

# FLYING FOXES

## Why are they important?

### Purpose and Structure of this Teaching Resource

Education plays a significant and unique role in constructing public understanding and opinion about Bats, as well as informing policy. Therefore, we developed this teaching resource to support educators who would like to introduce 'Bats' (Flying Foxes and Microbats) to their students while teaching required aspects of the Australian Curriculum. There are three Senior resources that offer teaching suggestions for embedding the teaching and learning about bats throughout the 11 and 12 curricula. These include: Supporting Native Animal Welfare; Flying Fox and Human Relationships; Flying Foxes and Why they are Important. Our goal is to assist you with teaching suggestions: linked to the Australian Curriculum; that provide background Scientific information; that offer activity specific teaching resources; and that present a vast array of web-links all relating to the teaching and learning of Bats.



As you will see in our *Notes for Teachers* (below), Flying Foxes are considered by scientists to be a keystone species (one of the most important species in an ecosystem), and yet in Australian culture, Flying Foxes [are misunderstood and vilified](#). Therefore, we developed these educational resources for Year 11 and 12 to promote scientific, as well as Health & Safety knowledge about Bats, and we invite students to challenge erroneous social stereotypes promoted in Australian media and wider society.

This educational resource is structured in the following way:

- An overview of each activity and their links to the Australian Curriculum (our curricular links are not definitive, as you may identify other Content Descriptors these activities are transferable to);
- Scientifically-based background *Notes for Teachers* about Flying Foxes and Microbats;
- A detailed outline of each activity that includes resources and discussion points to guide learning;
- An extensive online resource list; and Attachments of the printable resources suggested for the activities.

This teaching resource was developed by Australian teachers, for Australian teachers, and so we *do* understand that it can be difficult introducing controversial concepts into classrooms. We celebrate your commitment to ecological sustainability, and we stand beside you in your decision to advocate and education for change, not only for these important and wonderful mammals, but for wider Australian Ecosystem. Even though these teaching suggestions present factual information, we believe it is essential for students to emotionally connect with bats in order for them to be open to learning and making a difference. The following video illustrate how cute and wonderful Flying Foxes and Microbats are! We hope you enjoy this resource.



<https://www.youtube.com/watch?v=T84jdO8YrYA>  
<https://www.youtube.com/watch?v=Uuvaos1WHTk>  
<https://www.youtube.com/watch?v=T84jdO8YrYA>  
<https://www.youtube.com/watch?v=aMuWgN2DVD4>  
<https://www.youtube.com/watch?v=lo3yl0OhTSY>  
<https://www.youtube.com/watch?v=2GncgfPNNms>

This teaching resource was written by Dr. Ali Sammel ([a.sammel@griffith.edu.au](mailto:a.sammel@griffith.edu.au)) and Tara Hart. Please reference Dr Alison Sammel when using this material.

## Activity Summary

This concept-based teaching suggestion looks at the keystone species of Flying Foxes and is designed to enhance students' understanding of these protected native mammals.

These concept-based teaching suggestions are designed to help students learn about the role of the Flying Fox in our ecosystem through scientific, legal and statistical viewpoints. It provides the opportunity to deconstruct the concept of the Flying Fox as a 'socially or legally constructed' ecological risk.



Flying Foxes play such an essential role in ensuring we have healthy native forests that they are viewed as a [keystone species](#). A keystone species is a plant or animal that plays a crucial role in ecosystem functions. Without this keystone species, the ecosystem would be dramatically different or cease to exist altogether. Through these activities, students will develop an understanding of the role Flying Foxes play within Australian ecosystems.

### Activity 1 (suggested for Social & Community Studies)

Protecting the Flying Foxes and their welfare - whose responsibility is it? Through this lesson students investigate social responsibility in relation to environmental and animal protection as it pertains to Flying Foxes, through a community role play experience. To authentically create role-play characters, students engage in community-based research, to understand the perspectives of their representative character. They will need to work empathetically with different community sectors to achieve a resolution that provides legally required protections for the Flying Foxes whilst also meeting the needs of society.

### Activity 2 (suggested for Biology)

Students develop their understanding of the role of keystone species by exploring an endangered Flying Fox species and consider its impact on the forests of east coast Australia. In small groups, students research what makes the Flying Fox so important to the Australian ecosystem and present to the class their predictions of what the effect would be if these endangered animals were to become extinct.

### Activity 3 (suggested for General Maths)

Students learn about the importance of the Flying Fox and why the government collects data about their population numbers. Students determine their own investigative question about Flying Fox populations and through the information provided, table the data and draw conclusions.

## Australian Curriculum Senior Secondary Curriculum

These learning activities can be linked into the following subjects and units:

### Biology

- Year 11 Unit 1 - Biodiversity and the interconnectedness of life. Topic: Ecosystem Dynamics - Keystone Species and Conservation

### General Maths

- Year 12 Unit 1 - Bivariate data analysis. Topic 1. Review the statistical investigation process; for example, identifying a problem and posing a statistical question, collecting or obtaining data, analysing the data, interpreting and communicating the results.

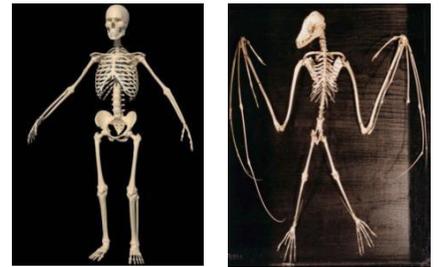
## Queensland QCAA Senior Secondary Curriculum

### Social & Community Studies

- Topic 3 - Active citizenship in the community ensures that a person contributes to the society in which they live. Empathy with different perspectives within various social contexts is developed by connectedness to the world and to others. Active citizenship sustains quality community life, from local to global contexts.

## Background notes for Teachers about Flying Foxes and Microbats

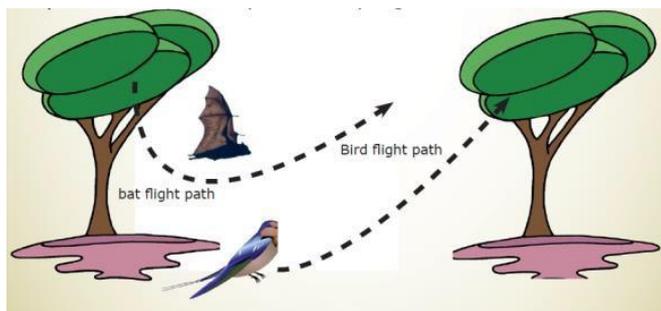
For far too long, bats have instilled fear and inspired bad omens in many cultures around the world. Vilified in the media, these deeply misunderstood and misrepresented creatures are incredibly unique animals that play a vital role in Australia's ecosystem. In a world where attitudes towards sustainability are continuously changing and evolving, it is vital that students of today move away from misinformed historical stereotypes in order to develop a strong understanding and appreciation for this amazing creature, the only mammal capable of sustained flight.



There are over 1000 different species of bats worldwide. Bats are classified into two major groups: Flying Foxes and Microbats. Both share many similarities with humans: they have a similar skeletal structure (they have elongated fingers, not wings that they fly with), are warm-blooded, give birth and suckle their young, are devoted and caring mothers and even leave their children (called pups) at 'childcare' as they go in search of food! Most species can only give birth to one pup per year. Infants are carried everywhere by their mothers and suckled for up to five months. Bats are not aggressive animals. Bats do not 'swoop' or 'attack'. If spooked, a bat will fly away but because they have hands and fingers rather than wings, they must drop or fall in order to catch the wind that will provide them with the lift necessary to sustain their flight.

Flying Foxes or Megabats, are the largest sized bats (they also used to be known as Fruit Bats, but Flying Fox is the term that is used today). A Flying Fox has extremely good eyesight (the same as ours during the day and 25% better at night) and hearing and use these, and their strong sense of smell, to navigate the world. They are not blind and do not use echolocation. Flying Foxes are a keystone species in Australia meaning they are one of the most vital animals in our ecosystem. Flying Foxes play a key role in ensuring we have healthy coastal forests. Australian native trees reproduce by releasing and accepting pollen for fertilisation. After a flower on a tree is fertilised via pollination, the new genetic materials combine to produce seeds that then need to be distributed to other locations, away from the parent trees. Flying Foxes play an essential role in these processes. Flying Foxes and our native forests have coevolved together for over 40 million years

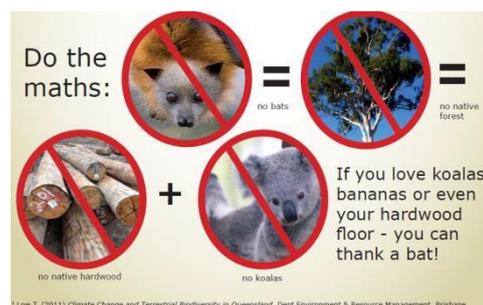
(yes, 40, 000, 000!), which means they have perfected the process of forest reproduction. Our native trees only release their flowers' pollen at night, specifically for the Flying Foxes to pick up. Flying Foxes have the exact soft belly fur needed to collect and carry as much pollen as possible while they fly from flower to flower. As the Flying Foxes move from flower to flower, drinking



nectar, they pass along the pollen they collect on their bellies. This process fertilises the plant's flowers. Bees also do this role: however, as pollination occurs at night, Flying Foxes are more effective. Furthermore, bees can only travel up to three kilometres and so cannot introduce new genetic material from other forest locations. A Flying Fox can travel over 100

kilometres per night and can fly from one forest to another, introducing new genetic material that will strengthen the resilience of the new generation of forests. Indeed, it is predicted that Australia's forests will only survive climate change due to Flying Foxes introducing new genetic material to the next generation of trees. For example, one forest might not like much water, and a bee will keep that gene pool the same, but a Flying Fox might fly from a forest that likes lots of water, 100 kilometres away, and introduce this new gene to the area. In doing so, the new generation of trees in that forest will be resilient to both drought or flood conditions.

Not only do Flying Foxes pollinate our native forests, they also eat the seeds from the fruit and disperse them to new areas so that the young trees can grow. Other animals do this, but a Flying Fox can digest the seed in a way that does not harm the seed, and when it is excreted, it can grow into a new plant. The process of chewing and digestion in other animals can ruin the seed, making the seed non-viable for growth. A Flying Fox can distribute up to 3000 seeds in a single night! Their role as a keystone species means that Australian tree species, all Australian mammals such as koalas who seek shelter and food in these trees, Australian fruit trees and the Australian hardwood industry are all reliant upon the existence of the Flying Fox. In this way, humans are also dependent on Flying Foxes via the forests they sustain, as the forests supply us with oxygen, food and resources.



The second category of bat in Australia is the Microbat. This small bat plays an equally important role in the Australian ecosystem. Unlike the Flying Fox, the Microbat has extremely bad eyesight and relies on echolocation for travel and food. Microbats are insectivorous and can catch up to 500 insects per hour. The Microbats' incredible ability to consume large numbers of insects such as mosquitoes and fruit flies means that life would be far less tolerable for both humans and plant species without them. It is interesting to know that Microbat boxes are being installed by universities, schools, farmers and the general public to reduce the use of pesticides within the environment and eradicate mosquito related diseases such as Ross-River fever.

Considering the key role both Flying Foxes and Microbats play in Australia's ecosystem, it is unfortunate that the biggest threats to the species are habitat loss and ignorance and misinformation leading to poor human perception. People usually hold the misconception that bats carry lots of diseases. This is untrue. Science shows that there is only ONE disease that a human

can catch from a bat: the Australian Bat Lyssavirus (ABLV). It is a form of rabies, but it is really, really rare. There have only been three reported cases in Australia. ABLV is very rare in the bat community, and most bats that contract this disease leave the colony and die within a few days. A person would have to be bitten by a bat within a small window of time (within those few days) to become infected. This is why the World Health Organisation considers it one of the rarest diseases on the planet! Contact with bat excrement, bat-eaten fruit, or having a bat fly above you will NOT transmit this disease. However, if bitten or scratched by ANY bat, all Australian government departments and bat groups strongly recommend people go to the hospital where they will receive a series of three post-bite injections (free of charge) that will ensure they do not get ABLV. There is no reason why any person should contract or die of ABLV as injections are available in Australia to stop this disease. If you do catch ABLV and do not receive the injections, you WILL die. It is important that students learn that if bitten or scratched by ANY animal, they must tell an adult, and if it is a bat, they should get the injections from the hospital. It would be interesting to look at the Australian Bureau of Statistics to see the statistics associated with animal related deaths. This investigation would highlight that horses, cows, dogs and cats are dramatically more likely to cause human deaths than bats are.

**The most important message that students need to learn is: never touch a sick or injured bat, tell an adult if you get bitten or scratched by a bat and if you find a bat, it is best to notify your local bat (or animal) rescue and conservation organisation.**

This summary was written by Dr. Ali Sammel. If you have any questions please email ([a.sammel@griffith.edu.au](mailto:a.sammel@griffith.edu.au)) and for more information please see the [Bats Queensland website](#).



## Activity 1 (suggested for Social & Community Studies)

This learning suggestion can be modified to fit within the learning requirements of the specific unit you are presently working on:

### Social & Community Studies

Core Topic 3 - Citizenship Skills.

Citizen skills is about receiving from, and contributing to, community. It covers skills relating to the student's role and active participation within community from local to global contexts. It allows students to achieve a broad understanding of, and empathy with, different perspectives and within various social contexts.

Through this lesson students investigate social responsibility in relation to environmental and animal protection as it pertains to Flying Foxes, through a community role play experience. Students will be asked to engage in community-based research to understand the perspectives of their representative character. This will mean seeking out and interviewing members of their community to understand authentic perspectives and general community knowledge and understanding about Flying Foxes. In the role play activity students will be asked to work empathetically with characters representing the different community sectors to achieve a resolution that provides legally required protections for the Flying Foxes whilst also meeting the needs of society.

1. Ask students to research why Scientists and Governments believe Flying Foxes are important to Australian ecosystems. For more information please see:

- <https://www.ehp.qld.gov.au/wildlife/livingwith/flyingfoxes/importance.html>
- <http://www.environment.gov.au/biodiversity/threatened/species/flying-fox-law>
- [http://www.nwc.org.au/wp-content/uploads/2016/12/Flying\\_Fox\\_Article\\_June2010.pdf](http://www.nwc.org.au/wp-content/uploads/2016/12/Flying_Fox_Article_June2010.pdf)
- <http://www.environment.nsw.gov.au/topics/animals-and-plants/native-animals/native-animal-facts/flying-foxes>

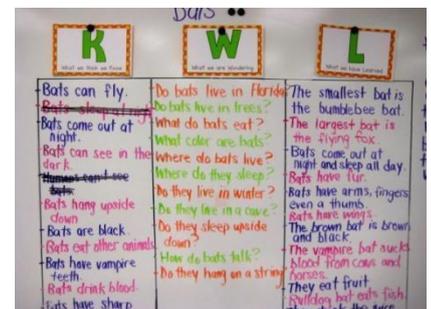
2. Introduce students to the plight of Flying Foxes through video explaining about the importance of Flying Foxes to the Australian eco-system: <http://sydneybats.org.au/education/bat-videos/no-tree-no-me/>

The information in Background Notes for Teachers will assist in talking with students about the importance of Microbats and Flying Foxes to our ecosystem.



2. Write this heading at the top of the board:  
**Protecting the Flying Fox: Whose responsibility is it?**

Create a [KWL chart](#) on the board to ascertain prior knowledge regarding Flying Foxes. A KWL is a graphic organiser divided into three columns, titled: Know, Want/Wonder and Learn. They letters KWL are an acronym for what the students already know, what they want to know (or wonder) and what they have learned. This is a link to a KWL chart [https://commons.wikimedia.org/wiki/File:KWL\\_Chart.jpg](https://commons.wikimedia.org/wiki/File:KWL_Chart.jpg).



The *Background Notes for Teachers*, above, will assist in understanding the facts pertaining to Flying Foxes.

3. Start a discussion with students about whether understanding different viewpoints helps with developing solutions to community issues - start with a concept that is familiar to them and then ask if this might also apply to other topics? Have students research about what has happened to Flying Fox populations over the past few decades and why research says this is a BIG problem for our native forests, other native species and industries that use our natural environment as a resource. To help start this exploration please see the resource list below. Once students understand the issues facing Flying Foxes in Australia and their ecological and economic importance, begin a preliminary discussion about who should protect Flying Foxes and why? Answers may include the Government, animal welfare organisations, businesses, community members or all individuals.
4. To delve into this discussion in more depth, the students will be asked to complete a community role play activity through which they determine who is responsible for the ongoing protection of Flying Foxes. The first step in this activity is to choose whose perspective they would like to research. After they have chosen, they will be asked to go into the community and speak to people in their chosen category to discuss this issue. Once they have completed this interview, they will then participate in a class role play in which students represent the various members of society in a discussion about the role of Flying Foxes, the protections they require and the way in which each community member can be involved. As a group they may answer the main discussion question: *who is responsible for the protection of Flying Foxes.*
5. The first step in this activity is for students to determine which role they will be playing in the final group discussion. Students are to use the 'Role Cards' (Attached Resource 1) to investigate a perspective on human interactions with Flying Foxes with the intention of coming together as a class in a 'Community Meeting' role play to discuss the plight of local Flying Foxes. Students should focus their character development on their community member's position on the management and protection of Flying Foxes. Potential roles may include young parents, Indigenous Australians, an elderly couple, Council worker, night shift worker, animal rights activist, scientist, day shift worker, farmer, driver (with vehicle), Councillor / Politician, public space cleaner. Assign 2 students to be the community representatives (speaker and scribe) who are responsible for running the discussion. Provide these students with the suggested statements and questions list (Attached Resource 2) to help the progression of the meeting.

***It is important to remind students that Flying Foxes are protected by law and that the Grey Headed Flying Fox is classified as a [Nationally Vulnerable species](#).***

6. The second step is to brainstorm how to contact the necessary people, how to develop respectful questions and accurately represent findings. Guiding questions may include:
  - Who are the local Indigenous Elders, and how do you contact them? What protocols do we need to know? Who can we ask for help?
  - If students do chose to contact their local Aboriginal Elders, invite them to read '*Respect for Elders and Culture*' to help them better understand how to respect cultural engagement and processes: <https://www.creativespirits.info/aboriginalculture/people/respect-for-elders-and-culture>
  - What are effective interview techniques? (some sites providing interview tips include: <https://www.forbes.com/sites/shelisaerl/2012/04/14/8-tips-on-conducting-great-interviews/2/> <https://www.articulatemarketing.com/blog/how-to-interview-someone>)
  - What do you want to know? Students need to be clear on the opinions and agenda of their character regarding the management and protection of Flying Foxes. Break this down into all the areas you think are relevant - remembering that you are both building a character and seeking to understand their thoughts regarding Flying Fox

preservation. Is there anything you should or should not ask? Think about how to make sure your questions are respectful?

- How should you best record the interview? Remember to ask permission and let someone know if you are videoing or voice recording them.
- How do you build a Character Profile from the information gained through community research? You may wish for the class to collaborate on the development of a character profile template to guide their inquiry.

7. In Step 3, students are allocated a period of time in which to research and interview the people in the community whom they represent in this activity. To assist students better understand the people they are to portray, they can collate the information to create a character profile - focusing primarily around this person's position on the management and protection of Flying Foxes. It should be noted (and discussed with the class) that a single person's views do not represent the totality of perspectives for that group - however, it should allow students to have a better understanding of the issues from this perspective. Students may choose to interview a few people to gain deeper insight. This is an example of one of the many character profile templates available online\_ <https://larawillard.com/2012/06/15/character-profile-worksheets/>.

8. In step 4, students undergo a role play activity through the platform of a community meeting to discuss the Flying Foxes living in their community. Set the classroom up as if they are in a community meeting and have them execute the role-play meeting with the Speaker and Scribe roles facilitating the community discussion. Emphasise beforehand that some of the members will hold different extreme viewpoints and suggest that they try to bring this to life as authentically and respectfully as possible. Before conducting this activity - it is important to go over some ground rules for respective meetings. See:

- <https://theparticipationcompany.com/2016/12/successful-town-hall-style-meeting/>
- <https://blog.polleverywhere.com/town-hall-meeting-format/>

Give students a 5-minute notification before the meeting is due to conclude and advise students, they are to find an answer to the question of *who is responsible for protecting the Flying Foxes*.

#### Resource list:

- The Greens Queensland - Flying Fox Policy <https://greens.org.au/policies/qld/flying-fox-policy>
- Local Government Association of Queensland - Flying Fox Management <https://lgaq.asn.au/flying-fox-management>
- Australian Government - Department of the Environment & Energy - Species Profile & Threats Database - Grey Headed Flying Fox [http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon\\_id=186](http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=186)
- In Defence of the Flying Fox <http://www.abc.net.au/catalyst/stories/3000668.htm>
- Pearson, T., 2013. TEDx Talk 'No Tree No Me' <http://sydneybats.org.au/education/bat-videos/no-tree-no-me/>

## Activity 2

This learning suggestion can be modified to fit within the learning requirements of the specific unit you are presently working on:

### Biology

Year 11 Unit 1: Biodiversity and the interconnectedness of life

Topic: Ecosystem Dynamics - Keystone Species and Conservation

This learning sequence is designed to demonstrate the importance of keystone species, in how they fill a critical role in ensuring the maintenance of the structure of the ecosystem in a way that is greater than would be expected based on their relative abundance or biomass (ACSBL024). It addresses the importance of our forests being genetically robust and able to survive a changing environment. Students demonstrate their learning at the end of this activity through a multi-modal presentation to the class.



How Wolves Change Rivers - YouTube  
YouTube - Sustainable Human

1. Engage students in a discussion about how a keystone species can impact the structure of their overall environment. As explained in the Background Notes for Teachers, the Flying Fox is a keystone species. Honey Possums, Hummingbirds, Beavers, Sharks and Grizzly Bears are some of the examples, explained in this link <https://greentumble.com/12-examples-of-keystone-species/>. Ask students to name some animals they believe to be keystone species. Show students the video, "How Wolves Change Rivers" <https://www.youtube.com/watch?v=ysa5OBhXz-Q>. Remind students whilst watching this video to pay close attention to all the changes they see occurring - in plants, animals and ecological infrastructure, as a consequence of the reintroduction of the wolf to Yellowstone National Park.
2. As a class discuss how the ecosystem changed because of the reintroduction of wolves into Yellowstone National Park. Ask students to consider the changes that may have occurred when they were originally removed from the park's environment.
3. Ask students to research Australian's keystone species, the Flying Fox. As a class discuss what this means (other references are listed at the end of this document).
  - <https://www.ehp.qld.gov.au/wildlife/livingwith/flyingfoxes/importance.html>
  - <http://www.environment.gov.au/biodiversity/threatened/species/flying-fox-law>
  - [http://www.nwc.org.au/wp-content/uploads/2016/12/Flying\\_Fox\\_Article\\_June2010.pdf](http://www.nwc.org.au/wp-content/uploads/2016/12/Flying_Fox_Article_June2010.pdf)
  - <http://www.environment.nsw.gov.au/topics/animals-and-plants/native-animals/native-animal-facts/flying-foxes>

The key point is: as long-distance pollinators of native trees, Flying Foxes cross-pollinate our native trees and therefore introduce genetic diversity into the next generation of plants. This may help native trees become more resilient to the changing water conditions that climate change will bring (please see the *Teacher Notes* above).



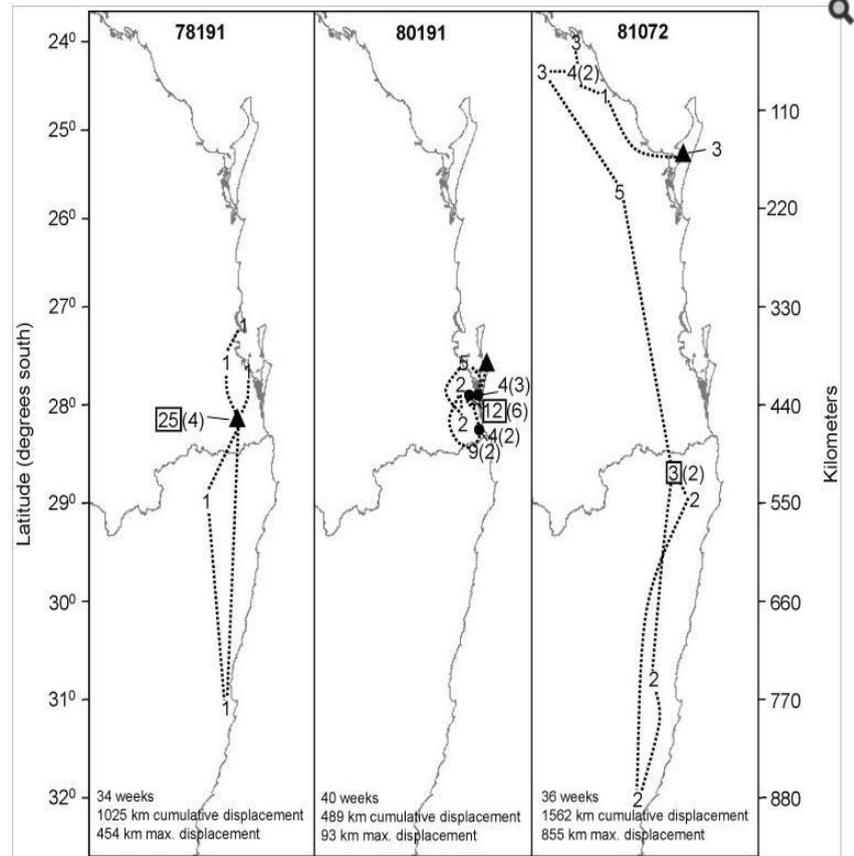
Flying Foxes travel significantly further than bees, with one tracked Grey-headed Flying Fox travelled 855 km over a 40-week period. Through this cross-pollination, the sexual reproduction of native forests experience mutations (adaptations), through [meiosis](#), that support [ecological sustainability](#).

- Ask students to hypothesise about what may occur if Flying Foxes were eliminated from the Australian ecosystem. In small groups, students research and predict what would happen to the Australian east coast if we were to lose the Flying Fox. You may choose to have the class collaborate to create a [flowchart as a reference](#), of the reaction that may occur - from the cross-pollination of tree species, to the forests reduced ability to cope with climate changes, and subsequent impact on fauna and the ecological infrastructure. If the trees are unable to develop resilience to a changing environment, what or who else will be impacted, and in what ways? Some suggested research sites are at the end of this document.

- Students can develop an understanding of the extensive distances covered by Flying Foxes through the Weekly movement patterns of 3 satellite-tracked *P. poliocephalus* from their points of capture.

*Triangles show the points of capture. Map shows the individuals' identification numbers (see [Table S1](#)), their roost locations at each week's start and the numbers of weeks spent at each roost (with number of separate visits if >1 in brackets); squares represents end points. For clarity, other roosts visited within-weeks are not shown. Summaries at bottom show number of transmission weeks, cumulative displacement and maximum displacement.*

Figure 3



Weekly movement patterns of 3 satellite-tracked *P. poliocephalus* from their points of capture.

(<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3411823/>).

- Using the information, they have obtained through their research, and through the whole class flowchart activity, students could communicate their learning through a 4-6 minute multimodal presentation to the class.

Some online resources include:

- Queensland Government, Department of Environment and Heritage Protection. Importance of Flying Foxes <https://www.ehp.qld.gov.au/wildlife/livingwith/flyingfoxes/importance.html>
- Victoria State Government, Environment, Land, Water and Planning. Flying Foxes. <https://www.wildlife.vic.gov.au/our-wildlife/flying-foxes>

### Activity 3

This learning suggestion can be modified to fit within the learning requirements of the specific unit you are presently working on:

#### General Maths

- Year 12 Unit 1 - Bivariate data analysis. Topic 1. Review the statistical investigation process; for example, identifying a problem and posing a statistical question, collecting or obtaining data, analysing the data, interpreting and communicating the results.

Students develop an investigative question based on information pertaining to the population of Flying Foxes in different regions of Queensland. They are to create a bar graph to make comparisons between different factors in response to their question.

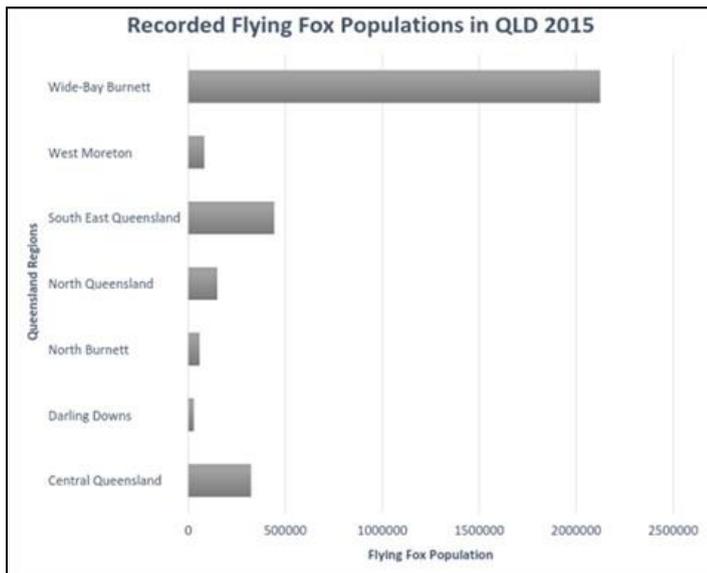
- Show students one of the following videos to generate understanding of the importance of the role of the Flying Fox (see *Background Notes for Teachers*).
  - 'No Tree, No Me' <http://sydneybats.org.au/education/bat-videos/no-tree-no-me/>
  - 'In Defence of the Flying Fox' <http://www.abc.net.au/catalyst/stories/3000668.htm>
- Once students understand the importance of Flying Foxes in an ecosystem, they are to explore if and why Flying Fox populations have decreased in the past few decades. Online resources include:
  - <http://wildlife.org.au/flying-foxes-in-decline-were-taking-action-september-2017/>
  - <http://publications.rzsnsw.org.au/doi/pdf/10.7882/AZ.1999.024?code=rzsw-site>
  - <http://www.animalsaustralia.org/issues/flying-foxes.php>
- The outcome of this research is for students to understand that one species of Flying Fox, the Grey Headed Flying Fox is now classified as a Nationally Vulnerable species. Government and research organisations are now monitoring Flying Fox populations to determine whether their numbers are increasing, stable or depleting. For more information please see <http://www.environment.gov.au/biodiversity/threatened/species/flying-fox-monitoring>



- Introduce the Flying Fox Monitoring Program to the students and have them choose one of the datasets to interpret and graph. The datasets cover 2003-15, January-March 2016 and April-June 2016. The datasets are displayed in tables and include information about the monitoring of Flying Foxes in Queensland, giving information about the location, date and population numbers. Students can compare the datasets for a certain location over time.

Name of local government	nameofcamp	latitude	longitude	date of survey	flying-fox absent (true/false)	total number of black flying-fox	total number of Grey-headed flying-fox	total number of Little red flying fox	Total number of all species
Redland	Birkdale, Birkdale Tip	-27.5112	153.2253	01-Apr-03	TRUE	0	0	0	0
Gold Coast	Broadbeach, Cascade Gardens	-28.0222	153.4277	01-Apr-03	FALSE	0	10	0	10
Moreton Bay	Burpengary	-27.152663	152.971398	01-Apr-03	FALSE				100
Ipswich	Camira, Pilney Reserve (Barbara Street)	-27.6315	152.9206	01-Apr-03	TRUE	0	0	0	0
Scenic Rim	Canungra, Beachmont Rd	-28.0398	153.1824	01-Apr-03	FALSE	0	700	0	700
Redland	Cleveland, Black Swamp	-27.5275	153.25804	01-Apr-03	FALSE	0	1200	6700	7900
Moreton Bay	Dayboro, Strong Road	-27.2069	152.8316	01-Apr-03	FALSE	0	4000	0	4000
Brisbane	East Brisbane, Norman Creek (Heath Park/Giffin Par	-27.484127	153.051947	01-Apr-03	FALSE		300		4000
Somerset	Esk	-27.2349	152.4233	01-Apr-03	TRUE	0	0	0	0
Gold Coast	Helensvale, Mildura Drive	-27.9012	153.3343	01-Apr-03	FALSE	0	5000	0	5000
Brisbane	Indooroopilly Island	-27.5157	152.9886	01-Apr-03	FALSE		1150		5000

- Students can access the Flying Fox Monitoring Program data and develop an investigative question that they will be able to respond to from the data collated from this program.
- The teacher can illustrate the multiple ways data can be displayed and each student can make a judgement on [how best to display their data](#) in order to answer their question. They



may create their graphs either manually or digitally through a spreadsheet program.

7. Students analyse the data in their graphs and draw a conclusion to their question from the data in their own graphs.

8. As a class they will then share their conclusions and discuss the similarities and differences between each student's interpretation of the data. If students have used different datasets for their bar graphs, discuss how this could change the interpretations drawn.

## Resources



- Long Distance and Frequent Movements of the Flying Fox *Pteropus poliocephalus*: Implications for Management <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3411823/>
- Exit Ticket: <http://www.theteachertoolkit.com/index.php/tool/exit-ticket>
- Flying Fox Monitoring Data 2003-15: <https://data.qld.gov.au/dataset/flying-fox-monitoring-program/resource/161f7356-4d58-42ea-a586-8f40fb029d42>
- Flying Fox Monitoring Data—January-March 2016: <https://data.qld.gov.au/dataset/flying-fox-monitoring-program/resource/10ef7011-d52b-499b-8803-dc086688a25f>
- Flying Fox Monitoring Data—April - June 2016: <https://data.qld.gov.au/dataset/flying-fox-monitoring-program/resource/eb97262a-73a0-4641-88a9-23e49bc5b92b>
- Flying Fox Monitoring Program: <https://data.qld.gov.au/dataset/flying-fox-monitoring-program>
- 'Flying foxes' Article: <http://bats.org.au/about-bats/flying-foxes.php>
- NSW Wildlife Council - Flying Foxes [http://www.nwc.org.au/wp-content/uploads/2016/12/Flying\\_Fox\\_Article\\_June2010.pdf](http://www.nwc.org.au/wp-content/uploads/2016/12/Flying_Fox_Article_June2010.pdf)
- Australian Government, Department of the Environment and Energy. Flying Fox law. <http://www.environment.gov.au/biodiversity/threatened/species/flying-fox-law>
- How Wolves Change Rivers" <https://www.youtube.com/watch?v=ysa5OBhXz-Q>
- Environment & Ecology. Sustainability <http://environment-ecology.com/what-is-sustainability/247-sustainability.html>



- No Tree No Me <http://sydneybats.org.au/education/bat-videos/no-tree-no-me/>
- 'In Defence of the Flying Fox' <http://www.abc.net.au/catalyst/stories/3000668.htm>
- 'How to make a common craft style video' Video: <https://www.youtube.com/watch?v=oCl1zoxs3Zo>
- The Amoeba Sisters, Meiosis <https://www.youtube.com/watch?v=VzDMG7ke69g>

## Attachments

ACTIVITY	RESOURCE	DETAILS
ALL	1	Flying Foxes - Australian Wildlife Society
ALL	2	Bat Conservation & Rescue Qld document, Flying Foxes
1	3	Community Discussion Role Cards
1	4	Community Discussion Guide sheet



Grey-headed flying-fox "belly dips" in the Parramatta River to cool and rehydrate itself on a scorching hot Sydney summer day. Photo: Nick Edrads ([www.enigmatech.com.au](http://www.enigmatech.com.au))

**Bats**

One quarter of all mammal species in the world are bats, which belong to the order Chiroptera, meaning 'hand-winged'. Bats can be divided into two suborders:

- Megabats (Megachiroptera), which includes flying-foxes, as well as the lesser known tubenosed bats and blossom bats.
- Microbats (Microchiroptera), which are smaller insectivorous bats.

Megabats differ greatly from microbats (see Table 1); their main similarities are that they are the only winged mammals and are primarily nocturnal.

**Flying-foxes**

Flying-foxes, otherwise known as fruit bats, are members of the Pteropodidae family. They have the largest body size of all bats, weighing up to one kilogram, with a wing span which may exceed one metre. There are eight known species of flying-fox in Australia, of which only four are relatively widespread on the Australian mainland. These are the black, the spectacled, the grey-headed and the little red flying-foxes. The first three of these have similar habits and lifestyle but are found in different

parts of Australia, their ranges partially overlapping. The little red flying-fox is smaller and gives birth at a different time to the others and tends to follow the flowering of the eucalypts inland, moving to the coast irregularly.

The grey-headed flying-fox (*Pteropus poliocephalus*) is the largest member of the family and is a native species that is endemic to Australia on the eastern sea board – southern Queensland, New South Wales and Victoria.

The beautiful spectacled flying-fox (*Pteropus conspicillatus*), which is only found in tropical rainforest areas in north-eastern Queensland, is also listed as vulnerable at the national level.

The black flying-fox (*Pteropus alecto*) was previously listed as vulnerable under New South Wales legislation, ranging across most of the coast of northern Australia, but was recently delisted due to increasing numbers in NSW. However, many believe that this is likely to be due to a range shift southwards, rather than a range expansion or any actual overall population increase.

The little red flying-fox (*Pteropus scapulatus*) is both more numerous and more nomadic than the other

three species. They roost much closer together in larger numbers and because of this often cause a lot of damage to vegetation where they decide to camp. This is one reason that they are so nomadic – if they were to stay too long in one place, the vegetation would struggle to recover, but if they keep moving regularly, the vegetation gets the chance to bounce back so that it is healthy again for the next time they might visit.

**Flying-fox diet**

Although flying-foxes are commonly known as fruit bats, their favourite food is actually the pollen and nectar of eucalypt blossoms, followed by other native hardwood blossoms, such as melaleuca (paperbark) and banksia, and rainforest fruits including lilly pillies and figs. Exotic fruits are generally not preferred, but often lack of preferred food sources will force flying-foxes into orchards and backyard fruit trees, where they face such dangers as shooters and loose netting.

This lack of preferred food sources is caused by two main factors. The first is the natural unreliability of flowering in the eucalypt forests. Nectar and pollen production varies considerably from year to year, with many species

flowering may be only every three to five years. Because different species flower at different times throughout the year, most flying-foxes have to travel great distances, often hundreds of kilometres, following large flowering events in order to find enough of this high-energy food to eat. The second problem is that many of the flying-foxes' native food sources, as well as already being naturally unreliable, have been cleared. Rainforests and eucalypt forests have largely been cleared for agricultural land, while paperbark swamps have more recently been targeted for the popular canal developments in Queensland. This goes a long way to explaining why many people mistakenly believe that flying-fox numbers are increasing.

Many people are experiencing a higher level of conflict with flying-foxes than they used to. With the increase in popularity of native garden plants, backyard fruit growing, and native street and park trees, flying-foxes are finding a lot more food in urban and residential areas. These food sources tend to be more reliable than those in native bushland because they are regularly watered and well cared for and, with a greater variety of species over a relatively small area, there is always something that is flowering or fruiting. Just like people, flying-foxes like to live close to a regular food and water supply; hence a lot more flying-foxes are now camping in areas where people live, work and play.

#### Flying-fox camps

The term *camp* (or *colony*) is generally used to refer to a site where flying-foxes roost, rather than to a group of a particular number of flying-foxes, eg the flying-foxes have a 'permanent' camp at Ku-ring-gai in North Sydney,



Female grey-headed flying-fox stretches in the sun as her young pup takes milk from the nipple under her wing. Photo: Nick Edards ([www.enigmatech.com.au](http://www.enigmatech.com.au))

which is occupied all year round. However, there are 'annual' camps that the flying-foxes use at the same time every year, and also 'irregular' camps that the flying-foxes may roost in occasionally if there is a nearby food source available at the time.

Flying-fox numbers in a camp increase and decrease throughout the year, depending on the availability of food. The flowering of many species occurs irregularly in different areas and at different times of the year, governed mainly by variations in weather. A camp may contain a few hundred to tens of thousands of flying-foxes (or even more in the case of little red flying-foxes). Sometimes the camp may be empty if food is not available nearby. Some of these camps have been in use for more than 100 years.

Occasionally a smaller group may roost in a location for a short period, but these small groups will usually either attract more flying-foxes to the site, or will move on to join other larger flying-fox camps. Flying-foxes are very sociable and, because they are so focused on finding food in many different locations at night, they use

**Table 1. Summary of general differences between megabats and microbats**

	Megabats	Microbats
<b>No. of species</b>	170 species worldwide 12 Australian species	760 species worldwide 64 Australian species
<b>Size</b>	Large: wingspans about 1 metre	Small: wingspans about 25centimetres
<b>Diet</b>	Nectar, pollen and fruit	Insects
<b>Navigation</b>	Sight and Smell	Echo location*
<b>Roost location</b>	Hang from tree branches	In caves, roof cavities, under bridges, in tree hollows, under bark, etc.
<b>Winter habits</b>	Travel to locations where food is more abundant	Hibernate until insects become more abundant

\* Echo location involves emitting high-frequency sounds that bounce off objects to allow the bats to find their way around in pitch darkness.

'camps' for social contact (as well as for rest) when they are all together during the day.

Flying-foxes sleep during the day and feed on pollen, nectar and fruit at night. At dusk, flying-foxes depart from their camps to feed on various local food resources. As dawn approaches, some flying-foxes gradually start to return to the camp from which they came, whereas others may fly to another nearby camp to rest for the day. This means that camps have constant turn over of individuals – there are different flying-foxes there every day.

Camps tend to occur in relatively sheltered areas with tall trees, often in gullies and commonly near some form of water. To drink, flying-foxes swoop down to the water, dip their belly fur in, then land in a tree and lick the water from their fur. Belly-dipping normally occurs in still fresh water, but it has also been occasionally observed in estuarine or even salty water. Flying-foxes also lick dew from leaves.

### Pollination

Most people do not realise just how essential flying-foxes are to the health of our native forests. Flying-foxes have adapted to an unreliable food resource by being nomadic. When a species of tree flowers well in a particular part of their range, tens of thousands of flying-foxes will congregate to feed on the blossom. Radio tracking of individual flying-foxes, combined with observations of population fluctuations at colony sites, has confirmed that



This female grey-headed flying-fox is tending her young pup which appears to be at most a week or so old. Photo: Nick Edards ([www.enigmatech.com.au](http://www.enigmatech.com.au))

individuals move many hundreds of kilometres to prolific flowering.

Flying-foxes are in fact our most effective seed dispersers and pollinators of our rainforests and

native hardwood forests (including native timber plantations). Unlike the birds and insects that are usually given all of the credit for this role, flying-foxes have the advantages of a large body size combined with a fur coat that allows much pollen to stick to and be transported potentially up to 100 kilometres in one night. Flying-foxes can also carry small seeds of rainforest fruits in their gut for up to an hour, by which time they may have flown 30 kilometres away from where the fruit was eaten. Other pollinators, such as birds, bees (including native stingless bees), moths, butterflies, wasps, flies, beetles, other small mammals such as gliders, and the wind, operate over much smaller areas.

By dispersing rainforest seeds over wide areas and across cleared ground, flying-foxes give seeds a chance to grow away from the parent plant, and potentially expand remnant patches of valuable rainforest vegetation. It is estimated that a single flying-fox can



Little red flying-fox. Photo: Lib Ruytenberg



A young black flying-fox (*Pteropus alecto*) roosting in a Sydney colony which is the far southern end of their range. Photo: Nick Edards ([www.enigmatech.com.au](http://www.enigmatech.com.au))

disperse up to 60,000 seeds in one night.

Through pollination and seed dispersal, flying-foxes help to provide habitat for other flora and fauna species and also help to sustain Australia's hardwood timber, honey and native plant industries. But to be effective in this role, flying-foxes need to be in large numbers.

#### Reproduction

It is sad how difficult it is to find an article or news item in the media about flying-foxes that does not use phrases

such as 'bats out of hell', 'disease risk' or 'plague proportions'. This kind of propaganda not only fosters unnecessary hatred of these beautiful, intelligent and social animals that form an essential part of our ecosystem, but it also gives momentum to lies that are circulated as truth.

Plagues occur when environmental conditions allow a localised 'explosion' of numbers of a particular species that has the ability to reproduce at a very rapid rate. For example, a single Australian plague locust can lay 100-200 eggs, and one breeding pair

of mice and their offspring has the potential to produce 500 mice in just 21 weeks. It is simply not possible for a flying-fox plague to occur – their slow rate of reproduction does not allow it.

Mating occurs between March and May and often results in excess noise in the camps as males mark a territory in a tree and defend it from other males. Females become pregnant in autumn (March–April) and, after a gestation period of about six months, give birth in spring (mainly October–November) to a single young (twins are rarely born, but often only one will survive).

As soon as the pup is born it begins to suckle from its mother. Its milk teeth curve backwards so that it can keep a firm hold. The mother protects her young with her wings during the daytime. At night when she flies to search for food the pup clings to its mother, with its mouth around the nipple and its claws in her fur. The pup is not able to maintain its own body temperature until it is 15–17 days old, so it stays close to its mother in the early weeks of its life. When the pup gets heavier and is able to thermoregulate, it is then left behind with a group of other pups in the colony at night while the mother goes out to feed. When the adults start returning to camp early the next morning, the mothers call out to their pups, and the pups call back. The mothers each recognise the voice of their own pup and this helps them to find their little pup among the branches and give it its morning feed. At this stage the pups are still unable to fly, and are dependent on their mother's milk. Unfortunately, these pups commonly become the unseen victims of orchardists that shoot their mothers who are desperately trying to find enough food near the camp that provides adequate nutrition to allow them to produce milk for their young at the same time of year as most orchards are producing fruit.

For this reason, the Queensland government recently banned the killing of flying-foxes as a method of fruit crop protection, but New South Wales has not yet followed suit and is still issuing licences to shoot flying-foxes, even those listed for protection under its own threatened species legislation. This is despite the fact that recent survey results indicate that shooting is, at best, around 60 percent effective as a crop protection



The wet belly of this grey-headed flying-fox means that she's just "belly dipped" in a nearby stream to cool and rehydrate herself.  
 Photo: Nick Edards ([www.enigmatech.com.au](http://www.enigmatech.com.au))

measure, while properly installed full-exclusion netting is 100 percent effective. The added advantage of installing such netting is that fruit damage by other animals, such as birds and possums, is also prevented at the same time. Financially, netting is a very good investment; many fruit growers have now recognised this and have netted their crops, but others will need financial assistance in order to get started. The Wildlife Preservation Society fully supports government subsidies for orchard netting.

If the flying-fox pups survive the fruit-growing season, they begin to practice flying within the camp at night around December, and by January are flying out with the adults to feed.

#### Threats

There are currently estimated to be less than 450,000 grey-headed flying-foxes in Australia. The species suffered a population decline of around 30 percent over the ten years between 1989 and 1999, which contributed to its listing as a threatened species under both federal and some state legislation. Scientists believe that at the current

rate of decline, grey-headed flying-foxes may be functionally extinct (as an effective pollinator and seed disperser) within 50 years and totally extinct within 70 years. It is believed that the main factor contributing to this decline is habitat loss (including loss of both roosting habitat and food trees), although shooting, electrocution, entanglements and severe heat events are also major contributors.

Predators known to eat flying-foxes include carpet pythons, goannas, sea-eagles and the powerful owl. Currawongs and ravens are known to attack flying-foxes found on their own in the daytime. These predators do not significantly reduce the overall flying-fox population. The most likely victims are the young, sick or old. Predators contribute to the health of a population by removing the least fit individuals.

Flying-foxes do not cope very well in extreme temperatures. Their ability to fly long distances means they can usually avoid the extremes of summer and winter by migrating. Although flying-foxes do have behavioural

mechanisms for cooling themselves down, severe heat events (eg where temperatures reach over 40°C for more than one day in a row) have been known to result in thousands of flying-foxes dying of heat stress. This can be exacerbated if circumstances (such as scarce food or forced relocation) have forced flying-foxes to camp in a site that may have less than adequate shelter. At the other end of the scale, black flying-foxes that used to be found primarily in northern Australia, but are now shifting southwards, are used to warmer temperatures. As far south as Sydney, individuals have been sighted with frostbitten ears, and some seem to have died from these cooler temperatures.

Parasites and diseases tend to affect flying-foxes more greatly when the population is under stress (by lack of food, camp disturbance, etc). The Australian bat lyssavirus is one disease that is fatal to them, though it is quite uncommon. But when the immune system is low, flying-foxes are more susceptible, so that parasites that have adapted to living in the flying-fox

population without causing undue illness suddenly start to make their hosts sick. Some of these issues have slightly more complex reasons for occurring, such as the tick poisoning in Queensland that you can read about in Steve Amesbury's article 'With wings on their fingers' on page 15.

Flying-foxes have a very short intestine and absorb their mostly liquid diet very rapidly. The average time from mouth to anus (doing a poo) is about twenty minutes, although some material takes up to an hour to digest. This is important for seed dispersal because the small seeds contained in the faeces (poo) fall and germinate in new areas where they grow into new trees and vines.

In the past, some fruit-growers have used electric grids to electrocute flying-foxes attempting to eat their fruit - these are now illegal. Now electrocution is mainly caused by overhead powerlines, killing flying-foxes if they touch two wires at the same time. If the animal happens to be a mother carrying a pup, the pup often survives the shock only to die a slow death of dehydration.

Entanglements are another problem that is happening more and more as starving flying-foxes searching for food come closer to humans. In rural and industrial areas, barbed wire is common, and where it is installed in close proximity to flying-fox food trees is where the most flying-foxes get entangled in it. The wing of a flying-fox is essentially like a large, elongated hand with a thin, stretchy webbing that joins the fingers. If a small amount of damage occurs to the webbing, then it can heal, but if large holes are torn or if severe damage occurs to the bones or ligaments that support the wings, then it is very unlikely that the animal will ever fly again - which is a death sentence for a flying-fox. Other animals, such as gliders, suffer horrific injuries from barbed wire. Studies show that 86 percent of wildlife entanglements occur on the top strand of wire, so if not all of the barbed wire can be replaced with wildlife-friendly fencing (see [www.wildlifefriendlyfencing.com](http://www.wildlifefriendlyfencing.com)), then even replacing just the top strand with plain wire would make a lot of difference.

In residential areas, the more common entanglement problem is backyard fruit tree netting. If white knitted

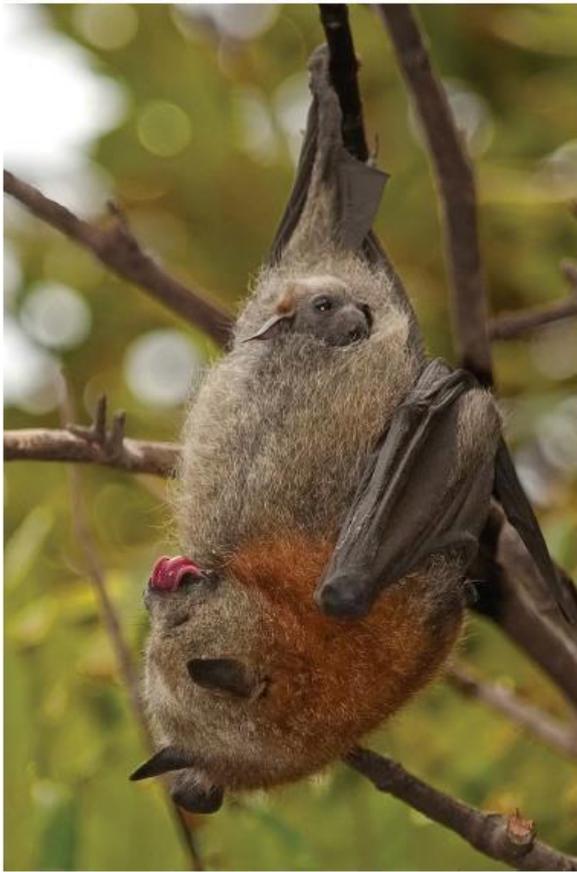
netting is installed correctly and pulled taut over a frame, then both wildlife and fruit can be kept safe. But unfortunately, many people are unaware that the cheap black monofilament netting that they buy from the local shop with few (if any) instructions is essentially a death trap for not only flying-foxes, but also other wildlife such as birds, possums, lizards and snakes. The trap works by providing an attractive lure (the fruit or the insects attracted to the fruit), with a type of net that cannot be easily seen but does easily entangle anything that tries to get to the tree, the monofilament strands painfully cutting into the skin of the animal as it struggles to get out. These animals often die of dehydration, or if they are rescued in time, may still die from the severe wounds that can result from their struggles. And of course during

summer there is always the possibility that these are mothers with young pups waiting for them back at the camp.

With the increasing tendency for flying-foxes to find reliable food and water near people, there is increasing pressure from humans who sadly do not want to share their lives with flying-foxes. Camps can be noisy (particularly when the bats are mating or disturbed) and do have a distinctive smell that is not to everyone's taste. For this reason, many people object to camps being set up near their homes. Other people don't like flying-foxes because of the mess they make when feeding, or simply because they have been taught through folklore, media propaganda and rumours that flying-foxes are scary, diseased, ugly animals. If only they knew



Spectacled flying-fox and baby. Photo: Hailey Design



Grey-headed flying fox giving birth. Photo: Nick Edards ([www.enigmatech.com.au](http://www.enigmatech.com.au))

the truth! Unfortunately, too many people know very little about bats, and what they think they know is often misinformed. There is intense pressure on governments to relocate 'problem' flying-fox camps, but flying-fox advocates fear that there are so few 'acceptable' places for them to go, that they may end up being chased all over the countryside to no avail. Relocations are rarely successful, and often end up causing bigger problems than they solve. However, in the past, where governments resist communities wishing to move the bats on, colonies have occasionally been illegally disturbed, physically

attacked, or even bulldozed by communities taking matters into their own hands. It is so important that people are taught how to live with and appreciate flying-foxes.

#### Living with flying-foxes

Regardless of what many people would have you believe, it is possible for people and flying-foxes to live harmoniously side-by-side, if only the people are willing. The first step is to learn more about flying-foxes – facts not rumours. The more you understand about an animal, the more you can come to appreciate it. And whatever you learn, teach it to

others – because the more everyone understands what the cause of these issues really are, the closer we will get to finding real solutions.

If you live near a flying-fox camp and the noise is bothering you during the day, first of all look at why they are noisy. Are people disturbing them? Maybe some community education is needed to help the flying-foxes get undisturbed sleep (and hence reduce disturbance to the community). Is it mating season? Maybe you could plan some extra day trips during the season to avoid being around the noise. Or you could even get yourself some binoculars and find a good vantage point to watch the camp. You may actually find enjoyment in watching their social antics, and may even find that the noise doesn't bother you so much anymore (people learn to ignore and even enjoy many bird noises – why not flying-foxes?). But if all else fails, maybe soundproofing your home might be the way to go.

If flying-foxes are visiting your yard at night to feed in your trees, be proud that your garden is providing much-needed food for a species that is so important to our unique Australian environment. However, if they are feeding on the fruit of coconuts palms, we recommend removing these palms, as the unripe fruits are toxic to the bats. If the flying-foxes (or other wildlife) are feeding on your fruit trees, you can either place paper bags over the low-hanging fruit that you wish to eat, or, if you don't want to share, place a sturdy frame over the whole tree and stretch a white knitted bird net (or wire mesh) over the frame and secure it to the ground to exclude animals from accessing the tree without entangling them.

If the noise of flying-foxes feeding at night is keeping you awake, remember that they will only be there for as long as that particular tree is flowering or fruiting and then they will move on to another food source. Ear plugs can be effective to get through that short period. Or if you have trees close by that are being visited more regularly by flying-foxes, you might also want to consider investing in soundproofing. Alternatively, if the tree is particularly close to your bedroom window, maybe pruning some branches back away from the window would help to reduce the noise.

Flying-foxes have a very fast metabolism. Food travels through their gut completely in about 20–60 minutes. For this reason, most of the mess is made by flying-foxes at night where they feed. If you have flying-foxes feeding around your home at night, we suggest bringing in your washing before going to bed and parking your car in a carport or garage, or using a car cover. If you do get 'mess' on your car, it should lift off with a wet rag. Although there is no known risk of disease transmission through flying-fox urine or faeces, in cases where flying-foxes leave behind a mess on your property, basic hygiene and cleaning practices are recommended, eg washing any outdoor food preparation surfaces with an appropriate cleaning solution, and cleaning with water any walking surfaces that may present a slip hazard.

Like all other animals, including humans, bats can be hosts to viruses and parasites. However, there are only two diseases known to be carried by flying-foxes that have ever been contracted by humans:

- **Australian bat lyssavirus (ABL)** is a rabies-like virus that has been identified in flying-foxes and microbats. Only two people have ever contracted the disease – one from a flying-fox and one from a microbat. Research indicates that less than one percent of wild flying-foxes carry the virus which is transmitted by a bite or severe scratch from an infected bat. The virus is fatal to both flying-foxes and humans, so it is important to never handle bats unless you are appropriately trained and have up-to-date rabies vaccinations. However, it is important to remember that this is not an easy disease to contract – it requires blood-saliva contact. Since we started using rabies vaccinations (including post-exposure shots) against this disease, not a single person has contracted it.
- **Hendra virus** (previously equine morbilli virus) has been detected in flying-foxes in the form of a respiratory disease (similar to a cold or influenza virus). This disease can also be contracted by horses, where the virus becomes dangerous and often fatal to

the horse. In recent years there have been a few human deaths associated with the handling of horses infected with this disease. But as people are becoming more aware of the disease, more precautions are being taken in the handling of sick horses. There is a belief that the Hendra virus is transmitted to horses through flying-foxes urinating in horse feed – although conclusive evidence for this or any other method of transmission of the disease to horses is yet to be established. No human has ever caught the Hendra virus from a flying-fox.

- **Histoplasmosis**, a respiratory illness, may be contracted by breathing in the fungal spores found in some bird and microbat cave roosts, where there is high humidity and these organisms breed in the guano (droppings). Avoid breathing dust in caves where microbats or swifts roost. This disease has nothing to do with flying-foxes.

If you find a bat that is sick or injured, do not touch it, but contact your local wildlife rescue organisation immediately. If the bat is on the ground, place a washing basket or similar over it and wait with it until the rescuer arrives, taking care to shield it from the sun and following any other instructions given to you by the rescuer.

Flying-foxes that are found anywhere within human reach almost certainly will have something wrong with them and will be in need of rescue,

examination and probably care. Be aware that bats are not able to flap their wings and fly off the ground like birds. They need to gain some height before they can get wind under their wings in order to take off. People that have been in the vicinity when a bat has crash-landed near them may have mistakenly thought that the bat was trying to attack them: the bat crawls along the ground towards the nearest tall object, (in this case the person) and then attempts to climb up it. On rare occasions, bats (usually juveniles that have not yet perfected their flying skills) have crash-landed directly into people. On the off-chance that this ever happens to you, the best way to avoid being injured is to stay still and let the flying-fox get its bearings and maybe climb a little higher so that it can take off again. After such a traumatic experience it will certainly want to be getting out of there as quickly as possible. Trying to shake off or otherwise manhandle a frightened bat is a sure-fire way of getting scratched or bitten, or both.

If bitten or scratched by a bat, wash the wound thoroughly with soap and water for five minutes and apply an antiseptic solution. See a doctor as soon as possible to care for the wound and to assess whether you might require a post-exposure rabies vaccination (these are the same shots given to people who are bitten by monkeys overseas). People such as vets, wildlife researchers, educators or carers who handle bats should be up-to-date with their pre-exposure rabies vaccinations in order to protect themselves against ABL.

## What can you do to conserve the flying-fox?

The two most important things you can do to help conserve the flying-fox and help reduce their apparent need for taking refuge in urban and suburban areas (where food is reliable but conflict is common) are:

- Support all efforts to protect and regenerate large areas of forests, woodlands and mangroves, including a mosaic of diet species, across the landscape in order to provide food and shelter throughout the year.
- Tell others the truth about flying-foxes to help dispel the common myths and to encourage appreciation of these wonderful animals and teach people how to live harmoniously with them.



Above: A heavily pregnant grey-headed flying-fox and sleepy "friend" in one of the Sydney colonies.

Photo by Nick Edards/Enigmatech. For more photos of flying-foxes visit Nick's website at [www.enigmatech.com.au](http://www.enigmatech.com.au)



Left: This photo was taken a short while later of the same flying-fox with her new baby.



Pregnant grey-headed flying-fox enjoys the spring sun in a Sydney flying-fox camp. Photo: Nick Edards ([www.enigmatech.com.au](http://www.enigmatech.com.au))



Spectacled flying-fox (*Pteropus conspicillatus*). Photo: Halley Design



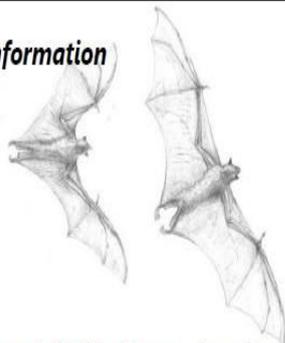
Little red flying-fox. Photo: Halley Design



Although still dependant on its' mother for nutrition, this young grey-headed flying-fox is starting to take a lot of interest in its' surroundings. Photo: Nick Edards ([www.enigmatech.com.au](http://www.enigmatech.com.au))

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### General Information



Flying-foxes (also called fruit bats) are members of a large group of mammals called BATS. They are the only group of mammals capable of sustained flight. There are four recognized species on mainland Australia: little red, grey-headed, black and spectacled. They have a very keen sense of smell and good eyesight, both of which are needed to locate their food during the night. Flying-foxes are a protected native Australian species. They are usually found in coastal areas of Melaleuca and Casuarina swamps, mangroves, heaths, dry and wet eucalypt forests, woodlands and rainforests. The little red flying fox can also be found further inland in arid and semi-arid areas.

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### Family life

Flying-foxes only have one live young per year. The little red gives birth around April/May whilst the remaining three species give birth around October/November. The young are carried by their mother for 4-5 weeks until they are fully furred. They begin to fly at about 8-10 weeks and feed by themselves at 12 weeks.



After 4-5 weeks the young are left in trees with other young whilst the mother goes at night to search for food. Females start breeding when they are 2-3 years of age. Males form either paired or harem groups during the mating season. It is during this season that flying foxes tend to be the noisiest due to the defending of territories. It is also during this time that the campsite appears to emit the strongest odour due to secretions from the male scent glands.

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### Campsites

Campsites are very important to the survival of flying-foxes, as this is where they are born, grow, form relationships and learn to survive. Campsites may be permanently or temporarily occupied throughout the year depending on the season and availability of food. Flying-foxes only have one live young per year. The little red gives birth around April/May whilst the remaining three species give birth around October/November. The size of the campsite may also vary during the year, increasing when there is a good food source around or when mothers arrive to give birth to their young. Numbers may also increase if there is little food elsewhere or another campsite has been disturbed or destroyed. A decrease in numbers usually indicates poor food in the area or disturbance of campsite.



Flying-foxes need campsites made up of large areas so that they can circulate with the site according to the defoliation of the trees in which they roost. Currently many sites sustain more damage due to the small areas that the flying-foxes are now confined to and due to their staying longer because of lack of food elsewhere or due to the extensive distances that now exist between campsites. Campsites are usually located on rivers, creeks or near large bodies of water, which provide both fresh water, and a navigation device when coming home at night.



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### Feeding Habits

Flying-foxes are very fond of the nectar, pollen and fruit of native Australian forest trees such as eucalypts, *Melaleuca*, *Banksia*, Lily pilly and Moreton bay figs. Although they do consume cultivated fruit such as peaches, mangoes and pawpaw, they only do so when their native food is scarce.

Flying-foxes generally migrate from one area to another depending on the amount of food available. Unfortunately, with land clearing for agriculture and urban development, flying-foxes have very few areas in which they can migrate to once flowering/fruitletting ceases in another area and so find it necessary for them to sometimes eat cultivated fruit.

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## **Role in our Environment**

The food that flying-foxes eat and the method by which they forage and process that food has led to the flying-fox being one of the most efficient pollinators and seed dispersers of native Australian forest trees. As they move amongst the flowers of Eucalypts or *Melaleuca* searching for nectar, large amounts of pollen attach to their fur. When they fly to the next tree, which may be several kilometers away, this pollen is deposited on the stigma of awaiting flowers. Such transport of pollen is very important for trees such as eucalypts as they rely on cross-pollination, i.e. pollen coming in from other trees which are a substantial distance away. In the case of seed dispersal, many seeds will not grow unless they are a certain distance away from the parent tree. Flying-foxes carry out seed dispersal by one of three methods: 1) carrying the fruit away and dropping it accidentally, 2) carrying the fruit away, eating the flesh and spitting out the seeds and 3) consuming the fruit and seeds but passing the seeds through the gut. Flying-foxes have a very short digestive tract, thus seeds swallowed are not digested but pass through the gut within 12-34 minutes.

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**Know the risk – not so deadly** Bats are very clean animals and spend hours grooming and cleaning themselves. They are not associated with many diseases as they spend their lives in the tree tops, not scavenging on the ground. **Australian Bat Lyssavirus** has to be the rarest fatal disease in the world having killed only 2 people in history, one from a Yellow Bellied Sheath-tailed (a microbat) and one from a flying-fox. Since 1998 no one has died as there is a protective vaccine if anyone is bitten. The message is do not handle them

Handle bats. Only a small proportion of the bat population may have the virus. Since routine vaccinations of humans who are bitten or scratched, no one has died.

**Hendra virus** is not contagious from bat to human; it requires a mediator, such as horses in the case of the Australian incidents. More research needs to be done as the suspected transmission mode from bats to horses is still unknown.

**What can you do?** If you do find a bat alone during the day, this is not normal, it needs help, whether it is a flying-fox or a microbat, **do not pick it up, like any wild animal it may bite when frightened or injured.**

**Please – do not handle bats – seek help** immediately call Bat Conservation & Rescue Qld. Do not risk infection to yourself by being bitten this means the death of the bat for testing. If bitten or scratched, wash the area immediately and thoroughly with soap and warm water for 10 minutes, seek medical attention as soon as possible.

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## **Conservation**

Flying-fox numbers have decreased dramatically over the last 50 years due to a continual loss of habitat and changing climatic patterns. Recovery teams have now been formed for both the Grey-headed and the Spectacled flying-fox in an attempt to bring their numbers back from dangerous levels. These teams are headed by the Queensland Environmental Protection Agency, New South Wales Department of Environment and Conservation, and the Department of Environment and Heritage.



Information by Dr. Patrina Birt  
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**Bat Conservation & Rescue Qld Inc.**  
**Rescue line: 0488 228 134**  
**.Rescue.Education.Conservation.Habitat.**

All donations \$2.00 and over are Tax Deductible

### Resource 3

Role Cards Template [x3] (Matfin, 2017)

Name:	Age:	Gender:	Family:
Role in Community:			
Issue Effects:			
Top Concerns:			
Position on Bats Management:			

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<http://bats.org.au/uploads/about-bats/foxes/resources/Patrina.pdf>

**Speaker Role Breakdown**

**Beginning:** Gather the attention of community members and suggest they sit in preparation for the meeting.

1. Explain that that they are here today to discuss the current nesting of Flying Foxes in the area.
2. Indicate that the wellbeing of both humans and bats are of priority and that the meeting is being held to discuss the issue and propose ways to manage it that suits all parties.
3. Explain that all are welcome to share their views, experiences, and ideas.
4. The goal is that by the end of the meeting they would have a number of mutually agreed on actions that the community and councils can realistically take to minimise any disadvantages or woes that are triggered from the increased numbers of bats whilst ensuring the preservation of these **endangered and protected keystone species**.
5. Ask if anyone would like to start off with something they want to share (if not, move forward and ask questions below).

**Middle:** Follow the discussion and respond as best you can. Use the questions in the table to help you interact with the other community members. Modify the questions as you see fit.

WHO...	WHAT...	WHEN...
<ul style="list-style-type: none"> <li>• Is being affected by the presence of the bats?</li> <li>• Thinks they have a solution?</li> <li>• Believes that we must remove the bats? Why?</li> <li>• Agrees/disagrees?</li> </ul>	<ul style="list-style-type: none"> <li>Is the impact of this issue?</li> <li>Would this cost?</li> <li>Solutions have worked in other communities?</li> <li>Problems/dangers can this reap?</li> </ul>	<ul style="list-style-type: none"> <li>Do they affect you the most?</li> <li>Should we implement this strategy?</li> <li>When will the bats likely leave?</li> </ul>
WHERE...	WHY...	HOW...
<ul style="list-style-type: none"> <li>• Are they affecting the community? Can we target that area?</li> <li>• Can we gather the funds to implement this solution?</li> <li>• Are some resources that already exist that we can use to our advantage?</li> </ul>	<ul style="list-style-type: none"> <li>Is this an issue for you/your family?</li> <li>Is this not a good solution?</li> <li>Is it important for us to take the bat's rights into consideration?</li> </ul>	<ul style="list-style-type: none"> <li>• Can we work together and use our resources to take action?</li> <li>• Does this impact you?</li> <li>• Does your solution that works for you impact the other community members?</li> <li>• Have other solutions resulted?</li> </ul>

**Close:** Based on discussion and recordings on whiteboard (by scribe), identify 2-3 solutions and call a vote (with a raise of hands). Once the solution/s have been picked, identify who will be involved with its execution and where the funding will come from.

**End** by thanking everyone for attending and that you look forward to the solution/s being put into action

Image sources:

<http://www.whitewolfpack.com/2016/11/dedication-and-nice-warm-blanket.html>

<https://www.islandconservation.org/flying-foxes-need-conservation/>