonstrated beforehand. Don't take too long to explain; let the game do the work and then follow up with discussion after. This is an opportunity to recap the prior knowledge consolidated in the first session, but they will also teach themselves a lot more just by playing.
   - **Outcome**: Students understand mosquitoes have life cycles, and reproduction requires a male, a female and a blood meal. Students understand that disease intervention is a human action.

Game-based learning is powerful because it:

- Increases **motivation**
- Develops decision-making
- Enhances critical thinking through reflection
- Reduces cognitive load
- Provides a sense of control
- Displays interactions and feedback in real-time
- Provides authentic context
- Demonstrates randomness and variability in outcomes (common **system** behaviour)
- Facilitates the **Generating** component of **Critical and Creative Thinking**

The game is designed to demonstrate the **complex system interactions** of humans and mosquitoes. For example: both the mozzies and the humans can win at the same time, because the disease is what actually matters to the humans, not the mozzies themselves.

Game-based learning should support learning rather than obscure it. This provides a context in which students can learn relationships and interactions first hand, which is powerful for ***competence, relatedness*** *and* ***agency.*** *These factors lead to* ***motivation.***

See page 58 for a simplified game about the mosquito life cycle

See page 59 onwards for more details underlying the intervention and disease cards of the game.

Mozzie Mayhem Rules

One player/team acts as the mosquitoes.
One player/team acts as the humans.
The mosquitoes must reproduce as much as possible.
The humans must keep themselves safe from the diseases the mosquitoes can carry.

Materials
Play mat featuring:

- 3x humans
- 1x animal meal/disease deck
- 4x breeding sites: one natural, three artificial and space for a fifth that is left empty.

Deck of cards including:

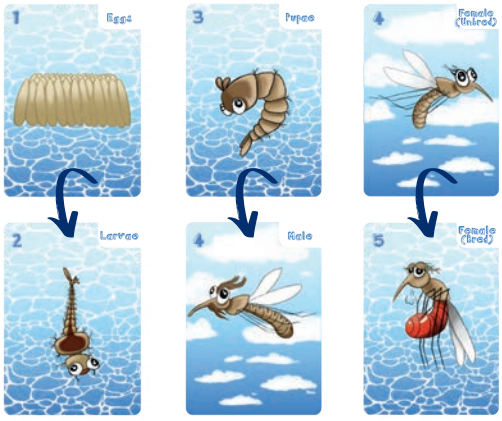
- Disease cards (set of "not-infected" cards and "infected" cards)
- Nuh-Uh cards (set of playable event cards for the human player(s) which includes a subset of "event" cards)
- Reversible life cycle cards to be used by the mosquito player(s)

Materials preview

Nuh-Uh and Event Cards

Disease Cards

Mosquito Cards (Dual sided)

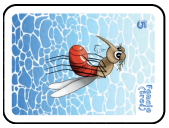


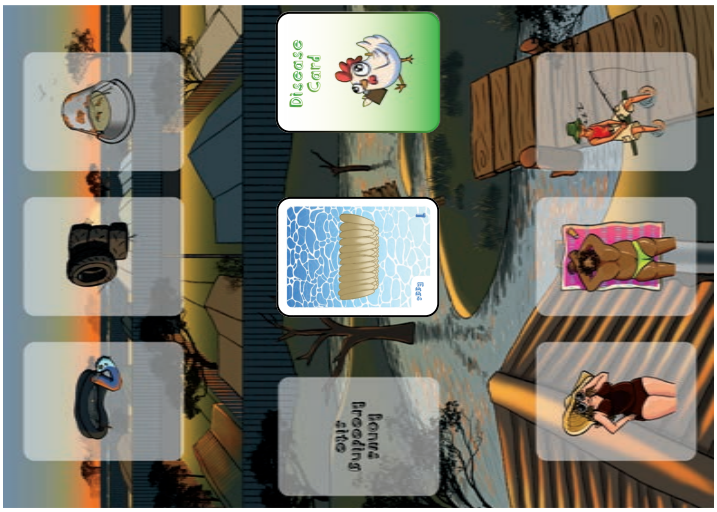
Play Mat

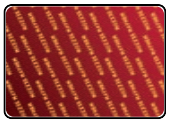
Mozzie Mayhem Rules

Setup

One “Eggs (1)” card is placed in the natural breeding site, and one bred adult female mosquito card is placed on the mosquito side. The disease cards are shuffled and stacked face down on the “animal meal” space (the chicken). The mosquito side keeps the life cycle cards, and the remaining “Nuh-Uh” and “Event” cards are shuffled and placed face down by the human side.







Order of play

Mosquito team starts

Mosquito Team Turn:

1. Lay Eggs:
   - At the start of your turn, place one "Eggs (1)" card on an empty breeding site if available.
2. Progress Life Cycle:
   - Flip or replace cards to progress the life cycle at each breeding site:
     - "Eggs (1)" → "Larva (2)"
     - "Larva (2)" → "Pupa (3)"
     - "Pupa (3)" → Choose to flip to "Adult Male (4)" or replace with "Adult Female (unbred) (4)" and place the card in front of you. The breeding site becomes empty.
3. Adult Mosquito Actions:
   - Male Mosquitoes: Can mate by flipping an "Adult Female (unbred)" card to "Adult Female (bred)" and leaving play.
   - Bred Females: Can lay eggs by "feeding":
     - Choose a human to feed on and draw a disease card from the disease deck, placing it face down under that human.
     - If no humans are available, declare you have had an animal meal.
     - After feeding, lay an "Eggs (1)" card on an empty breeding site.
4. End Turn:
   - Once all actions are complete, the turn ends, and the humans take their turn.

Mozzie Mayhem Rules

Human Team Turn:

1. Draw Cards:
   - Draw three cards from your deck.
   - If any "Event" cards are drawn, apply their effects immediately, then draw replacement cards.
2. Play Cards:
   - Play as many cards as you like from your hand. Cards can:
     - Protect humans or breeding sites.
     - Disrupt mosquito actions.
     - Meet specific conditions for use.
3. Manage Cards:
   - Keep unused cards in your hand (no hand size limit).
4. End Turn:
   - Once all chosen actions are complete, the turn ends, and the mosquitoes take their turn.

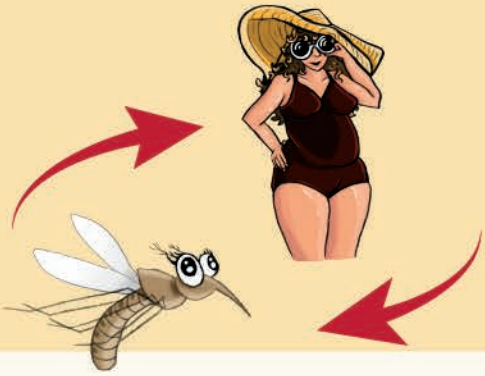
Ending conditions:
The game ends once the humans' draw pile is used up. The humans finish their turn with the cards they have and the game ends.

Victory conditions:
Mosquitoes: Total victory occurs if the team has 3 adult female mosquitoes, they live to fight on if they have any adult female mosquitoes. They lose if they are wiped out.
Humans: Score a total victory If they have 2 "infected" cards or fewer, but it is still a success if they have 4 or fewer "infection" cards. They lost if there are more than 4.

Humans

Mosquitos

Systems Thinking
Through Game-Based Learning With

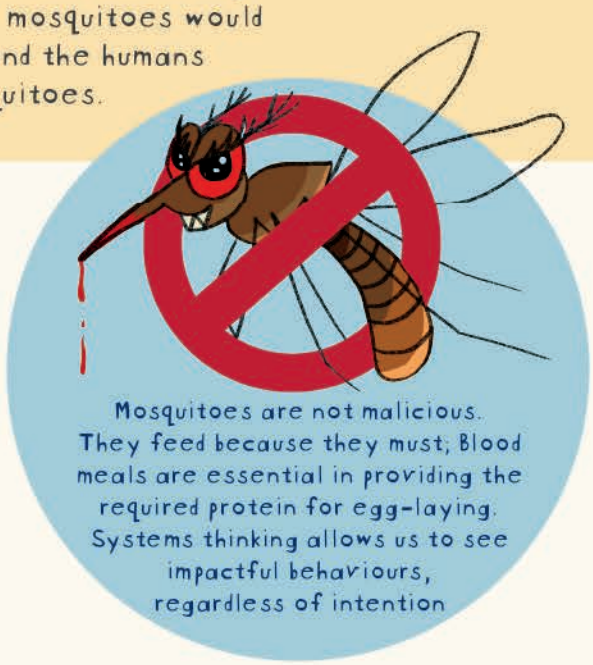


This game is designed to model interactions between mosquitoes and humans, which is a key component of **systems thinking** and sustainability.

For example:

The victory conditions for humans and mosquitoes are not mutually exclusive. Both players can win, both can lose. Their goals interact through the diseases being spread. If there was no disease, the mosquitoes would have far less impact on the humans and the humans would have less need to kill the mosquitoes.

Humans and mosquitoes are part of a larger **system**: randomly drawn cards and events reflect the everyday chaos of real life.

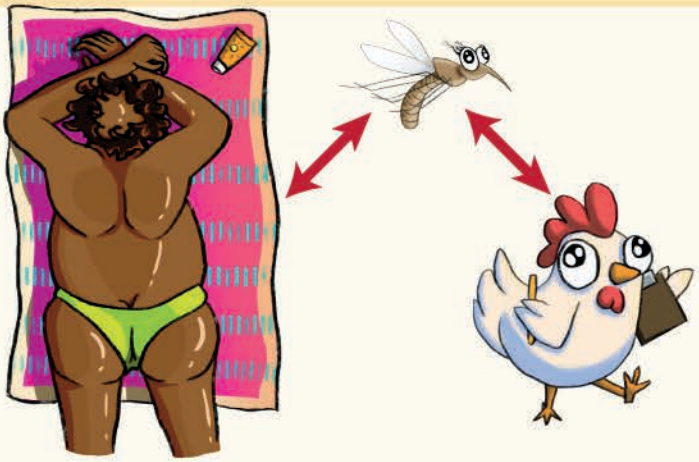


Mosquitoes are not malicious. They feed because they must; Blood meals are essential in providing the required protein for egg-laying. Systems thinking allows us to see impactful behaviours, regardless of intention

Game-based learning provides an authentic context to practice Systems Thinking. Players must make predictions and strategic decisions to prevent disease as the system updates and changes. this reflects real-world disease prevention, which reacts to a dynamic system.

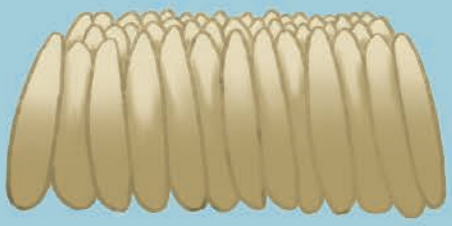
The three humans are shown doing things that bring them into contact with mosquitoes and make them more likely to be bitten. For example, activities that occur near water, like fishing, exposed skin, etc. This demonstrates overlapping system elements, and lead to emergent behaviours, such as disease spread.

Male and Female mozzie cards mirror real mozzie reproduction and system dynamics. Females only need to mate once to lay multiple clutches of eggs, but they need a blood meal for those eggs to develop.



Humans and Mosquitos aren't the only nodes in the system. Mozzies act as vessels to pass disease from animal to human, demonstrating non-linear cause of disease.

The sentinel chicken demonstrates this non-linearity. These are real chickens who have weekly blood tests to monitor for possible disease outbreaks.



Systems don't always have an intention. Evolution is a system that relies on chance and survival. Mosquito success (victory) is determined the same way as for all living things: do they survive and reproduce? It's natural selection in action.

Systems, like disease spread, pose complex problems that require complex solutions. Using Systems Thinking, we can see that a complex problem requires many little solutions to be effective.
All the 'Nuh-uh' cards are based on real methods of controlling mosquitoes, disease and avoiding being bitten. Each behaves a little differently and (as in real life) a combination of interventions gives the best results. You may choose to discuss or rank these interventions in an extension activity.

With Systems Thinking, we know that there is no simple solution. Full mosquito elimination is not a likely outcome of intervention, because mosquitos are a necessary component of the ecosystem.
Instead, we can alleviate the disease burden by driving them away from humans. This is why the game focuses on disease prevention, not mosquito eradication.

Mozzie Monitors

Session 3

Experimental setup: Trapping

Session 3

Inquiry in Action

Now that students have established a strong knowledge baseline about mosquitoes, and started to interact with the complexities of the mozzie-human relationship, they will now think more about mosquitoes in their own spaces and what they might discover as they begin their mozzie monitoring project.

1. ***Watch***
   - **Title:** Field Observations from Mozzie Monitors Citizen Science programme
   - **Duration**: 5 mins

SCAN ME

Video Link

*The conclusion of your experiment is currently **unknown** as it depends on the research question and the unique factors of your local environment. Students can feel overwhelmed by the unknown, but embracing it builds **agency** and **resilience.***
*This also provides an authentic context to explore **Critical and Creative Thinking,** and the **Self-Management** component of **Personal and Social Development.***

We are going to make predictions about how we might find mosquitoes around the school in the coming months.

First we need a **research question** - what we want to learn about our local mosquitoes. **Through citizen science, we are asking questions nobody in the world knows the answer to!** That is what makes science exciting, but students may be unfamiliar or uncomfortable with grappling with the unknown.

Then students predict what the answer to this question will be.These predictions are our "**hypotheses**" - what we expect to find. To determine if we're correct, we need to **investigate** by **observing** mosquitoes.

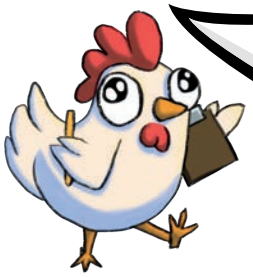
1. ***Forming research questions***
   - **Duration**: 5 minutes
   - **Materials**: Paper, pens, BluTack/staples, wall
   - **Knowledge**: Science requires making meaningful, testable predictions. These can only be made by determining what you are looking to discover first.
   - **Activity**: As a class, in groups or individually, everyone chooses a question about the mosquitoes they are going to find, such as "When will we find the most mosquitoes?" or "Will we find more males or females?" These questions are written down and fixed to the wall around the tracking chart. Students should add their name to the back of the chosen question for tracking purposes later.
   - **Outcome**: Students produce and display their research question and become invested in the answer. These questions form part of a larger wall display (continued in the next activity).

Asking impactful questions

A meaningful research question is the foundation of all scientific discovery. ***Inquiring*** *and* ***generating*** *are essential components of* ***Critical and Creative Thinking****. Some good research questions might be*

- *What does the population of mosquitoes in our area look like?*
- *Do common disease-carrying mosquitoes live in our suburb?*
- *Is there a noticeable difference in mosquito species diversity between older and newer housing developments in our suburb?*
- *How common are mosquitoes at our school?*
- *What other types of insects are common in our local area?*

You can adjust the amount of **autonomy** you give the class here based on what you know will work best. Will they cohere more as a unit around a single shared question? Do they need more scaffolding by presenting research questions to choose from? Or will they become more personally invested if they have selected their question as a team or individual? Do you think the class will invest more heavily in individualised learning or group discussion? It's your call.



Committing an idea on the wall display helps to keep it at the forefront of students' minds while making their thoughts tangible and more personally meaningful. Adding students' names personalises it further, giving them a sense of ownership and ***agency.***
Updating hypotheses over time reflects real-life science, which is an iterative and dynamic process

2. *Hypothesis making*

- **Duration**: 10-15 minutes
- **Materials**: Paper, pens, BluTack/staples, wall
- **Knowledge**: Science requires making meaningful, testable predictions
- **Activity**: Everyone makes a prediction about what the answer to their question will be. They write their prediction (or "hypothesis") on a piece of paper and add their name and the date. This is fixed to the wall around the tracking poster alongside the linked question. As the chart is populated over the coming weeks, you can encourage them to write new hypotheses in the same way and add them to the wall as their predictions change in light of what they find.
- **Outcome**: Students produce and display their own hypotheses and become invested in whether they are correct or incorrect and update their predictions for the future.

Now we need to test our hypotheses. How might we observe mosquitos around the school?

One method is through trapping.

Depending on your class, you may choose to tell them this, or facilitate their questioning so they feel like they come up with the idea on their own. The latter facilitates agency and motivation.

What is the point of a methodology?
Often when teaching science we provide the methodology without explanation. Giving your students a 'why' and enabling them to consider it for themselves can increase motivation. They might come up with new methodologies that are even more appropriate or efficient!

Without providing context, students lose the opportunity to explore **Critical and Creative Thinking**, which relies on **agency**.

Supporting Agency

- *In a shyer class, you could have each student jot down one or two ideas individually and then collate the ideas. This allows students **autonomy** over the idea building within a safe, scaffolded environment.*
- *For highly collaborative classes, this may work better as a group discussion.*
- *To reduce cognitive load, you may also choose to give four or five ideas and have students rank them.*
- *Asking open-ended questions about their hypothesis supports curiosity. You can ask questions like "What do you think will happen?" or "Tell me about how you came up with this idea".*

*Agentic behaviour demonstrates a successful **Personal and Social** capability through self-management*

Trap instructions are on page 49.

3. ***Introduction to mosquito trapping (part 1)***
   - **Duration**: 10 minutes
   - **Materials**: BG-GAT trap, water, animal pellets, card, pen, sticky plastic
   - **Knowledge**: Trap setting
   - **Activity**:
     - Show the trap to the class and demonstrate how to empty it to collect and count mosquitoes, and then how to set it up again. Make the instructions available and introduce a system to have students in pairs or threes take turns to set and collect the trap each week.
     - Show the students the appropriate location you have selected to set up a mosquito trap (you may like to take the students for a walk around the school to identify the appropriate position of the trap).
     - Make sure it is sheltered from wind, rain and direct sunlight. It should be kept out of the way of student activities to prevent being knocked or being a tripping hazard. This trap will be collected by the first group of students next week.
     - Demonstrate how to preserve the collected mosquitoes, by spreading them with a brush on prepared white card with the date written on and gently covering them with sticky plastic and placing the card into a prepared box/drawer/etc.
   - **Outcome**: Students are introduced to the method of setting and collecting traps. They are prepared for their turn in monitoring and setting the trap.

For discussion of students' ethical understanding of killing mosquitoes, check page 46

For a pesticide free method of trapping, see page 47

How to set a mosquito trap (BG GAT type) at home

SCAN ME

Video Link

4. *Introduction to data collection*

The tracking sheet poster is on page 50

- **Duration:** 10 minutes
- **Materials:** Mozzie Monitors poster, pen, wall
- **Knowledge:** Format of chart, method of data tracking
- **Activity:** Demonstrating the instructions on the poster, show students how to record results from each week's monitoring, filling in the mosquito tally blocks and adding the date. Effectively, having set the trap the week prior, the teacher walks the group through all the steps they will be conducting independently by doing the first round as a whole class.
- **Outcome:** Students understand the system for data collection.

Adding Complexity
Identifying mosquitoes is essential to the citizen science program. Depending on your group, this activity can be incorporated into a longer study. A mosquito identification activity is provided below to help students become comfortable with the process.

Students can learn to distinguish between males and females and identify three different mosquito genera based on patterns, which is a form of ***Computational Thinking****. You can provide the identification guides below when they collect their traps. This facilitates the* ***analysing*** *component of* ***Critical and Creative Thinking.***

iNaturalist

Now that we know how to collect, we have another important question:
How do we share our results with the rest of Australia?
Science becomes impactful when it is communicated. Science is a human endeavour, so we need to share our results. We can do this through Citizen Science, where we are answering one of hundreds of questions: What is happening in *our* backyard?
To do this, we can use apps such as iNaturalist.

SCAN ME

How to Make an Observation on iNaturalist using our Mobile App

SCAN ME

Observe Nature with iNaturalist

SCAN ME

Seven reasons to contribute to iNaturalist as an identifier

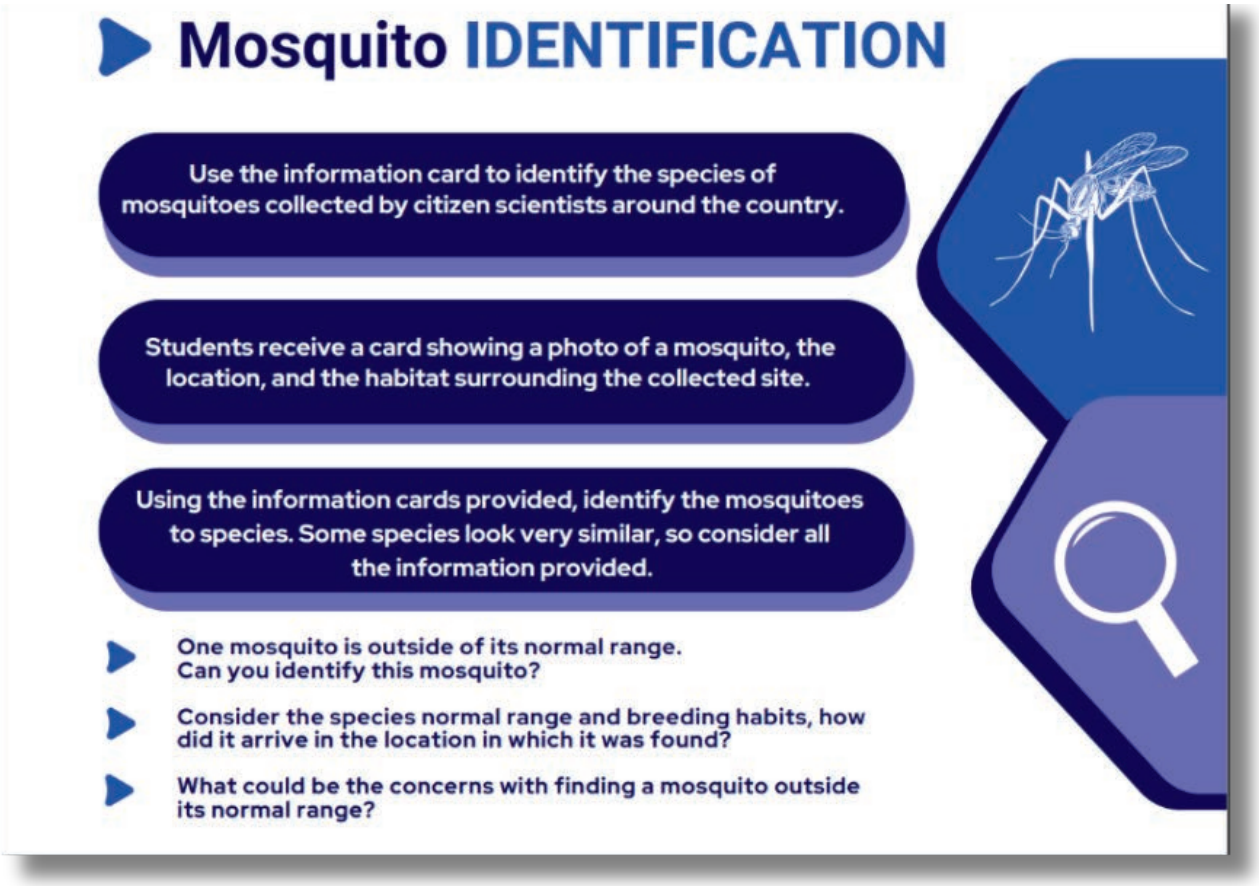
5. *Mosquito ID Activity*

- **Duration**: 10-20 minutes
- **Materials**: Mosquito photos and ID guides
- **Knowledge**: Differences between mosquito species, habitats, etc. Context of what scientists use to study mosquitoes.
- **Activity**: Use the mosquito classification guides to ID mosquitoes from photos. The images provided were actually uploaded to iNaturalist as part of the Mozzie Monitors programme, this should be made clear to students. Discussion to resolve disagreements and clarify details can follow the activity.
- **Outcome**: Students practice observing and identifying mosquitoes before applying these skills, learning what information scientists can gather from such observations. They then **draw conclusions** to identify each mosquito, including any invasive species.

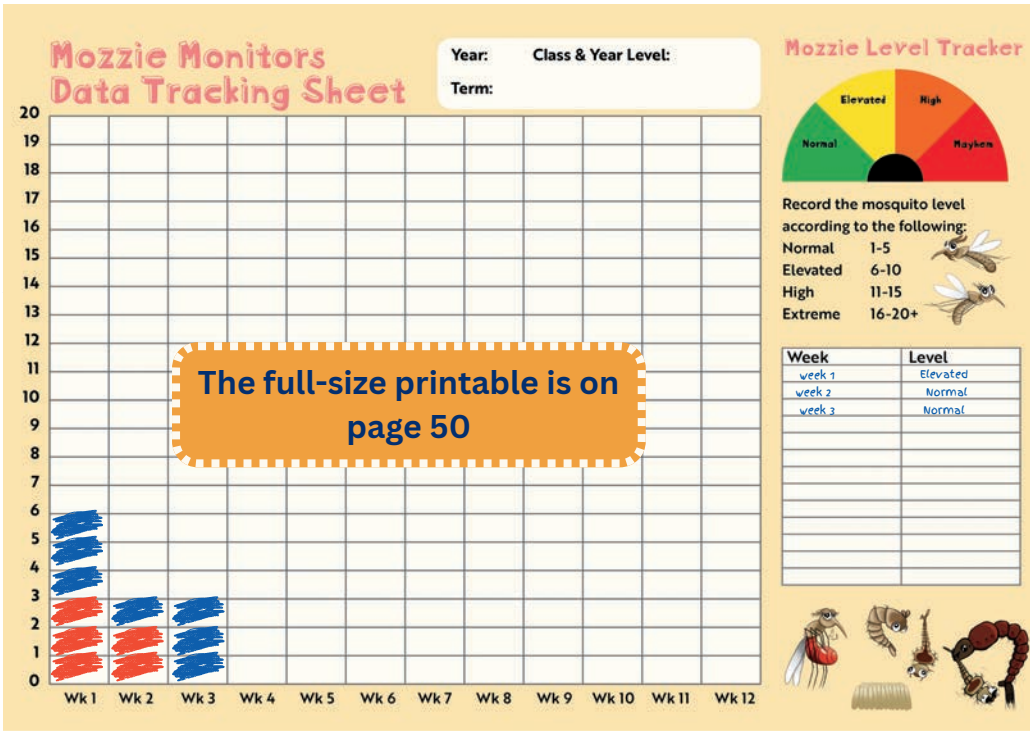
SCAN ME

The Mosquito ID cards required for this activity are available for download on our website.

Link here



Tracking sheet



The full-size printable is on page 50

Extension

To add detail to your poster, use different coloured pens and label them for the types students are tracking – for example, red for "Male" and blue for "Female". This way students can record both by dividing each block to log separate accounts. This adds more complexity to the ***Numeracy*** *component of the general capabilities.*

Mozzie ID

Male mosquitos have fluffy antenna to set them apart from females. The palps flanking the proboscis help identify what female species mozzie you have. For species identification, *Anopheles* mosquitoes have very long palps. You can tell *Culex* and *Aedes* mosquitoes apart by their body shape, *Culex* tend to have a rectangular abdomen which is square or rounded at the end. *Aedes* mosquitoes' abdomen is rounder and tapers off to a point. Males can be more difficult to group as all have palps, as shown above, but body shape is still a good indicator.

See page 48 for a Mozzie ID printout for your students.

6. *Mosquito observation*

- **Duration**: 10-30 minutes
- **Materials**: Collected samples, models, preserved samples, videos, etc. of mosquitoes. Magnifiers, pencils and paper.
- **Knowledge**: Integration of mosquito biology and life cycle with real world findings and observations.
- **Activity**: Encourage students to draw out information in some way as they examine the materials: have them draw what they see, identifying body parts they have previously labelled, comparing to their models, considering where/how mosquitoes live and what stage of the life cycle they are looking at.
- **Outcome**: Students use observation as a scientific investigative process. They practice linking theoretical knowledge to their practical observations.

Finish with this video as a reminder of the purpose and value of the project.

Learning By Doing & Mozzie Monitors

SCAN ME

Video Link

Mozzie Monitors

Weekly Activities

Ongoing data collection

Weekly Activity

Mozzie Monitors

Collection and Recording

Now that students have created their research question and hypothesis, groups will carry out the observations week by week to create the final data set and explore conclusions based on **numeracy**.

1. ***Mosquito trap collection***
   a. **Duration**: 10 minutes
   b. **Materials**: Trap from previous week's group, white card and small paint brush (can be used to move mosquitoes)
   c. **Prior Knowledge**: Trap emptying and result collection
   d. **Activity**: Students bring the trap back to the classroom. Follow steps 1-4 to empty the trap and photograph your findings. Mosquitoes collected can be observed using a magnifying glass. Count how many mosquitoes were collected. Students look to see if they have different types (species) and if there are males and females. Preserve these mosquitoes for comparison and further observation in the following activity.
   e. **Outcome**: Students make observations of their results and participate in the citizen science program by reporting their findings.

2. ***Recording and preserving data***
   a. **Duration**: 5 minutes
   b. **Materials**: A6 mozzie specimen card, sticky plastic, scissors, class chart and marker pen
   c. **Prior Knowledge**: Graphing, labelling, recording data
   d. **Activity**: Students record their mozzie total on the graph on the classroom wall, colouring in the number of blocks that matches their total in the next column and labelling it with the date. They set what they believe is the mozzie "danger level" for the week and can consider how the data meshes with their hypothesis. Trapped mosquitoes (and/or other insects) are uploaded to iNaturalist.
   e. **Outcome**: Progressive completion of a data set for each school term conducted and a collection of mozzie samples to examine later in the year.

Weekly review
It is worth reviewing the progress as a class once every few weeks and giving students the chance to add new hypotheses to the wall, but make sure they have their name and the date on the back.
This builds **relatedness** and **agency.**

Supporting Motivation
*As the students are given more **autonomy** by taking responsibility for data collection, many will naturally feel motivated to take part. For those who don't, you can encourage them by:*

- *giving them more choices or control*
- *contextualising why this matters to them*
- *discussing their interest or focus (personalisation/investment)*
- *connect observations to 'danger level'*
- *updating hypotheses*

The full trap instructions are on page 49

3. ***Mosquito trap resetting***
   a. **Duration**: 10 minutes
   b. **Materials**: BG-GAT trap, water, animal pellets
   c. **Knowledge**: Trap setting
   d. **Activity**: Students reset the trap where they collected it from using steps 5-12 in the instructions. Make sure the trap is sheltered from wind, rain and direct sunlight. It should be kept out of the way of student activities to prevent being knocked over or becoming a tripping hazard. Step 6 will only need to be completed every few months, likely by the teacher preparing it in advance and must be performed outside. ***Note***: *Consider the time of the year you perform this activity; Warmer months are best as mosquitoes tend to be most active in these months. Cooler months will likely have the lowest mosquito populations.*
   e. **Outcome**: Students gain practical experience in outdoor science activities and consider their environment in setting up the traps.

Extending the project

- You can make the class responsible for monitoring mosquitoes all year rather than just a term to do a more longitudinal study, which demonstrates a more sophisticated **numeracy** engagement. Each term's graph can be put up next to the others to show all the data together.
- Compare this years data with data collected by the previous cohort.
- The class could keep the school updated with warnings when the populations are high and what people can do to stay safe through assemblies, posters, announcements, etc. This demonstrates **Science as a Human Endeavour**.
- For more sophisticated **numeracy,** add a weather station to see whether temperatures or rainfall affect how many mozzies they collect, recording these along with the date on their chart, or even adding a second or third bar to each section of their graph to compare them directly. For a simple alternative, they can just note what the weather was that week as qualitative data.
- Multiple traps can be set in different areas to find mozzie hotspots. If the school has a mozzie problem, they could use this information to help improve the school. This demonstrates **Science as a Human Endeavour.**
- Mozzies aren't the only important insects: You may trap other insects in your trap that can scaffold future experiments and data for iNaturalist. This helps students **adapt goals and plans** as part of their **personal and social** capability.

Mozzie Monitors

Session 4

Results: what have you discovered?

Session 4

Mozzie Monitors

This unit does not end here. It is essential to continue to promote citizen science through these and further activities to make the most of everything students have completed. At the end of the period of monitoring, this session brings together students' learning and the data they have collected as well as examining their research questions and hypotheses.

1. *Examining findings*

a. **Duration**: 5 minutes
b. **Materials**: Gathered display materials: completed poster graph(s)**, mozzie sample cards, hypothesis cards.
c. **Knowledge**: Predictions and baseline results
d. **Activity**: Research questions and hypotheses are distributed and the chart(s) are made available. All students confirm what predictions they had made and looks at the results.
e. **Outcome**: All students are in a position to move on to the next activity after reviewing the basics of their results and reminding themselves of their hypotheses and research questions.

We recommend making copies of the completed poster to distribute to the class. The students can have the raw data and **can draw their own conclusions**, presenting them in their own way later, as part of the **analysing** component of **Critical and Creative Thinking.

*The main challenge is the long duration of the experiment, as months may pass for students who started early. To maintain **engagement**, use the wall display and brief check-ins, like adding hypotheses, reviewing numbers, or discussing the current 'danger' level. These quick actions keep the project fresh and relevant as well as engaging them with the social components of the **Personal and Social Awareness** general capability, through group discussion and considering the impact of their findings on their community.*

*This is even more powerful with the extension options above. More data means more student choice and **agency** that will lead to more engaged learners with more interesting conclusions and questions. Prevent decision paralysis by introducing new data slowly.*

2. ***Drawing conclusions***
   - **Duration**: 15 minutes
   - **Materials**: Gathered display materials: completed poster graph(s), mozzie sample cards, hypothesis cards, pens and paper
   - **Knowledge**: Use of data alongside hypotheses to draw conclusions. Use of observational data in science as an alternative to controlled experimentation.
   - **Activity**:
     - **Facilitate Class Discussion:**
       - Review the collected data as a class.
       - Encourage students to share their original research questions and hypotheses and describe how they adapted them as the data collection progressed.
     - **Draw Individual Conclusions:**
       - Ask each student to write a conclusion related to their research questions based on the data, linked to their hypothesis.
       - Emphasise that a valid conclusion can also be recognising that the data did not confirm or disprove their hypothesis.
     - **Propose Further Inquiry:**
       - Students identify one additional question they would like to investigate and add these to the wall.
       - Alternatively, students suggest a modification to the experiment to better address unresolved hypotheses.
     - **Share and Discuss:**
       - Discuss how these suggestions could lead to a more refined or expanded understanding of the topic in a national context.**
   - **Outcome**: Students have participated in group discussion, cemented their thinking and have initial ideas both for their conclusions and how they would develop their experiment further

> ***In science, the best result of an experiment is not a neat conclusion, but a new question. This curiosity drives innovation.***

This is an ideal opportunity for students to understand that not answering their question or finding a simple 'no' is a common outcome in scientific investigation. Ruling out possibilities or identifying ways to improve an experiment for the future are both frequent and valuable results in science, contributing meaningfully to the body of knowledge that science builds over time. Progress, even in small steps, is still progress. This builds mental* ***resilience.

This also requires students to use the ***Analysis*** *component of* ***Critical and Creative Thinking*** *as they apply* ***Numeracy*** *as part of the general capabilities.*

But what happens if we find no mosquitos?
See page 42

Tangible outcomes
A tangible work product where students synthesise their knowledge adds incalculable value to long-term learning and **motivation.** It ends this stage of the project with impact, rather than allowing it to fizzle, and building the **Self-management** component of **Personal and Social** capabilities. This artefact can also be used as an assessment based on our provided rubric.

3. *Sharing results*

a. **Duration**: 30 minutes (and homework)
b. **Materials**: Everything from the previous activity, plus those needed for students' medium of choice for their final output
c. **Knowledge**: That the end goal of any science is to be able to clearly report a summary not only of their findings, but also of their process and to suggest directions for future work.
d. **Activity**: Students create a report, poster, or other form of media to report their findings to others. This output must be clear enough for someone unfamiliar with the project to understand what they did, why they did it, what they discovered and its significance. They should incorporate their hypothesis and include their conclusions, along with an additional question that arises from their observations.**
e. **Outcome**: A class set of diverse reports, varying in format and the questions posed, all utilising the same observational data, can be displayed and shared within the school and beyond. These reports can also be presented to future groups conducting this activity, enriching the data available to each cohort by allowing them to review previous results, hypotheses and conclusions.

This activity fulfils the **Literacy** General Capability.
Communicating is essential in science, but it comes in many forms. Scientists often choose to write reports, create infographics and posters, produce videos and TikToks, or even appear in a news segment to share their findings. **If the students want to make impact in their community, you can contact your local newspaper to share your class findings.**

Session 4

What if we didn't find any mozzies?
Many factors might result in no mosquitoes in the trap. For example, it may not be mozzie breeding season, there may have been inclement weather, or the traps were set incorrectly. Maybe your school is already doing a good job managing possible mozzie breeding sites. If you don't catch anything, encourage discussion with your students so that they can **adapt their goals and plans**:

- What might have stopped the trap from working?
- Is everyone using it correctly? Is the location right? How has the weather been? Have you still be catching other insects?
    - If you are catching other insects but mosquitos, the traps work, but it is the wrong season. If you don't catch anything, there is a fault in the trapping.
- Use iNaturalist - what else *did* you find? It can still be submitted there with other specimens and someone will still use your findings.
- Reframe the research question and create new hypotheses to match. Switch from mozzies to insects you are finding. Remember with the sticky cards, you are storing all specimens you find for later inspection

This is an opportunity to consider - **What is a result supposed to look like?**

When we are asking scientific questions, we might not know! Science is about finding the unknown, so open questions, unexpected answers, and interpreting data in new ways; that is all good science. Practicing this builds **resilience** and his helps students **adapt goals and plans** as part of their **personal and social capability.**

What's Next?

- Ensure you show the students their photos and results displayed on inaturalist.org/projects/mozzie-monitors-australia; they have contributed to genuine research. They can also explore reports from others and see what findings have been made.

- Check inaturalist.org/projects/mozzie-monitors-australia/journal for updates. Occasionally there will be discussion of the project and what it has achieved.

- Encourage students to download and use the iNaturalist app at home. It assists users in identifying local animals and plants, and simply taking and uploading photos of the plants and animals they encounter greatly enhances ongoing research. Follow the link to explore the many citizen science nature tracking projects they can participate in as well: inaturalist.org/projects/search?utf8=%E2%9C%93&q=australia

- There are a whole range of citizen science resources and projects for students to engage in, on iNaturalist and beyond.

Mozzie Monitors

Appendix

Possible extension activities

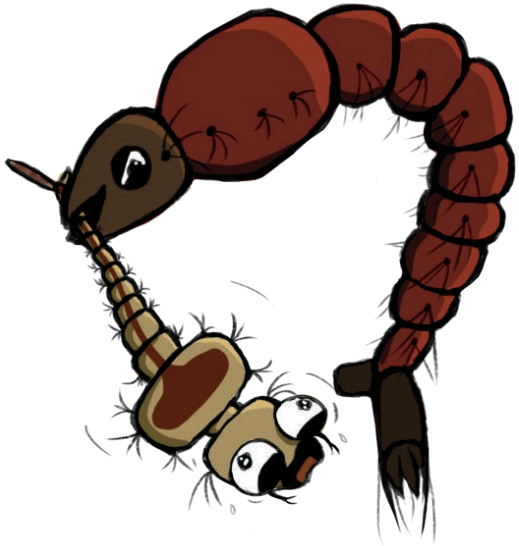
The below are possible extension activities for each year group based on the science curriculum:
Pick an activity (extension opportunity) 20 minutes (optional)

- **Extension - Year 7 - Ecosystem impact (consider activity for all ages)**
  - Place the mosquito within a food web or set of food chains. What impact can we expect if we remove the mosquitoes from the web? Which animals/plants will benefit, which will suffer. Is this a problem? Give some students an urban environment food web, some a web from a saltmarsh. Eliminating mosquitoes in a salt marsh would have more serious consequences, than in the city.

- **Extension - Year 8 Mosquito organs/organ systems**
  - Year 8 students are prompted to discuss what the body parts are for in their groups, and how they are connected in a discussion exercise like (1) and (2). Have them consider which parts are needed for feeding, flying, moving, etc. Use models and images from the previous session. Which parts are involved in spreading disease?

- **Extension – Year 9 Public Health Advertising**
  - Get students to develop public health warnings around mosquito borne disease. Consider information pamphlets that could be distributed at medical practices, press releases, social media or television advertisements, or newspaper advertisements. Include information about when and how to protect yourself from mosquitoes as well as why it is important to be aware of mosquitoes. Use catchy images and slogans to promote the message. Students may be encouraged to film their own advertisement or news article.

- **Extension - Year 10 - Mosquito evolution and pesticide resistance**
  - Do a population game/exercise to show how quickly resistance can fill a population from a small starting proportion. Talk about how this turns it into an arms race.



Ethics and Killing in Biology

This activity involves the killing of mosquitoes for collection. Biology frequently involves the harming of living creatures in the name of science.

How do we navigate ethical research?

Conducting ethical research is about weighing up the pros and cons of Harm and Benefit.

The value of research

Setting these traps will provide data that reduce how people are infected by -and die from- mosquito-borne disease. Is it better to save human lives or mosquito lives? Are there other alternatives?

Role as a pest or disease carrier

Mosquitoes can bite us and cause a nasty, itchy bite, or even disease. If you wouldn't set a killing trap for mosquitoes, would you squash one if it bit you? What do you feel is the difference?

Sense and sentience

mosquitoes have about 200,000 brain cells. Humans have 86 billion. Even these small brains are still doing more work than a supercomputer, so are they complex enough to care about?

Lifespan

Once a mosquito emerges, a male can live for 10 days, a female for up to 8 weeks. Are these shorter lives less valuable or less important than longer lived animals?

Pain

Insects have been shown to feel pain. Does the benefit of research justify the harm caused to mosquitoes?

Emotive connection

When we form an emotional connection to something, we are more likely to care what happens to it. How do your feelings about mosquitoes affect your decisions? Would you feel differently about lice or cockroaches? What about mice or monkeys?

The act of killing

Struggling with being part of the act of killing is entirely natural. Plenty of non-vegetarians would be hesitant to kill their own dinner. Does doing the killing feel worse when you or somebody else doing the killing? Does the benefit outweigh the harm?

Pesticide-free mosquito collection experiment

Equipment

- Black bucket
- Grass or leaf matter
- 2-5 L Water
- Plywood boards or heavy duty cardboard cut into approximately 5 cm x 15 cm strips
- Containers for housing larvae (takeaway containers are ideal)
- Mesh/mosquito netting.
- Large rubber bands
- Pipettes (you may need to cut off tips to ensure larvae can fit)
- Forceps
- Ground pet food or fish food

Setting your trap

Fill the black bucket with 2-5L of tap water and add grass or leaves shredded into small pieces. Place the bucket in a safe, well shaded place out of the wind. Ensure it that will not be in the way, or present a trip hazard to students or staff and cannot be easily tampered with. Prop one piece of plywood or cardboard in the bucket with half in the water and half out (this provides a surface for eggs to be laid on).

After one week check the buckets. Lift the plywood or cardboard to see if any small black eggs have been laid. Check for eggs on the surface or small larvae in the water. If there are larvae or eggs, remove and bring the bucket into the classroom for closer observation. Often a week is not long enough, so if there is nothing to see top the water up and leave for another week

Grow to ID

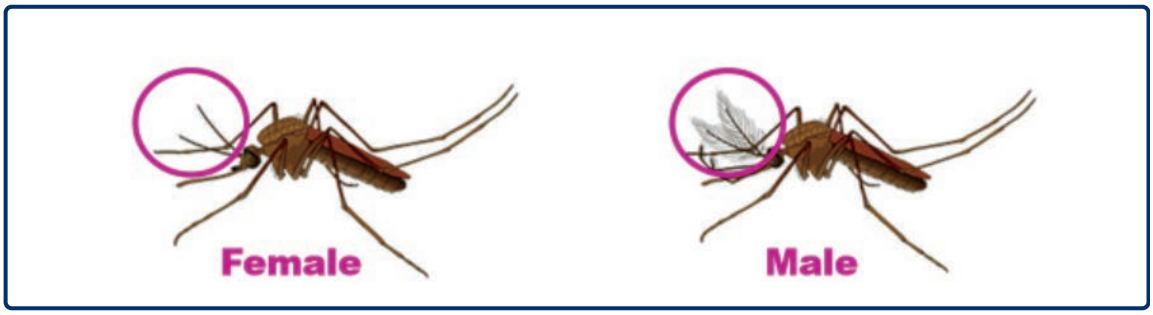
Use a pipette with the tip removed or small scope to collect the mosquito larvae and place them in a small clear container with a little ground pet food or fish food and cover with a mesh and a rubber band, these can be grown until they are big enough for ID.

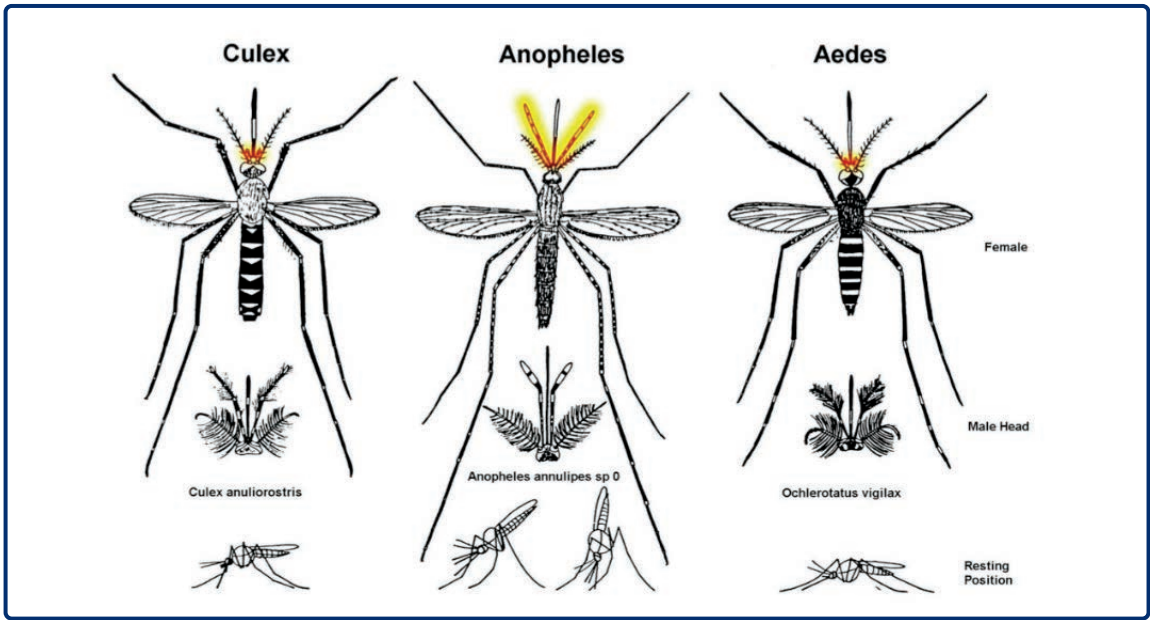
If you have collected eggs on your board submerge the board in a container of water and leave for one to two days. If you have eggs rafts floating on the surface of the water these can be gently removed and place in a separate container of water, these will generally hatch within 48 hours of being laid so should also be visible as larvae in the water after 2 days.

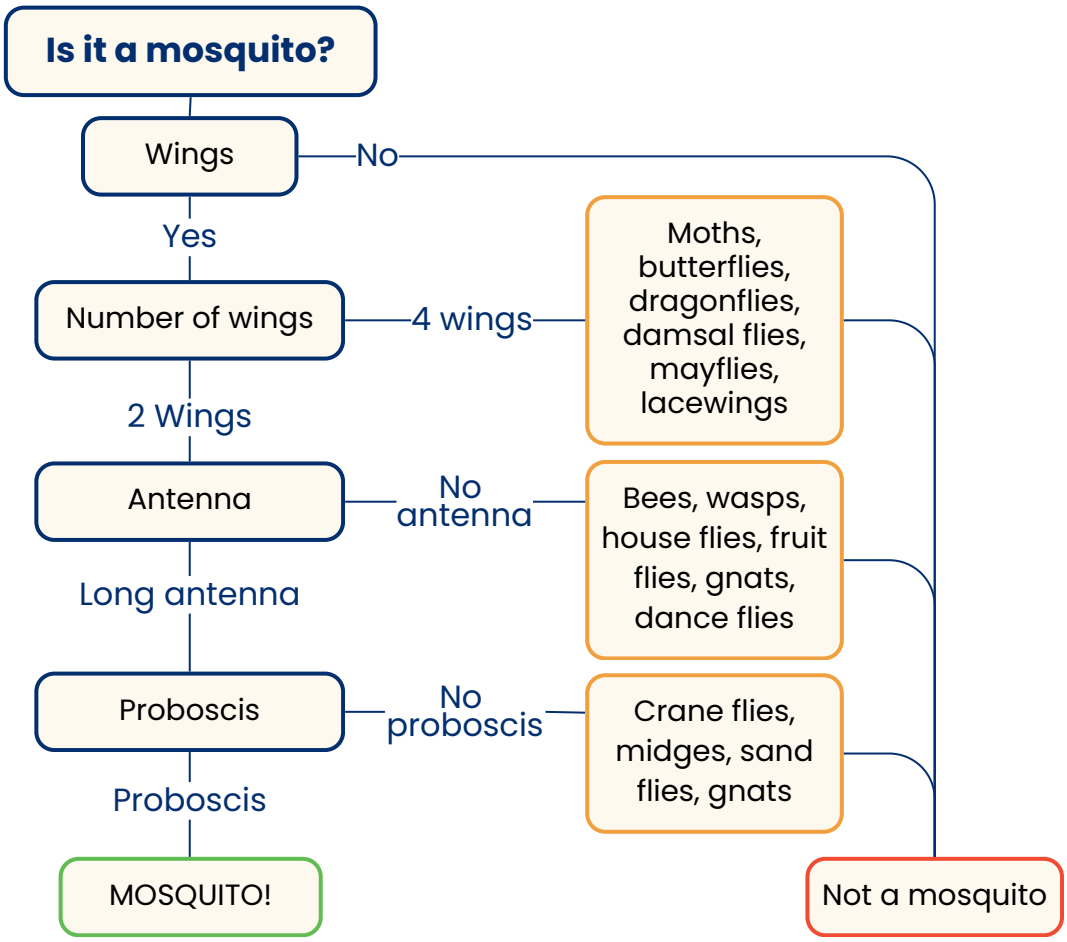
Newly hatched larvae are too small to ID so they need to be allowed to grow. To grow larvae take a subsample of the newly emerged larvae or the larvae collected from the bucket. 10-15 from each subset (eggs on board, egg raft and larvae from bucket) should be enough to capture the species diversity represented. If you have different subsets house the larvae separately and label their origins as they are likely to be different species. You should record the total number larvae or eggs collected in your trap too. Place a small amount of ground pet food or fish food into each container housing larvae and cover with a mesh and a rubber band to prevent emerging adults escaping.

After identifying your adult mosquitoes, these should be disposed of safely by placing the container in the freezer. Though newly emerged mosquitoes do not pose any health risk from disease, we should avoid releasing them into our education spaces.

Mozzie ID


Female
Male

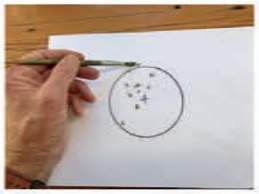

Culex
Anopheles
Aedes
Female
Male Head
Resting Position
Culex anuliorostris
Anopheles annulipes sp 0
Ochlerotatus vigilax


Is it a mosquito?
Wings
No
Yes
Number of wings
4 wings
2 Wings
Moths, butterflies, dragonflies, damsal flies, mayflies, lacewings
Antenna
No antenna
Long antenna
Bees, wasps, house flies, fruit flies, gnats, dance flies
Proboscis
No proboscis
Proboscis
Crane flies, midges, sand flies, gnats
MOSQUITO!
Not a mosquito

Mosquito Trap Instructions (BG-GAT model)

1 Remove the top of the trap and inspect for mosquitoes on the mesh.

2 Remove the mesh screen and carefully tip the contents on to a white card.



3 Brush the mosquitoes captured into the black circle on the card.

4 You are now ready to photograph your collection. Use your mobile phone or tablet, and send in to us!

5 Empty and clean the trap, then get ready to set it up again with new pellets and the spray.

6 Treat the translucent top with insecticide surface spray. Allow to dry.

7 Fill the bucket section with tap water up to the overflow holes.

8 Add about 6-10 rabbit food pellets.

9 Fit the screen to the wider end of the translucent trap top.

10 Place the trap top on the bucket base, with the hole facing up.

11 Fit the entry port to the top of the trap.

12 Set the trap out of direct sun and rain for one week.

Reset your trap (Steps 1-8) and begin again!

You can also watch Associate Professor Craig Williams set up the trap here: unisa.edu.au/mozzie-monitor-trap-instructions
https://chuffed.org/project/mozzie-monitors

Mozzie Monitors Data Tracking Sheet

Year: **Class & Year Level:**

Term:

	Wk 1	Wk 2	Wk 3	Wk 4	Wk 5	Wk 6	Wk 7	Wk 8	Wk 9	Wk 10	Wk 11	Wk 12
20												
19												
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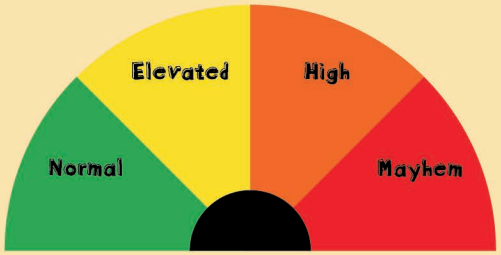
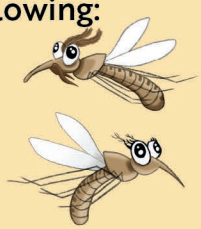
Mozzie Level Tracker



Record the mosquito level according to the following:

Normal	1-5
Elevated	6-10
High	11-15
Extreme	16-20+



Week	Level

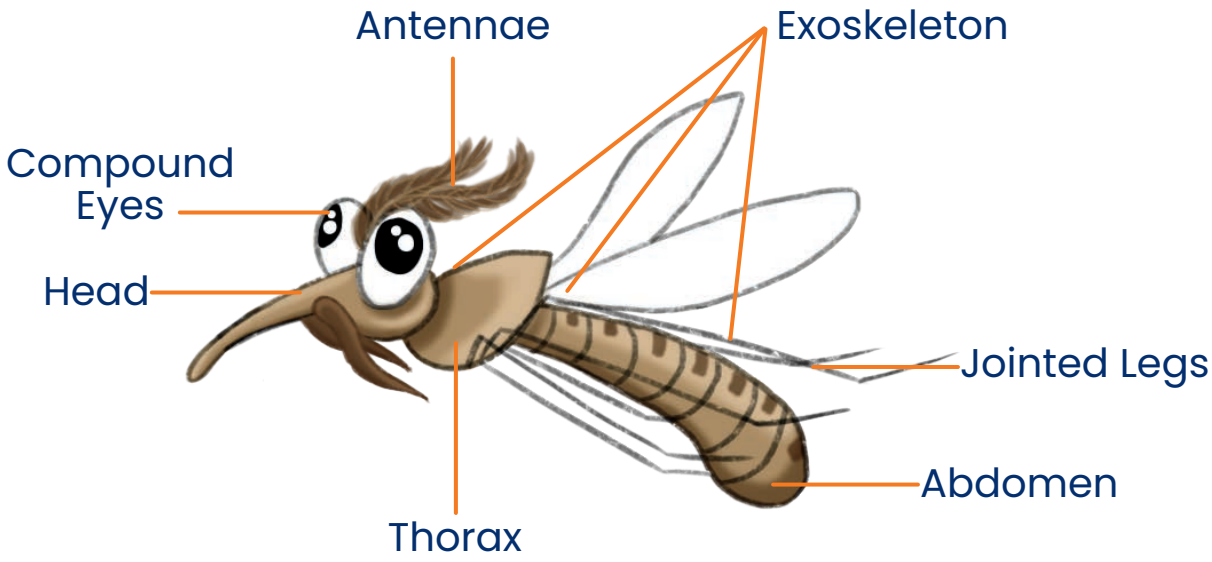
Mozzie Basics

Below is some basic mosquito information for you and your students. It has been written to be as accessible as possible. Please note that whilst this information will help answer questions and provides a basic understanding of how mosquitoes work, this workshop is not supposed to teach mosquito facts. Instead, it promotes citizen science and a broader understanding of science as it interacts with our daily lives.

What is a Mozzie?

Mosquitoes are small, flying insects. As with all insects they have:

1. A hard exoskeleton (skeleton on the outside) made of chitin
2. A body with three parts (head, "thorax" and abdomen
3. Six jointed legs
4. Compound eyes
5. A pair of antennae



Mosquitoes belong to the Order Diptera (meaning 2 (di) wings (ptera)) along with crane flies, midges and house flies. As adults, you can tell a mosquito easily by their 2 wings, slender bodies and long proboscis (feeding tube), which female mosquitoes use for blood sucking. Like many insects, mosquitoes have four life stages. They lay eggs, which hatch into larvae. These larvae wrap themselves into pupae and then emerge looking completely different as an adult mosquito.

Think of it like the life cycle of a butterfly, with the larvae being the caterpillar and the pupa the cocoon.

Mosquito larvae and pupae are aquatic (i.e., they live in water) so mosquitoes tend to be found near stagnant (not flowing) water. Mosquitoes can survive in a lot of different places, with many commonly found in urban environments.

Mozzie Basics

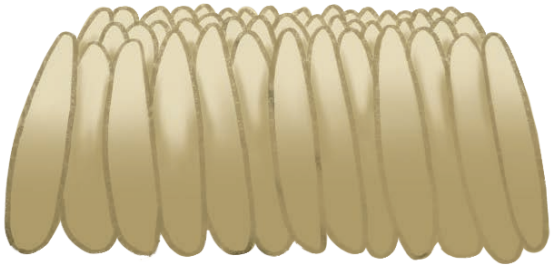
Mozzie Monitors

Eggs

Mosquitoes generally lay small pill shaped eggs with a hard black outer shell. They can be laid on water in rafts of up to 100 eggs which float on the surface. Some species will instead lay their eggs in small groups of 1 to 10 on debris on or just above the water line.

Mosquito eggs resist drying out and can lay in wait for weeks or even months if water levels are too low.

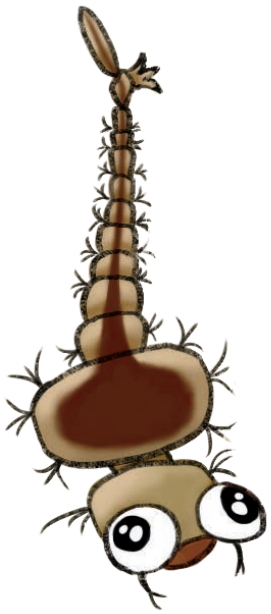
Eggs laid on the surface of the water will usually hatch within a few days, but these waiting eggs will often hatch after a rise in water levels puts them under the surface. This way, the newly hatched larvae are somewhere that won't dry out before they are fully grown.



Larvae

Larvae, which are also called "wrigglers", are long and worm-like. They have a head with special mouths which let them filter food, like algae or organic debris, from the water. Their bodies are covered in tiny hairs and at the back of their abdomen is a long siphon that lets them float and breathe the air. When you look at a larva from the side they appear to be hanging upside down with their siphon sitting at the surface, like a snorkel.

Larvae go through four stages, shedding their hard outer skeleton four times to let them grow larger. Full growth can take from 9 days to 2 weeks in perfect conditions.
Their growth speed varies between types, mostly down to where they normally grow. Mosquitoes which lay eggs in rain pools must become adults before their pools dry out, so they have to be quick. Those using more permanent water pools can grow more slowly.



Temperature also affects the larvae. Warmer water makes them finish growing faster, turning into smaller adults. When it is very cold, some larvae can wait to become adults for months, waiting for the weather to warm. Growing slowly like this gives them an advantage over mosquitoes which emerge later into the warmer seasons, because they have been able to grow larger and acquire more nutritional reserves.

Mozzie Basics

Mozzie Monitors

Pupae

Larvae wrap themselves in a skin to become pupae and then the adult mosquito develops like a butterfly in a cocoon. However, unlike butterfly cocoons, mosquitoes can still move at this stage, but they do not eat. The change takes 2 to 4 days. Like the larva, the pupa still breathes through floating tubes, but now these are on the top of the head, looking like ears hanging onto the water's surface.

Looking at pupae you might see them do a kind of somersault under the water to move, helping them to avoid being eaten by predators.

If you look carefully at the large round part, you may also be able to see the forming wings, thorax and legs of the adult mosquito. The tail end holds what will emerge as the abdomen of the adult.

Once transformation has taken place the pupae will float to the surface split lengthways down its back, allowing the adult to emerge.

Adults

New adults will wait on the water, while their soft bodies 'cure' to harden and spend two days near the water so they don't dry out. On average female mosquitoes will live up to 3 weeks, while males may only live a few days.

You can tell the male and female adults apart by looking at their antennae and palps. Males have longer palps than females and feathery antennae.

Female

Male

Long Palps

Females are sexually mature shortly after emerging, while males take a few days, so males often emerge first from a clutch laid together. Females only need to mate once as they can store sperm after mating in a structure called a 'spermatheca', which lets them use one mating to fertilise multiple batches of eggs.

As adults, mosquitoes will feed on sugary nectar from flowers. This also makes them important pollinators in some places, with plants relying on them to reproduce. Most species of mosquitoes also require blood meals, but only the females. Blood gives them the protein required to produce eggs.

Mosquitoes use lots of different ways to find a blood meal, including body odour and body heat and even the carbon dioxide from hosts' breath. After a blood meal it takes the female around 5 days to develop the eggs ready for laying. Once eggs are laid the female can seek another meal to develop the next batch of eggs. It is the female feeding on more than one creature that spreads diseases from host to host.

Mozzie Homes

Mosquito larvae are aquatic and can be found almost anywhere water can pool, from naturally occurring pools, puddles, plant stems and leaves or artificial pools in pots or buckets. Some species can survive salty water so can be found in coastal rock pools, mangroves and saltmarshes. Other species prefer fresh water which can be found in forests, wetlands or heathlands.

Mosquitoes adapted to urban environments, generally prefer fresh water for larvae habitats. These are the most common 'pest' mosquitoes that cause humans the most trouble. They grow in artificial breeding sites around our homes and backyards, including pot plants, bird baths and fishponds, containers and buckets, discarded rubbish which collects and holds water and rainwater tanks. Urban environments not only supply lots of places for larvae to grow, but also lots of blood meals, from both humans and our pets.

Learning about potential mosquito habitats in our local area can help us. We can screen rainwater tanks, empty pots and buckets regularly and avoid collecting rubbish, which may harbour mosquito larvae. This will reduce breeding sites and mean fewer adult mosquitoes around our homes.

Generally, mosquitoes will be active at dawn and dusk, seeking out food or a mate. Adult mosquitoes will spend much of their time resting in shaded sheltered areas, such as bushes or grasses to stay protected from the elements.

Screening our homes, wearing mosquito repellent and covering our skin when outside at dawn and dusk can prevent mosquito bites, preventing the blood meals that lead to eggs.

Use of man-made containers has allowed some mosquito types to spread across Australia, and even around the world, as we shipped them by mistake by sea or railway. This is a danger we must watch for, especially with our changing climate opening new places mosquitoes might be able to survive.

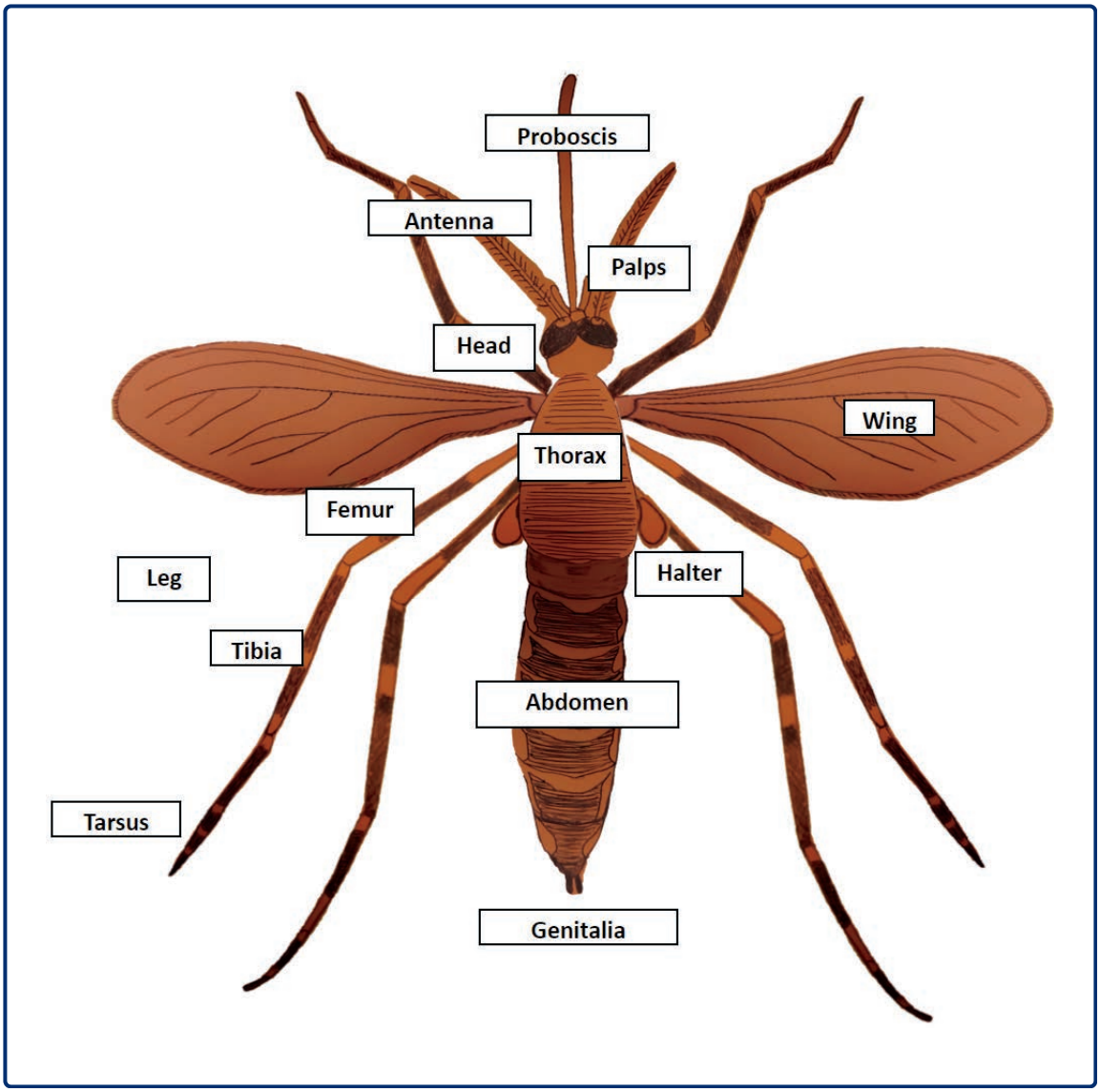
Mozzie Bodies

Mozzie Monitors

Adult mosquitoes have two wings with scaled fringes, slender bodies and a long proboscis (feeding tube) with 'palps' on either side which are 'chemosensors' like tongues or noses. A pair of longer 'antennae' sit above the mouth parts and are also used for sensing.

Mosquitoes have 6 segmented legs and a three-part body of the abdomen, thorax and head. Along with their wings their thorax has a pair of 'halteres' which are used for balance.

Their bodies are covered in small scales which can range in colours from bright white, to yellow, brown or black. The colour, location and pattern of scales is a great way to identify what type (or 'species') of mosquito you are looking at.



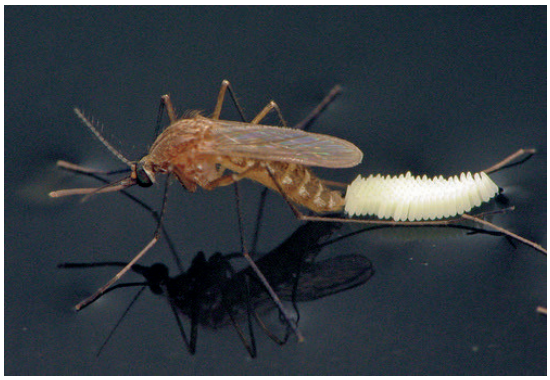
Mozzie ID

Worldwide there are thousands of mosquito species, with around 300 occurring in Australia.

Mosquito identification mostly happens at the adult stage, by observing differences in scale patterns. More general traits like palp length, proboscis shape and size can also help.

Mosquito larvae can also be identified, but it takes a keen eye. The siphon shape and size can be used, as well as the number and positions of their bristle-like hairs. Entomologists (bug scientists) also take clues from where they are found. *Aedes camptorynchus*, for example, lives in pools and puddles in saltmarsh areas, while *Aedes notoscriptus* will be found in freshwater around households such as rainwater tanks. Watching how the larvae move can also help as they shift to different positions in the water when feeding.

Aedes notoscriptus
Taken by: *Andrew Allen*
Uploaded to iNaturalist



Culex quinquefasciatus
Taken by: *Sean McCann*
Uploaded to iNaturalist

Your Local Mozzies

In South Australian cities and towns people are most likely to come in contact with those container breeding species, *Aedes notoscriptus* and *Culex quinquefasciatus*. *Aedes notoscriptus*, also known as the common backyard mosquito, is a small to midsize mosquito which can be identified by its striking silver lyre shape scales on the top of its thorax (scutum) and bright white banding on its legs.

The brown house mosquito (*Culex quinquefasciatus*), is a medium brownish mosquito with lightly mottled legs. They have some banding on the top side of their abdomen which helps set them apart from other members of the *Culex* family.

Outside of urban areas, *Aedes camptorynchus*, the southern saltmarsh mosquito, and *Aedes vigilax*, the saltmarsh mosquito, are the most commonly encountered mosquitoes in South Australia. They are mostly found in wetland and saltmarsh areas along the coastal and river land regions of South Australia. Both are medium sized dark mosquitoes with striped legs, but have different scale patterns, and *Aedes camptorhyncus* is generally larger than *Aedes vigilax*. Both are major carriers of Ross River virus in South Australia so monitoring these mosquitoes is really important.

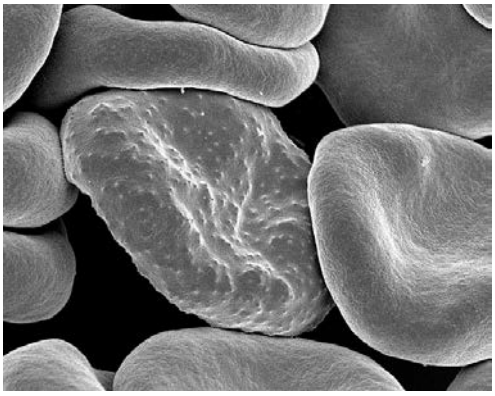
Mozzie Diseases

Mosquitoes are the deadliest animal on the planet. The diseases they transmit kill several million people globally every year.

When female mosquitoes bite a host they inject a small amount of saliva to stop the blood from clotting. The injected saliva is what can cause the itching and swelling many experience when bitten. The saliva is what can contain viruses, bacteria or parasites that can make people and animals ill. Mosquitoes prefer certain hosts which often relate to their habitats. Some will prefer animals such as cows, dogs, kangaroos or birds, while others prefer to feed on humans.

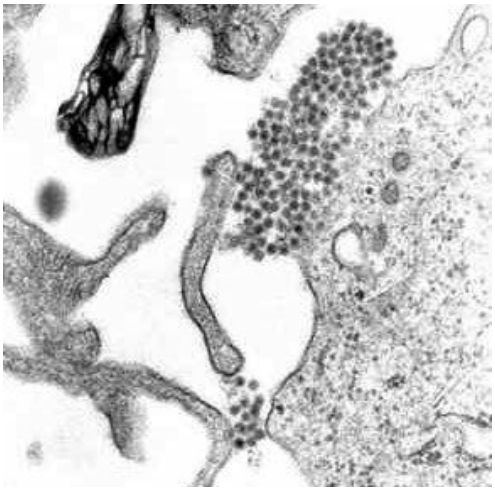
Because a female will take more than one meal in their lives, they can become infected when they drink blood from a host with the disease and then pass it on in their saliva when they next feed. If they feed on different creatures for each meal, they can even pass diseases from animals to humans.

Malaria



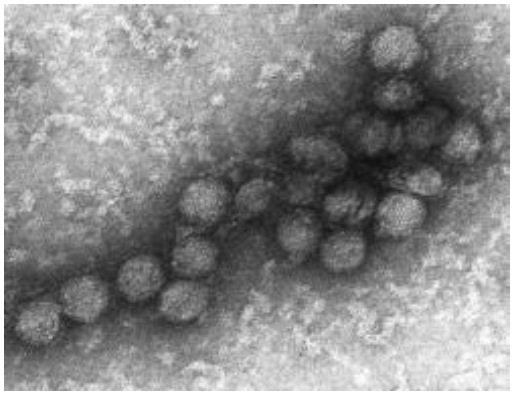
Red Blood Cell infected with Malaria
Uploaded to WikiMedia

Dengue Fever



A TEM micrograph showing Dengue virus virions (the cluster of dark dots near the center).
Uploaded to WikiMedia

Japanese Encephalitis



Electron microscope image of viral particles that cause JEV
Uploaded by: *Mamiossa*
Uploaded to WikiMedia

Wolbachia

Electron micrograph of Wolbachia isolated from an insect.
Uploaded by: *Scott O'Neill*
Uploaded to WikiMedia

Card Game – Life Cycle (mosquitoes)

AIM: Complete a mosquito life cycle from egg to egg.
PLAYERS: 2-4 players, or 2-4 teams of two.
RULES: Each player is dealt 5 cards; the remaining cards are placed face down in a central pile. Players take turns to try to build their own mosquito life cycle following the life cycle sequence.

On their turn a player can play their hand, swap cards or play an intervention, only one action can be performed per turn. If a player plays their hand, they place down as many cards as they can, following the life cycle sequence, every life cycle must begin with the egg and follow the sequence. If the player does not have the correct cards to continue their life cycle they can swap as many of their cards as they like (up to 5) with cards from the central pile, placing discarded cards to the bottom of the pile. If a player has an intervention card, they can use it on one of the other players, targeting the last card in a player's sequence, intervention cards can only be used once. If an intervention is used on another player, that player is then required to reinstate the intervened stage of the life cycle before they can continue on their sequence. At the end of a turn the play picks up cards from the central pile to ensure they have 5 cards in hand before play can move to the next player. The first player to complete a life cycle is the winner.

If playing as teams each team should work to build one life cycle and team members should take turns at placing down cards, e.g. team 1 player 1, team 2 player 1, team 1 player 2, team 2 player 2, team 1 player 1, team 2 player 1, etc. If you wish to make team play more difficult each player may only place one card into the sequence at a time or swap one card.

Deck composition:
Life sequence: Eggs– 9, Larvae – 7, pupae – 6, Adult Male -5, Adult Female- 5, Blood Meal Human – 4, Blood Meal Animal – 3, Breeding Site Artificial – 4, Breeding Site Natural- 2.
I**NTERVENTION CARDS:** Empty Standing Water – 3, Insect Repellent – 1, Clothing-1, Mosquito Net – 1, Larvicides – 1 (PACK OF 52)

SCAN ME

Link to a pdf downloadable of the simplified game coming soon on:
efa.unisa.edu.au/programs/mozzie-monitors-for-citizen-science/

Mozzie Mayhem
Intervention and Event cards

Vaccination – equip to a person. They are protected from disease cards until this card is removed.
Many mosquito-borne diseases do not have vaccines. If they did, this would be the best way to prevent them; people who were bitten would neither get sick nor pass on the disease.

Genetically modified male – equip to female without a male. The female reproduces only once.
Mosquitoes only breed once, but a female can lay many clutches of eggs from a single breeding. If we release a lot of genetically altered males that are less able to father these clutches, the mosquitoes won't behave any differently – the female who breeds with them will just find herself less able to lay eggs, and the local mozzie numbers will go down.

Genetic modification (disease resistance) - equip to female. It no longer passes on a disease card when feeding.
Genetic changes to the local mosquitoes could help them and us. If we make them immune to the disease we still get bitten, but no one gets sick. We can't simply alter all the mosquitoes though – all genetically modified mosquitoes must be made in a lab and then released.

Sterilised male - equip to a female without a male. It cannot reproduce.
These mozzies still have to be made but it is much easier than genetic modification. A machine traps the male mosquitoes, zaps them with radiation to make the sterile and then releases them again. They will mate as normal, but they won't fertilise any eggs. The females will still only breed once, so each one that mates a sterile mozzie isn't going to lay anything.

Mosquito disease (Wolbachia) - equip to any mosquito, it cannot pass on disease cards. A Wolbachia infected male passes it to the female when they mate.
Wolbachia is a disease that is not dangerous to humans and can even pass from a mosquito mother to its eggs. It reduces the ability of some other diseases to infect a Wolbachia infected mosquito. We still have to breed Wolbachia infected mosquitoes and release them, but then it spreads and stays in mosquito populations all by itself!

Medication – no disease card is taken if fed on this turn
Not all mosquito-borne diseases are curable, but some can be prevented with prophylactic medication (one that prevents the disease). In countries where malaria is a risk, travellers often take anti-malarial drugs during their visit to prevent infection, even if they are bitten.

Appendix

Beige or khaki clothes - equip to human, mosquito chooses another human if available and unprotected. Discard at start of next turn.
Mosquitoes are attracted to bright colours. Wearing duller outfits makes you a less appealing target to a hungry mozzie.

Long clothing/cover up – equip to human, mosquito cannot feed on this host. Discard at start of next turn.
Less exposed skin means less area for the mosquitoes to feel from. Even simple changes like this can help protect someone from an itchy bite.

No perfume – equip to human, mosquito must choose another human if available and unprotected. Discard at start of next turn.
Mosquitoes have a keen sense of smell and are drawn to strong scents like perfume or aftershave. So, avoiding scented products can help prevent bites.

No aftershave – equip to human, mosquito must choose another human if available and unprotected. Discard at start of next turn.
See above – strong smells draw in mozzies!

Mosquito net – equip to human, mosquito cannot feed on this host. Discard at start of next turn.
If a mozzie can't reach you, it can't bite you. A net surrounding your bed with holes too small for them to get through gives you bite-free rest... as long as one isn't in there with you! Don't sleep right up against the net either – they can still poke their mouthpiece through the holes from the outside!

Insecticide treated clothes/tents/sheets - Play when mosquito feeds on a human to kill the mosquito. Discard from hand at start of next turn
An insecticide is a poison to insects like mosquitoes. If they land on treated cloth, they die. Fair warning though – it's not poisonous to you, but it will kill other bugs that aren't bothering you too.

Insect repellent – equip to human, mosquito must not feed on them. Discard at start of next turn.
There are chemicals that mosquitoes don't like the taste or smell of. These won't kill them, but they'll keep the mozzies off you for a while.

Staying indoors at dawn/dusk - equip to human, mosquito cannot target this human. Discard at start of next turn.
Mozzies are most active at dawn and dusk. Staying inside at these times makes it less likely you will be bitten. It's not a guarantee though – they are still around at other times.

Appendix

"Kick the bucket" - Empty standing water – cover an artificial breeding site. Remove any eggs, larvae and pupae in it from play. Mosquitoes can no longer use the site.
Mosquitoes lay their eggs in standing water. Without it, they can't reproduce. The fewer places they have to breed in, the fewer mosquitoes that can hatch, and the fewer mozzies you will see in a couple of weeks. They often don't travel far, so standing water near your home means mozzies near you.

Larvicide – Remove one active larva card from play
Poisoning the standing water with something that kills mosquito larvae can be very effective. If you empty other standing water and the only nearby source contains larvicide, all the eggs that are laid won't become adult mozzies.

Human testing – check the disease cards under one of the humans in play
Mosquito borne diseases are not passed from mozzie to mozzie. They have to come from somewhere, so it's important to know how many people are carrying these diseases too. If there are no human or animal carriers for the mozzies to feed on (a 'reservoir' population) then the mozzies won't pass it on.

Mosquito testing – look at the top three cards of the disease deck.
If we catch and test mosquitoes for the disease, we can estimate how many of the local mosquitoes are carriers of the diseases we are concerned about and plan what steps to take. Mosquito numbers are not always a match to the disease prevalence.

Event – rainfall – all artificial breeding sites are open and available again, place this card as an extra breeding site on the table.
Nothing creates standing water for mosquitoes to breed in better than some good rain. You can't just tip the standing water out once – you need to know where to look out for after it rains and keep those places empty.

Event – warm weather – all mosquito eggs/larva/pupa grow one stage
In warm weather mosquito eggs hatch and the larvae develop faster. This can lead to smaller mozzies overall, but much greater numbers.

Event – cold weather – no eggs or larvae may grow this turn
Cold weather is bad for mosquitoes, but eggs and larvae can 'wait' to hatch or develop for a couple of weeks until it becomes warmer. This can lead to them actually being bigger when they emerge as adults, as they have been growing and feeding for longer.

Event – outbreak – two disease cards are dealt with each mosquito feed this turn
This event models that there is not a perfect link between mosquito numbers and disease prevalence. In this case, more of the mosquito population is carrying the disease than usual, so mozzie bites carry a higher risk of infection.

Appendix

Event – Predator (bird) – remove one adult mosquito.
Birds, lizards and dragonflies eat mosquitoes! More of them means fewer mozzies.

Event - Predator (fish) – remove one larva or pupa card.
Larvae and pupae get eaten too; fish, large insects, even other insect larvae eat them in the water.

Event – Mutant mosquito – remove cards "Genetically modified male," "Genetic modification (disease resistance)" and "sterilised male" from any active mosquito.
We can make genetic changes to a population of mosquitoes, but those may well not be permanent. Not only can mosquitoes occasionally mutate, if we give the mozzies traits that make them less likely to thrive, those traits will just naturally die out. It's natural selection at work.

Event – mutant disease – remove the "vaccination" card from any human it is equipped to; it is no longer effective.
Diseases also mutate. Vaccines and medications that work on them now won't forever as they mutate and evolve.

Event – Et tu Brute? – remove an eggs or larvae card currently in play
There is a mosquito species whose larvae eat the larvae of other mosquitoes! Even better for us humans, these mozzies are not bloodsuckers when they grow up.

Why a chicken?

The disease deck has a chicken with a clipboard on it. Why? It's a "sentinel chicken!"

These diseases aren't only carried by humans, but also by animals. If we can track when our animals are infected, we can monitor diseases not just in our populations, but in all of these others that mozzies will also feed from. Keeping chickens outside and taking blood tests once a week can give us warning of likely disease outbreaks, as these infections will appear in the chickens before becoming widespread in people.

SCAN ME

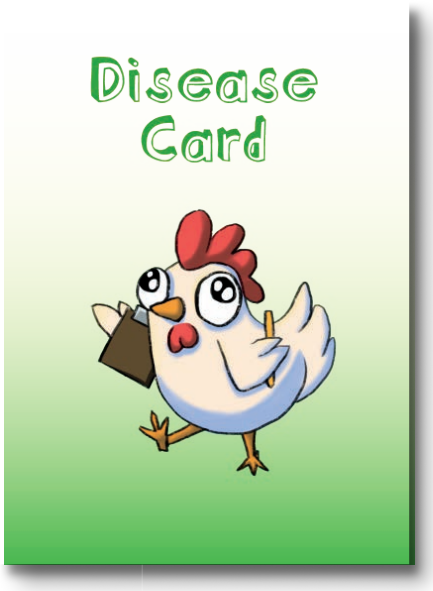
pathology.health.nsw.gov.au/articles/sentinel-chickens-provide-early-warning-on-deadly-diseases/

Appendix

Disease Card Facts

These are the facts written on the Mozzie Mayhem disease cards:

1. Malaria is not caused by a virus or a bacteria, but single cells much more like your own.
2. Malaria is the biggest mozzie borne disease in the world, but it isn't found in Australia.
3. The mosquito that carries Ross River virus was discovered in New Zealand but was then completely eradicated. There has never been a reported case of the disease there.
4. These diseases aren't only passed to and from humans. Animals, such as birds and pigs, are also bitten and infected by mosquitoes.
5. A Japanese Encephalitis outbreak in 2022 was traced to piggeries and wild pigs across Australia. Before then, it was thought to only be found in the Torres Strait regions and most northern Queensland.
6. The *Aedes aegypti* mosquito is a vector for 56 different diseases.
7. *A. aegypti* mosquitoes are found in Queensland but aren't native to Australia. Human beings have accidentally spread this mosquito from Africa all over the world.
8. The annual outbreaks of dengue fever in Queensland are always caused by people catching the disease abroad and it being spread by the mosquitoes that bite them in Australia.
9. Dengue fever is not spread outside of Queensland and the Torres Strait because the mosquitoes that can carry it do not live anywhere else in Australia.
10. Mosquitoes do not pass these human infecting diseases on to their eggs. Females pick them up in one bloodmeal and pass them on with another.
11. Someone caught dengue fever in Darwin in 2010, even though no dengue mosquitoes live there. A mosquito rode a plane from Indonesia and bit him at his workplace next to the airport.
12. Sentinel chickens, like the one on the reverse of this card, are chickens that are tested every week for mosquito borne diseases. They can give us early signs of an outbreak before it starts.
13. Chickens are estimated to be bitten up to 1000 times a day by mosquitoes. That makes them a good animal to test for what diseases are being carried by local mosquitoes.
14. Mosquitoes are an important part of wetlands ecosystems. Living near wetlands puts you more at risk of mozzie bites, and mosquito borne diseases.
15. There are more than 300 unique mosquito species in Australia, but only about 30 of them spread diseases.
16. Giving a mosquito the "Wolbachia" disease, which doesn't pass to humans or hurt us, actually makes them less likely to pass us other diseases.



GENERAL RISK ASSESSMENT
Managing Workplace Health and Safety Risks

Form WHS2

Workplace (Unit/Institute): **UniSA**

Useful links:
- WHS Procedure: Managing Workplace Health and Safety Risks
- Approved Code of Practice: How to Manage Work Health and Safety Risks

Local Assessment No:	Assessment Date:	Next Review Date: (3 years maximum)	**Sign-off:** *(by a person with safety responsibility for the risk being assessed)* **Name:** **Position:** **Date:**
IN/A	06/12/24	06 /12 /27	

What is being assessed?
Mozzie Monitors Lessons (plan on efa.unisa.edu.au)

People involved in the assessment
Joshua Ansell

Others consulted: *(eg safety consultant, manager or supervisor, elected health and safety representative, people familiar with the hazards, other personnel exposed to risks)*
Christie Byrne

Risk assessment				Risk control plan*			
Item	**Hazard description/ how exposed** (Refer Appendix 1)	**Risk control measure(s) in place** (If existing controls need improvement or new controls introduced, record under the Risk Control Plan columns)	**Current risk level (H/M/L/VL) with controls** (Refer App.2)	**Extra controls needed to reduce risks to low or very low** (The item should not be used or the process started until the remaining 'residual risk' is L or VL)	**Person responsible**	**Date extra controls to be done**	**Date extra controls completed**
1	Students will be in classrooms at their school, standard classroom hazards.	Relevant school safety procedures adhered to, including any COVID-19 processes, checking for electrical tagging on equipment etc.	VL				
2	General Classroom activities to complete	Students will have activities to complete using usual classroom resources (pens, paper, etc.). Standard school risk assessment applies.	VL				
3	Students will be required to use scissors and chenille sticks in Session 1.3	Students will be instructed on safe use of these items.	VL				
4	Students will play a board/card game in Session 2	Normal safety measures will cover these risks; only paper/card, some laminated, will be used.	VL				
5	Students will be part of creating and updating a wall display in Sessions 3&4, may require the use of a staple gun	If staples are to be used, only the teacher will operate the staple gun to secure paper to a display board	VL				
6	Students will be collecting and setting mosquito traps in small groups	Pesticide used is listed in documentation, along with full handling and chemical advice on the UniSA website. Teacher to review	VL				

		before use, and opt to do the spraying component themselves if student use is contraindicated for any reason (age, responsibility, broad concern, etc.). Student supervision during the activity follows school's own policy and staff's best judgement for the students involved. Instructions are given, practice provided and reinforcement of instructions given as needed. Trap instructions should be on display with the other workshop display materials. Students working outside take all usual outdoor precautions for sun safety, insect repellents, etc. Manual handling best practice to be observed for moving and setting traps					
7	If opting for no-kill trapping, mosquitoes will be kept, grown and released.	Mosquitoes are kept securely away from the possibility of tripping over or accidental release and checked on regularly. Staff take responsibility for release, doing so distant from educational settings, homes and densely populated areas. Releasing is conducted only when wearing mosquito repellent. Staff only opt for no kill option if necessary.	VL				

* may be left blank if the current risk level with existing controls in place ('residual risk') is low or very low.

Appendix 1 – Potential Hazards: Able to cause harm to people, property or the environment.					
General Work Environment		**Health and Security**		**Plant and equipment**	
Restricted access or egress	☐	Food	☐	Vehicles	☐
Confined spaces	☐	Poisoning or contamination	☐	Mobile and fixed plant	☐
Air-conditioning (thermal comfort)	☐	Communicable diseases	☐	Powered equipment	☐
Air quality	☐	Intoxication	☐	Non-powered equipment	☐
Lighting	☐	Dehydration	☐	Elevated Work Platforms	☐
Noise (discomfort)	☐	Violence or assault	☐	Pressure vessel	☐
Outdoors (sun exposure)	x OBJ ☐	Working alone or in isolation	☐	Laser (Class 2 or above)	☐
Uneven walking surfaces	☐	Working in remote areas	☐	Traffic control	☐
Working at height	☐	Bites / Stings	x OBJ ☐	Electrical	☐
Ergonomic/manual handling		**Chemical**		Vibration	☐
Workstation set up	☐	Hazardous chemicals	☐	Moving parts	☐
Poor posture	☐	Explosives	☐	Acoustic / Noise	☐
Lifting / Carrying	x	Engineered nanomaterials	☐	**Temperature / Weather effects**	
Pushing / Pulling	☐	Gas cylinders	☐	Heat	☐
Reaching/overstretching	☐	**Radiation**		Cold	☐
Repetitive movement	☐	Ionising radiation	☐	Rain / Flood	☐
Bending	☐	Ultraviolet (UV) radiation	☐	Wind	☐
Eye strain	☐	Radiofrequency/microwave	☐	In or on water	☐
Work design and management		Infrared radiation	☐	Pressure (Diving / Altitude)	☐
Fatigue	☐	**Biological**		Lightning	☐
Workload	☐	Microbiological	☒	Smoke	☐
Mental stress	☐	Animal tissue / Fluids	x OBJ OBJ	**OTHER**	
Organisational change	☐	Human tissue / Fluids	☐	Physical Cuts	☒
Work violence or bullying	☐	Allergenic	☐		☐
Inexperienced or new personnel	☐	Other Biological	☐		☐
Volunteer or work experience safety	☐		☐		☐
Children or U18 students	x OBJ ☒		☐		☐

Appendix 2 - Risk Assessment Matrix

	RISK SEVERITY/CONSEQUENCE			
LIKELIHOOD	**CRITICAL** *(may cause severe injury or fatality - more than two weeks lost time)*	**MAJOR** *(injury resulting in at least one day lost time)*	**MINOR** *(medical treatment injury - back to work)*	**NEGLIGIBLE** *(first aid treatment - no lost time)*
VERY LIKELY *(exposure happens frequently)*	**High**	**High**	**Medium**	**Medium**
LIKELY *(exposure but not frequently)*	**High**	**Medium**	**Medium**	**Low**
UNLIKELY *(exposure could happen but only rarely)*	**Medium**	**Medium**	**Low**	**Very low**
VERY UNLIKELY *(Exposure can happen but probably never will)*	**Medium**	**Low**	**Very low**	**Very low**

Based on SafeWork SA risk assessment matrix April 2015

Risk priority	Definitions of priority	Time frame
High	Situation critical, stop work immediately or consider cessation of work process. Must be fixed today, consider short term and/or long term actions.	**Now**
Medium	Is very important, must be fixed urgently, consider short term and/or long term actions.	**1 – 3 weeks**
Low	Is still important but can be dealt with through scheduled maintenance or similar type programming. However, if solution is quick and easy then fix it today.	**1 - 3 Months**
Very low	Review and/or manage by routine processes	**Not applicable**

Note: Once the WHS2 form has been completed you may delete the Appendices from the document if you wish.