ANIMAL WELFARE IMPLICATIONS OF FLYING-FOX CONTROL IN ORCHARDS BY SHOOTING

A response to questions by the Animal Welfare Advisory Committee

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The four species of flying-foxes shot in orchards in Queensland: Spectacled, Grey-headed, Black and Little red flying-foxes (photographs by Halley Design)

INTRODUCTION

In this document I provide responses to questions asked by the Queensland Animal Welfare Advisory Committee, April 2007, to assist in their investigation of the welfare implications of shooting flying-foxes for fruit crop protection.

Four species of flying-foxes (pictured on previous page) are shot under permit in commercial orchards in Queensland:

- Spectacled flying-foxes (*Pteropus conspicillatus*), listed as vulnerable under the federal *Environmental Protection and Biodiversity Conservation Act* 1999— in orchards from north of about Ingham;
- Grey-headed flying-foxes (*P. poliocephalus*), also listed as vulnerable—in orchards from south of about Maryborough;
- Black flying-foxes (*P. alecto*)—in most coastal fruit-growing districts; and
- Little red flying-foxes (*P. scapulatus*)—less commonly, in most fruit-growing districts.

Ever since European colonists planted fruit crops in Australia, there have been complaints about flying-foxes decimating fruit crops. This is not surprising, as orchards represent a concentrated and accessible source of food for flying-foxes, rendered even more attractive as a large proportion of their native food trees have been cleared. Flying-foxes would not distinguish between native and exotic foods. Furthermore, many of the Asian wild progenitors of fruit crops would naturally be eaten by flying-foxes.

The current 'killing' approach to crop protection in Australia has a long history. In 1929, biologist Francis Ratcliffe was brought from England to investigate the 'flying-fox problem'. He noted in his report after a 2-year investigation that the object of most orchardists suffering damage from flying-foxes was for the most part "to kill as many flying foxes as possible", and.he documented the variety of ways by which destruction of flying-foxes was attempted[1]:

- Shooting, which he deemed "expensive and ineffective"
- Strychnine poisoning in orchards – "partially successful"
- Poison gases (chlorine, hydrogen cyanide) in flying-fox camps – ineffective
- Introduction of an infectious disease – unsuccessful
- Flame guns – "distinctly promising" - "might conceivably be worth considering as a practical means of dealing with the flying fox, if it were not to be rejected at once on the score of cruelty"
- Explosives – "complete failures"

However, he concluded that the "assumption that the flying fox is a menace to the commercial fruit industry of Australia is quite definitely false, and cannot be cited as a valid reason for the expenditure of public money on its control."

Despite finding that numbers of flying-foxes had considerably declined since European settlement, Ratcliffe documented some very large camps of flying-foxes, numbering in the hundreds of thousands to millions. The decline he noted 75 years ago has continued to this day, to the extent that two species are now listed as federally threatened species, and most camps are much much smaller.

The decline in flying-fox populations has considerable ecological consequences. Flying-foxes are very important as pollinators and seed dispersers of Australian native trees. With the longest distance

[1] Ratcliffe, F.N. (1931) "The Flying Fox (*Pteropus*) in Australia: Report of cooperative work conducted on behalf of the Council for Scientific Research, the New South Wales Department of Agriculture, and the Queensland Home Secretary's Department", *Council for Scientific and Industrial Research* Bulletin No. 53.

capacity of all wildlife for pollination and seed dispersal, they will become increasingly important for the environment with climate change, as native trees will require movement and genetic flow to adapt to a warming climate.

Relevantly for the AWAC, flying-foxes are also highly intelligent mammals with complex social lives, including a considerable variety of communicative vocalisations. They are clearly sentient and thus able to suffer pain.

Unfortunately for their welfare and conservation, flying-foxes have a major image problem. They are reviled by many people and public statements about them often use terms like 'vermin', 'plague' and 'disease-ridden'. Unfavorable community attitudes towards flying-foxes are highly relevant to welfare outcomes.

Although the AWAC is considering only the shooting of flying-foxes by fruit growers, I note that birds also are killed for crop protection. Birds targeting orchard fruits include rainbow and scaly-breasted lorikeets, king parrots, rosellas, crows, currawongs and ducks.[2] The shooting of birds also undoubtedly causes suffering and has adverse welfare implications, but I have no substantial information about this.

SCALE OF PROBLEM

1. Is the problem of flying fox predation on horticulture increasing, decreasing, or stable? What factors contribute to this trend? How might this trend impact on the need for shooting in the future?

As noted in the Introduction, flying-foxes have been regarded as a problem by fruit-growers for as long as there have been commercial orchards in Australia.

Factors that would increase predation in orchards include:

- Loss of native food sources in many areas, particularly in coastal habitats
- Increased numbers of orchards in flying-fox habitat
- The recent decision outlawing the use of electric grids, thereby reducing the level of protection against predation in some orchards

Factors that would reduce the predation trend include:

- Declining populations of flying-foxes
- Increased use of netting for crop protection

Overall, the greatly increased use of netting is probably having the biggest effect on trends, and thus fruit losses have undoubtedly declined because of the adoption of the only wholly effective method of crop protection. In orchards using full exclusion netting—as recommended by the Queensland government and orchard business manuals—the losses from flying-fox (and bird) predation drop to zero. That the demand for damage mitigation permits has dropped in recent years would be largely explained by the increased use of netting. This trend should continue.

[2] Peter Rigden, Jim Page, John Chapman (2000) *To Net or Not to Net?*, Queensland Horticulture Institute, Nambour.

2. There are alternative, non-lethal control methods (scaring, netting). To what extent are these employed in Queensland, compared to lethal control methods? Compared to other states?

There is increased use of non-lethal methods for crop protection, in particular netting. It is now considered industry best practice to use netting. In a recent trip to North Queensland, focused on electric grids, I found that about one-third of orchards I knew to be previously using grids were now using nets. However, I do not know what proportion of orchardists previously shooting have now netted.

However, there are still significant numbers of farmers in Queensland shooting flying-foxes for crop protection, and while the numbers of flying-foxes permitted to be killed has declined since the introduction of the quota system in 2001-02, the number of permits issued has increased. The current total quota for flying-foxes permitted to be taken under DMPs in Queensland is more than 10,000. Below is a table extracted from the *EPA Guideline for Damage Mitigation Permits for Flying-foxes* showing how many flying-foxes were killed under DMPs for the 2000 to 2003 fruit seasons. According to figures supplied by QPWS, during the 2004-2005 season, there were 162 DMPs issued for the 'take' of flying-foxes. Discounting those permits I knew to be for non-lethal dispersals, there were permits issued to kill a total of 2970 flying-foxes.

SUMMARY OF DMP STATISTICS 2000-2003 GROWING SEASON

Species	No of permits issued				No of animals taken			
	2000/01	2001/02	2002/03	2003/04	2000/01	2001/02	2002/03	2003/04
P.scapulatus (LRFF)	59	22	26	42	4205	1360	1549	1695
P. alecto (BFF)	112	65	62	57	3463	2557	2425	2282
P. poliocephalus (GHFF)	21	5	19	29	1227	65	220	345
P. conspicillatus (SFF)	48	20	27	18	3180	1402	1018	425
Total	**112**	**112**	**129**	**146**	**12075**	**5384**	**5107**	**4747**

- ***Note:*** *Permits issued in 2000 include taking by shooting and electric grids.*

The numbers of flying-foxes killed under permit in NSW is less than in Queensland. The quota is set at 3040. In 2005-06, 30 licences were issued to 'harm' (kill) 1320 grey-headed flying-foxes. In Victoria, permits (20-40) have been issued only for non-lethal crop protection, the use of bird frite cartridges.

3. Is poisoning or any other lethal control method available or used?

Shooting is the only lethal control method currently permitted for crop protection from flying-foxes. Until the EPA banned the use of lethal electric grids in 2001 (on welfare grounds), they were a favoured method of crop protection. However, there is evidence—including evidence accepted in court [Booth v Frippery Pty Ltd; Booth v Yardley]—that some farmers have continued to use electric grids illegally.

In northern NSW, there was one fruit grower who used netting hung between fruit trees to capture flying-foxes—they were left entangled in the netting to die. There was an investigation of this farmer, but despite considerable evidence of illegal killing, no prosecution occurred.

There have also been reports (by farmers) of other methods being used illegally—including the spiking of bananas hung in an orchard with a pesticide and the use of barbed wire as a barrier. However, these reports have not been substantiated.

4. Why do some producers prefer shooting over alternative control methods?

The reasons are likely to include:

(a) **Economic**: Some farmers do not want to, or are not able to, afford the up-front capital costs associated with netting. However, orchardists who have not netted include those who own the biggest lychee orchards in the country, and who also claim massive losses from flying-foxes—this suggests (because of economies of scale that would result from that size) that it is not necessarily economics which is the barrier to netting.

According to the experience of most orchardists who net, the savings gained allow the cost of netting to be recouped within a very few years. According to the Lychee Information Kit, netting may be cost effective even if only small crop savings are achieved. The Kit provides two examples of the cost effectiveness of netting: (a) the netting of a 1.36ha orchard would provide a 30% return on investment if only 15% of the crop was saved per year over 10 years, and (b) the netting of a 4.28ha orchard would also produce a 30% return on investment if only 12.5% of the crop was saved per annum over 10 years. There are low interest loans available through QRAA for netting.

(b) **Culture**: The culture of killing for crop protection noted by Francis Ratcliffe 75 years ago continues today in some sectors of the horticultural community—despite the ineffectiveness of killing for crop protection (also noted by Francis Ratcliffe), let alone its inhumaneness.

5. The numbers of permits issued and number of flying foxes authorised to be shot are available from EPA. How confident can we be that the shooting of flying foxes is done only under permit?

There can be no confidence that the only flying-foxes shot are those allowed under a permit, for the following reasons:

Size of quota: The numbers permitted under the quota are small, and amount to only 0.5-1 flying-fox per night of orchard protection, depending upon the species. Killing in general is an ineffective form of crop protection—as discussed in Appendix 2, even the killing of thousands of flying-foxes failed to prevent massive crop losses in orchards. A farmer cannot patrol an entire orchard all night (and all day against birds). While killing is not very effective, killing very small numbers would be even less effective for crop protection. The numbers permitted now are much smaller than numbers previously permitted when there was not a quota system, suggesting that growers consider they need to be able to shoot more than the quota allows to achieve crop protection. Permits issued to kill 100-300 flying-foxes, and up to 500, used to be common practice. Even when orchardists were issued with permits for much larger numbers, there was evidence that they were shooting more than permitted (discussed below).

Enforcement limitations: Orchardists would have little fear of being caught if they exceeded permitted numbers, as the shooting is done at night on private property. No fruit grower has ever

been prosecuted for breaching the Nature Conservation Act (although civil action has been taken against 3 groups of growers for illegal use of electric grids). Under the Nature Conservation Act, EPA has no capacity to properly monitor shooting, as EPA officers are only able to obtain a warrant to enter a property for surveillance if they have evidence of non-compliance. The lack of capacity of the EPA to enforce the permitted quota (as well as concerns about welfare) has been recognised by the Queensland Ombudsman in a recent investigation. The following is an extract from a letter to me from the Ombudsman, in April 2006, summarising his report to the EPA into various issues associated with the killing of flying-foxes (See Appendix 1 for a more comprehensive extract):

> **6.2 Long term viability of the DMP system**
>
> The Ombudsman's report made a number of recommendations to improve the effectiveness of the existing DMP system. Specifically, he indicated the ongoing viability of the scheme needs to be addressed having regard to the following factors:
>
> - the confirmed reduction in the numbers of growers participating in the system;
> - the small number of protected animals permitted to be taken under DMPs (including under an agreement with the Commonwealth for some species);
> - the improbability that taking small numbers under DMPs offers effective crop protection;
> - the difficulty in killing animals the size of flying foxes by shooting them;
> - concerns about the suffering of animals not killed outright by shooting; and
> - the impracticality of enforcing compliance with the terms of the permits issued.
>
> … The Ombudsman formed the following opinion and made the following recommendation.
>
> OPINION: Sufficient evidence exists to question the ongoing viability of the DMP system for flying foxes.
>
> RECOMMENDATION 5: The QPWS undertake a review to ascertain the ongoing viability of the DMP system and ensure that the review has regard to any findings from the audit conducted in compliance with my recommendations 3 and 4.

Culture of non-compliance: There has been a culture of non-compliance in some sectors of the horticultural community. I have focused on obtaining evidence of illegal use of electric grids. Such evidence has been accepted by the courts in 3 civil cases I have brought against fruit growers, and colleagues and I have obtained evidence in other cases that haven't been taken to court. (a) In the worst case, lychee orchardist Rohan Bosworth (with a permit to kill 500 flying-foxes issued subsequent to my complaint to the EPA about his illegal killing), according to the judgement of the Federal Court, probably killed 18,ooo flying-foxes in 2000. He had also been killing flying-foxes for about a decade prior to that with no permit. (b) Merv Thomas, a lychee grower who has never held a permit, has admitted in court to killing about 50,000 flying-foxes over about a decade. (c) Dick Yardley, a lychee grower, admitted on public radio to killing 1100 flying-foxes without a permit. While grids typically kill far more flying-foxes than shooting, these cases demonstrate a culture of ignoring environmental law.

Clearly, obtaining reliable information from fruit growers on the extent of illegal killing is impossible. Despite this limitation, surveys and discussions with farmers have yielded some information that shooting without permit or exceeding permitted numbers is common and results in large numbers of

flying-fox deaths. Flying-fox researchers Dr Les Hall and Dr Greg Richards report on this in their book on flying-foxes:[3]

> A study on the animals killed on the NSW permit system estimated that in the seven years between 1986 and 1992, permits were allocated to cull over 240,000 flying foxes. It also showed that these licensed people were only half of those actually culling flying foxes, indicating the extent of the legal practice, and that many more animals were actually killed. During recent trials on a new flying fox deterrent system in orchards in northern NSW, it was established that most orchardists would cull approximately 20-30 flying foxes each night during the harvest season (6 weeks) ... this equates to 840-1260 flying foxes killed per orchard per season.

Another flying-fox researcher, Dr Patrina Birt, who spoke to orchardists in central Queensland, concluded that numbers of flying-foxes being shot probably exceeded permitted numbers 5 to 6-fold—and that was during the years when permits were issued far more liberally.[4]

6. WHAT ARE THE ESTIMATES FOR NUMBERS OF FLYING FOXES ACTUALLY SHOT, COMPARED TO THE NUMBERS FOR WHICH PERMITS ARE ISSUED?

Given that exceeding the permitted number is illegal, there is no way of knowing or reliably estimating numbers illegally shot. There are two types of evidence about actual numbers shot, both discussed in response to the previous question.

(a) The number of flying-foxes shot under permit or applied for prior to the quota system provides at least a clue that the numbers actually shot are much higher than permitted. Previously permitted numbers of 100-500 are significantly higher (in some cases >10 times higher) than the 15-30/month currently permitted.

(b) There is evidence noted above that fruit growers in northern NSW were shooting 20-30 flying-foxes each night of crop protection (about the level now permitted to be shot in a month), which would mean that numbers permitted under a quota would be exceeded about 30 times over. The other evidence referred to above suggests there were 5-6 times more killed in central Queensland than were permitted (prior to the quota system).

Based on these figures, I estimate that the numbers actually shot exceed the numbers for which permits are issued by 10-30 times. This estimate does not take into account the numbers that may be killed by orchardists without any permit at all.

7. HOW MANY PERMITS ARE USED BY PRODUCERS FOR THE PURPOSE OF CULLING SCOUTS TO DETER LARGE-SCALE PREDATION BY FOLLOWERS, RATHER THAN JUST TO REDUCE PREDATOR NUMBERS?

While there are often claims that some fruit growers shoot only the flying-fox scouts, and that this prevents larger-scale predation, there is no scientific evidence for the existence of flying-fox ' scouts' and the notion of scouts is contrary to current understanding of flying-fox behaviour. I have asked

[3] Les Hall and Greg Richards (2000) *Flying Foxes: Fruit and Blossom Bats of Australia*, UNSW Press, Sydney, p. 52.
[4] Patrina Birt (2000) "Summary Information of the Status of the Grey-headed (*Pteropus poliocephalus*) and Black (*P. alecto*) Flying-fox in New South Wales", In *Grey-headed Flying-fox Workshop* (G. Richards ed.), p. 84. Australasian Bat Society.

flying-fox researcher, Dr Len Martin, to respond to this issue. Below are excerpts from his response, which is provided in full in Appendix 2:

> It is often asserted that an orchard electrocution grid - like shooting - protects fruit crops from flying-foxes because it selectively kills "the scouts" - a hypothetical category of animals that allegedly guide the main body of "ordinary" bats to the orchard, and without which, said ordinary bats would not find the orchard. Culling of scouts is believed to have the benefit of reducing the total cull. Thus, p.46 of (Rigden et al., 2000) relating to a North Queensland rambutan grower reads, "*The grids are switched on as soon as the fruit starts to colour up about 8 weeks before picking, this policy ensures that any scouts entering the orchard are culled. Culling the scouts ensures that other flying-foxes are not led to the orchard, thus the total cull of flying-foxes is reduced. If grids are switched on too late 50% losses can occur, when the system is used to its optimum effect losses are reduced to 2%*".
>
> To my knowledge there is no scientific evidence for a specific category of scouts. In this, my colleagues, Dr P. Eby and Dr L. Hall concur. We also agree that it is so impractible to do the appropriate scientific experiments that it is essentially impossible to provide the necessary scientific evidence for the existence of "scouts". We consider that the idea of "scouts" is one largely generated by fruit growers, as cited above.
>
> That said, the hypothesis of "scouts" is ***not*** consistent with what we ***do*** know about the navigational abilities of flying foxes and their long and short distance movements.
>
> While flying-foxes lack the sophisticated sonar used by micro-bats to navigate and catch prey, they have large eyes and good night vision, excellent hearing and acute sense of smell. They are highly intelligent, inquisitive creatures capable of accurate long-distance navigation and of remembering specific locations.
>
> Radio-tracking research (Eby, 1991, 1996) has demonstrated that individual flying-foxes can return precisely to specific locations, after long periods of time, and over long distances. In other words, flying-foxes have an excellent spatial sense and spatial memory - maps-in-the-mind, as it were. Eby's research gives no support to the theory that specific "scouts" lead other bats into orchards. On the contrary it indicates that all flying-foxes are individually capable of locating their own food sources. Other radio-tracking studies described at the recent Bat Conservation Symposium demonstrated how individuals from the Sydney Botanic Gardens colony would each fly to its own specific tree over several nights. This is entirely consistent with my own numerous observations of animals flying out from the Indooroopilly colony - widely dispersed across the sky, the flight lines radiating out in all directions, with animals at widely differing heights - the highest apparently purposefully continuing off into the distance, the lower ones, slower, peeling off, circling and descending with great precision into local trees to feed. Frequently an individual would appear in the one patch of blossom each night at roughly the same time.
>
> Clearly, individual flying-foxes will vary in their navigational and food-finding abilities and presumably older and more experience animals will be more competent, and inexperienced animals may well follow them. Thus these data and observations do not exclude the possibility of *some* knowledge sharing, or of *some* leadership, but indicate that orchard attacks are not *dependent* on the hypothetical "scouts", as many fruit-growers seem to believe.

Perhaps the best evidence against the importance of hypothetical scouts comes from the two orchard electrocution grids involved in the court cases. Firstly it must be emphasised that such grids *do* kill many flying foxes. But are they effective in protecting fruit crops? Effective protection might support the scout hypothesis.

The affidavit from the respondent in one case states, "*Since 1986 I have... maintained electric fences... There are now... 14 erected electric fences... and consist of 20 verticle [sic] wires from 4.4 metres to 9 metres in height. The total length of fences is 6.4km... The fences are operated during the harvesting season only. In the current year... from 2 November 2000 until the end of the harvest... This amounts to less than eight weeks operation... about my average use... On average the orchard yields approximately 250 tonne... per year. The actual yield... fluctuates between nil and 450 tonne... To date [12 December 2000] we have harvested between 75% and 80%... The financial break even point... this year will be... the sale of approximately 100 tonne of fruit... I am expecting a harvest of only 70 - 75 tonne...* ***The low harvest... is mostly due to... flying-fox raids. I estimate the loss of fruit this year attributable to the flying-fox raids to be in the vicinity of 100 to 120 tonne***" [my emphases].

So, despite use of grids from November 2 onwards, there were crop losses of "100-120 tonne" attributed to flying-foxes. A loss that indicates that, **despite use of the grids, large numbers of flying-foxes continued to enter the orchard and feed even though the grids were on and killing many bats - and presumably any putative scouts**.

I conclude that, on the balance of probabilities, the hypothesis of "scouts" is not supported, and that any method of killing flying-foxes in or around orchards, whether by shooting or electrocution - will not be an effective deterrent (dead bats don't learn!) and will also be indiscriminate in killing old and young, male and female, pregnant and nursing females alike.

WELFARE ISSUES

8. THE FOLLOWING STANDARD CONDITIONS APPLY TO ALL PERMITS ISSUED FOR SHOOTING OF FLYING FOXES. ARE THESE CONDITIONS REALISTIC, SUCH THAT SHOOTERS CAN ALWAYS COMPLY?

- TAKE OF FLYING FOXES IS BY SHOOTING ONLY.
- SHOOTERS ARE TO ENSURE THE COMBINATION OF FIREARM, PROJECTILE, DISTANCE TO TARGET AND POINT OF AIM RESULT IN THE INSTANTANEOUS DEATH OF THE TARGET ANIMAL.
- IF DEATH IS NOT INSTANTANEOUS, SHOOTERS MUST MAKE EVERY EFFORT TO LOCATE WOUNDED ANIMALS AND QUICKLY AND HUMANELY CAUSE IMMEDIATE DEATH.
- JUVENILE (BABY) FLYING FOXES THAT ARE FOUND DISENGAGED FROM FEMALE FLYING FOXES MUST BE IMMEDIATELY PLACED IN CARE FOR HAND-RAISING. CONTACT A LICENSED WILDLIFE CARER FOR ADVICE. DO NOT TOUCH OR HANDLE THE ANIMAL YOURSELF.
- ACCURATE RECORDS OF ANIMALS TAKEN UNDER THIS PERMIT MUST BE RECORDED ON THE RETURN FORM PROVIDED. THESE RECORDS MUST BE MADE AT THE END OF EACH DAY/NIGHT THAT ANIMALS ARE SHOT.

- ADDITIONAL CONDITIONS THAT ARE USED IN NORTHERN REGION INCLUDE:
- NEIGHBOURS, POLICE AND THE RELEVANT LOCAL AUTHORITY SHOULD BE NOTIFIED PRIOR TO COMMENCEMENT OF OPERATIONS.
- BIRD FRITE AND/OR OTHER NON-LETHAL DETERRENT METHODS ARE TO BE USED IN CONJUNCTION WITH THE PERMIT.
- TAKING MUST BE HUMANE.
- TAKING CAN OCCUR ONLY WITHIN THE BOUNDARIES OF THE LANDHOLDER'S PROPERTY.
- CARCASSES TO BE DISPOSED OF IN AN APPROPRIATE MANNER.

Many of these conditions cannot be, or are unlikely to be, complied with by fruit growers.

Requirement to cause instantaneous death: As further discussed in response to Q12, it would be difficult for a shooter to cause instantaneous death. The factors that mitigate against this include:

(a) shooting occurs at night, and flying-foxes are dark in colour;

(b) the target for instantaneous death (the brain) is small;

(c) the targeted flying-fox is likely to be moving;

(d) in the circumstances of an orchard in which shooting is occurring, flying-foxes are likely to be wary and not allow a close shot;

(e) it would be almost impossible to get a clean line of sight to the head of a flying-fox if it is flying away from the shooter;

(f) the surface area of a flying-fox, with wings that may exceed 1 metre in diameter, is very large in comparison to the target and thus presents a large target for injurious pellets.

(g) the body of flying-foxes is quite dense, thus pellets are likely to penetrate and injure rather than kill—see information on this issue provided by researcher Jennifer Parsons under Q12.

Not surprisingly, given that flying-foxes roost in trees and will climb a tree even if they can't fly, flying-foxes injured by shooting are rarely found. In one recent case of illegal shooting of 48 Little red flying-foxes at Lowood (not by a fruit grower) there was apparently a significant proportion of deaths resulting from injuries (I understand the EPA has supplied the AWAC with information about this case). Carer Dominique Thiriet reports on three instances of flying-foxes injured by shooting: (a) One flying-fox was found by a member of the public along a track bordering a lychee orchard—it died of its wounds. (b) 3 or 4 flying-foxes were shot and injured in suburban Townsville. The animals suffered penetrating wounds in the body and broken wing bones. The damage caused the bones to splinter and as a result, the animals had to be euthanised. (c) Dominique and I found one injured flying-fox in a lychee orchard—it was crawling on the ground towards a tree, which it attempted to climb. It, too, was euthanased because its wing bones were shattered.

One further case demonstrates that injuries rather than instantaneous death often result even when shooters are skilled. Professional shooters were employed to shoot flying-foxes in the Royal Melbourne Botanic Gardens. One dead flying-fox found in the Gardens by members of the public was autopsied by veterinarian Dr Simon Coglan. He concluded that the wounds indicated the animal had not died immediately (a copy of this autopsy report is available). Note that the Victoria RSPCA

withdrew its support from the proposed cull by the RMBG when it became aware that shooting was to be the method employed, saying that it was unethical and cruel.

Below, associated with Q12, are xrays/pictures of two bats with shooting injuries who came into care after being found by members of the public—one in NSW, one in central Queensland.

Requirement to locate and humanely kill wounded flying-foxes: Shooters are unlikely to be able to, or desirous of, locating any injured flying-foxes. It would be very difficult to find them amongst the trees of an orchard—I have searched for an injured flying-fox I saw fall into a tree and was unable to find it. Many wounded animals would make it beyond the orchard boundary to die elsewhere. A wounded flying-fox would seek to climb a tree, and may remain hanging there until dead.

Requirement to rescue juvenile flying-foxes: It is quite difficult to see juvenile flying foxes when they are suckling under the female's wing, especially in the dark. It is very unlikely that farmers would go to the trouble of finding the dead or injured flying fox and then manipulating it to determine whether there is a juvenile attached. (If juveniles are disengaged, they would be left behind in the colony as flying foxes avoid flying with large babies. Farmers would therefore be ignorant of the fate of the orphan juveniles.)

There are exceedingly few records of orchardists contacting a wildlife carer to care for an orphaned juvenile. There is no incentive for a farmer to do so. I have asked carers on the Flying-fox Information and Conservation Network for their response to this question. Most care groups are represented on this network, but just one reported there *may* have been one instance of rescuing a juvenile at the behest of a fruit-grower who had killed its mother. Dominique Thiriet, a flying-fox rescuer in Townsville, says in response to this question:

> My partner and I have been the NQ Wildlife Care Inc flying fox coordinators since 1997. The area which is covered by this organization extends south to the Burdekin and north to Ingham, an area of approximately 10,000km^2. This region encompasses various commercial fruit growing districts including Major's Creek, Alligator Creek, Rollingstone, Balgal Beach and Mutarnee. The overwhelming majority of flying foxes rescued in this region are referred to us for assessment and care.
>
> Each year, 100 – 300 flying foxes come into our care, including injured and orphan animals. In the last 10 years, we can recall only three baby flying foxes found in orchards. The first one had been reported because its mother had been electrocuted (we cannot recall whether the orchardist or someone else had found this orphan). The other two had been found alone in the orchard. There was no evidence available to determine whether their mother had been shot, electrocuted or had failed to return because of another cause. I have not heard of anyone else in the region who has cared for an orphan found after its mother had been shot in an orchard.

Requirement for humaneness: There is inevitable inhumaneness associated with shooting flying-foxes. As discussed, shooting will often result in injuries rather than instant death. Furthermore, much of the shooting of flying-foxes in Queensland orchards takes place during the birth season of flying-foxes. As Dr Len Martin says (see Appendix 2 for full text):

> Given that the birthing and suckling season of three of our four species of flying-fox coincides with the fruit harvesting season, (McIlwee and Martin, 2001; Martin and McIlwee, 2002) it is likely that a high proportion of animals entering orchards in search of food will be lactating mothers with young attached, or left in a creche. This raises the issue of cruelty to the young. In the event of death or injury of females with young attached, many of the latter may

survive, albeit with the injuries, to die slowly of trauma and starvation and in considerable pain. Orphaned young in the creche will simply die by starvation.

Evidence from wildlife carers suggests that orphaned young flying-foxes may take up to 2 weeks to die from starvation. For example, carer Dave Pinson (pers. comm.) rescued a 10-week old orphan which survived 7 days of starvation in very hot conditions after a heat wave killed its mother. Carer Louise Saunders (pers. comm.) rescued a 4-week-old which had survived at least 6 days, but died from kidney and liver failure.

9. WHAT FIREARMS ARE USED?

I have only ever heard of shotguns being used. I have seen shotgun pellet casings in a number of orchards.

10. HOW DO THE TYPE OF FIREARM, LIGHT AND ENVIRONMENTAL CONDITIONS, INTERFERENCE TO CLEAN SIGHT AND CLEAN SHOT BY TREES AND BRANCHES, NUMBER OF FLYING FOXES, AND SPEED AND DIRECTION OF FLIGHT CONTRIBUTE TO INJURY FREQUENCY?

Shotguns—due to the splaying of pellets—are likely to result in a high rate of injury. This would be similar to what happens with duck shooting.

Shooting is carried out at night, therefore light is limited, and flying-foxes are dark in colour, making it even more difficult to see them clearly.

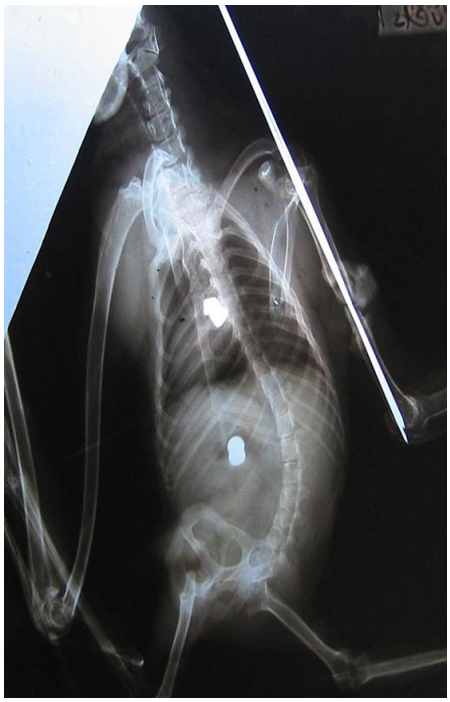
Environmental conditions include rain (flying-foxes tend to target orchards more frequently in rain because nectar is washed out of native food sources) and wind; uneven ground surface; and obstructions.

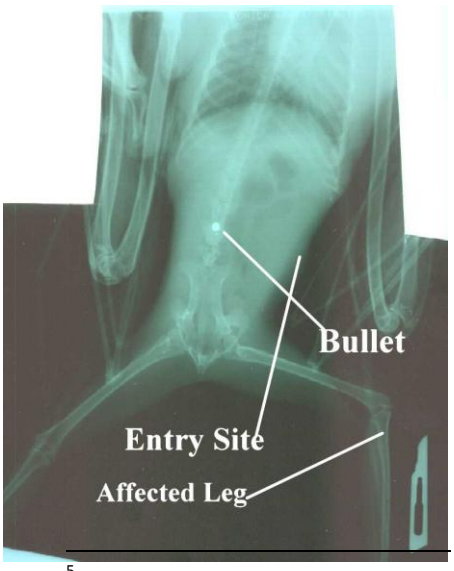
There would be interference to clean sight from trees in the orchard. Many flying-foxes would be fleeing from noise and thus be shot from behind—there is not likely to be a clean sight of the head from this angle.

11. WHAT IS THE LIKELY INCIDENCE OF NON-LETHAL INJURIOUS SHOOTING (NUMBERS, %-AGE)? WHAT NON-LETHAL INJURIES ARE SEEN AND REPORTED, BY WHOM?

Likely incidence of non-lethal injurious shooting: There is no direct evidence about the incidence of non-lethal injurious shooting—and given the circumstances of shooting in orchards, nor can there be. As discussed for Q8, carers occasionally take into care flying-foxes that have been shot, but there is typically no information about the circumstances of the shooting. Non-lethal injuries would not be reported by fruit-growers, because if an animal was still able to fly, it would leave the orchard, and the orchardist would not be aware that the animal had been injured. If an orchardist did know, s/he would be unlikely to report it as it would constitute a breach of permit conditions.

The best evidence for a relatively high incidence of injuries comes from a comparison with similar types of shootings for which there is reliable information. The best comparison is with the shooting of other creatures who fly—ducks. See Q12.





Non-lethal injuries: Adjacent are xrays/pictures of two bats with shooting injuries that did come into care. Following is an extract from *The Flying Fox Manual* by Dave Pinson, explaining how flying-foxes are injured by shooting[5]:

A CLOSE UP LOOK AT PROJECTILE INJURY:

Bang! It's all over in a few milliseconds, but let's just slow things down to look at what happens. As the projectile impacts and enters, it punches out a small plug of skin and fur, carrying it deep into the wound ahead of itself. As the projectile progresses through tissue, it creates a rapidly expanding temporary cavity, which continues to expand after entry, creating a negative pressure that sucks more contaminated material into the wound through entry, and/or exit wounds. Once pressure equalizes again, any skin or tissue forced out from entry and exit holes [but still attached to wound edges] snaps back into the wound like a piece of elastic. Projectile deceleration [as it is increasingly slowed by passing through various layers of tissue] can also create great damage, as this kinetic energy is transferred to surrounding tissue and bone like a high-pressure shockwave. Wound severity depends upon a number of factors such as mass of projectile, impact velocity, residual velocity, tissue reaction, tissue elasticity, and tissue density, but ultimately, it is tissue absorption of transferred kinetic energy shed by the projectile on deceleration that determines wound severity, and not the kinetic energy actually possessed by the projectile itself. Gunshot wounds are described as either "penetrating" - where projectile has entered the body, but not exited again [remaining inside the body], or "perforating" - where the projectile has sufficient velocity and energy to exit the body from another location.

…

One of the biggest problems with diagnosing gunshot injuries is that in many cases, they simply present with no signs at all to suggest they have been shot in the first place. No visible entry or exit holes, an often complete lack of bleeding [unless blood vessels are hit], and no lying on the

WOUNDED BATS: (TOP) X-RAY SHOWING TWO PELLETS . A THIRD WAS LODGED IN THE SKULL. THERE IS A BROKEN LEFT HUMERUS. (MIDDLE) THE SAME ANIMAL WITH LODGED SUBCUTANEOUS PELLET - THE GREY LUMP ON THE LEFT (X-RAY & IMAGE SUPPLIED BY MANDI GRIFFITH. (BOTTOM) X-RAY OF FLYING-FOX WITH PARALYSED LEG SHOWING LOCATION OF A SHOTGUN PELLET (IMAGE PROVIDED BY SUZANNE & HENRY GRZEGORSKI).

[5] Dave Pinson (2007) *The Flying Fox Manual*, Stickee Batz Publishing, Murwillumbah.

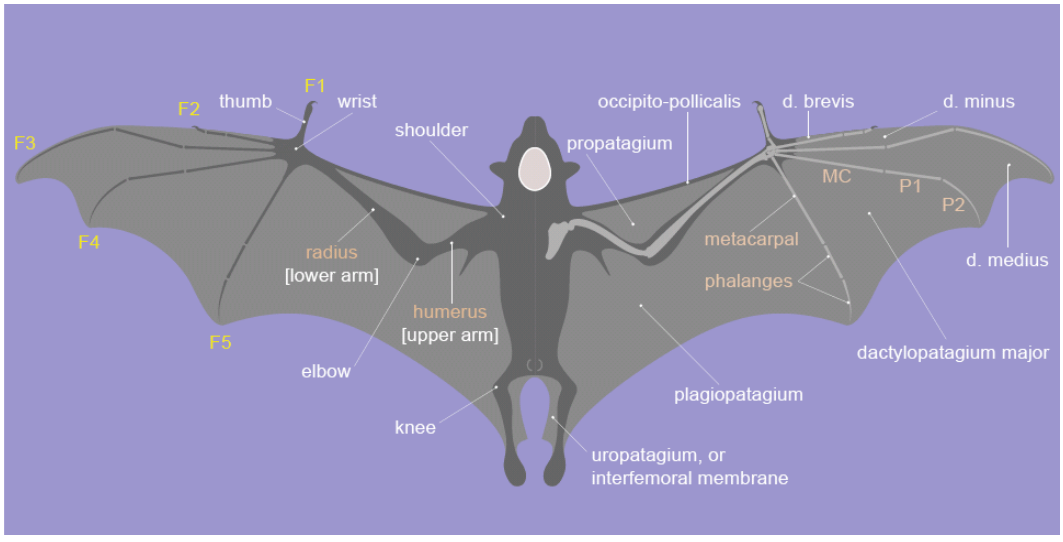
ground clutching their chests, wearing Stetson hats. The fact that the animal survived, indicates that initial injuries were not life-threatening. The animal pictured above is a good example, where both carer and vet had no idea he had been shot until X-rayed. Although initial injuries may not have been life-threatening, secondary complications usually are - otherwise you would not have been able to pick this debilitated animal up in the first place. Because these secondary conditions can include such diverse things as shock, infection, exposed bones, broken bones, exhaustion, dehydration, extreme malnutrition, maggot infestation, and paralysis, it is impossible to present a definitive list of signs for gunshot injuries. …

12. HOW WOULD THE FREQUENCY OF INJURIOUS, NON-LETHAL SHOTS COMPARE BETWEEN FLYING FOX AND DUCK SHOOTING?

The shooting of ducks and flying-foxes is comparable because the targets are similar in size and both are typically shot in flight. However, the circumstances under which flying-foxes are shot in orchards suggest that rates of injuries would be considerably higher than in duck shooting.

Light conditions: Shooting of flying-foxes occurs at night whereas duck shooting occurs mostly at dawn.

Shooting environment: Shooting of flying-foxes takes place in more difficult surroundings—lots of trees, uneven ground, the shooter having to move around an orchard, sometimes windy/rainy conditions. Furthermore, some shooters spend many hours patrolling their orchards, and are picking fruit during the day, so would be tired (and therefore less accurate) when shooting. Shots have to be made quickly because the target would usually be as rapidly as possible fleeing the shooter.



Surface-to-target ratio: The surface-to-target ratio of flying-foxes is equivalent to or greater than that in ducks. Studies of the wounding rates in duck hunting have found that the critical feature is the ratio of the 'vital' areas—the brain, heart and lungs—to the rest of the animal. X-ray sampling studies have found that the larger the duck the greater proportion of them have embedded pellets. For example, an Australian study of 40,000 ducks found that 9% of the relatively small grey teal had embedded pellets while 19 per cent of the larger mountain ducks had pellets.[6] The relative ratio for flying foxes

[6] F. Norman (1976) "The incidence of lead shotgun pellets in waterfowl (Anatidae and Rallidae) examined in south-eastern Australia between 1957 and 1973", *Australian Wildlife Research* 3, 61-71

would fall within this range. The image above shows the anatomy of the flying-fox and the relative size of the target for instant death—the size of the cranium is only about 0.8 per cent of the surface area of the flying-fox (Dave Pinson pers. comm.).[7]

Density of body: The body of a flying-fox is denser than that of a duck, and therefore pellet penetration to vital organs that would result in a relatively rapid death is less likely. Jennifer Parsons, a PhD candidate, provides the following information about body density (full text in Appendix 3):

> Unlike birds, flying foxes do not possess pneumatised bones or air sacs making them much denser (in the true sense of mass per unit volume). In addition, the body mass of a flying fox substantially exceeds that of a similarly sized bird (see Table 1). This finding is supported by my PhD research which is looking at the impact of flying foxes to the aviation industry. Flying foxes are rated much higher on the scale of damage caused to aircraft. While similar sized birds such as the galah (*Cacatua roseicapilla*) rate at around a 17.5% likelihood of causing major damage upon striking an aircraft, flying foxes cause major damage in around 25% of bat strike cases (ATSB, unpubl. data).
>
> Owing to their denser bodies, flying foxes are therefore likely to suffer a higher rate of non-lethal shots than would similarly sized birds such as ducks, all other factors being equal. This will be so because shots will not penetrate flying fox muscle mass to the same extent as they would in less dense bodies such as ducks.

Skill & attitude of the shooter: Primary producers are able to obtain a firearms licence simply because of their line of business. To get a firearms licence there is no requirement for a skills test. Thus, there is no guarantee that a fruit grower licensed to shoot flying-foxes has the skills to do so.

A shooter's attitudes towards an animal is also likely to affect the outcome of shooting—respect for an animal is likely to motivate attention to accurate shooting and follow-up to ensure that a downed animal has been killed rather than wounded. Many fruit-growers express hatred for flying-foxes—attitudes prevalent in submissions, letters to newspapers, and letters to politicians. For example, in a document submitted to the EPA one fruit-grower expresses these typical sentiments about flying foxes[8]:

> Fruit bats are disease ridden vermin that can transmit at least 3 fatal viruses to humans. For some unknown reason they are protected by law and have been for about the last decade.

With such attitudes common, there is not likely to be much concern for wounded flying-foxes. However, note that the same fruit grower seeks to claim the moral high ground for electrocution by claiming that shooting is more inhumane. He says:

> I am flabbergasted – no appalled that the bureaucrats consider that shooting a bat at night is more humane than electrocution. Their electrical ignorance…should not be reason to let most cull victims die a lingering death by lead poison, gangrene, gut shot or even a broken wing. If the pigs or goannas find these guys, they put them out of their misery by ripping them to bits.

I have found (and video-taped) shotgun pellet casings in the orchard owned by that fruit grower.

[7] Image from Pinson, Dave (2007) *The Flying Fox Manual,* Stickee Batz Publishing, Murwillumbah.

[8] Merv Thomas (2005) "A Fruit Bat Deterrent System", a report sent to the EPA, obtained through discovery processes in *Booth v Frippery* court case.

Note that studies of duck hunters have found that they are highly unreliable in reporting their own rates of kill. A 1987 Canadian study involved firstly asking hunters to estimate their cripple rate and then, from concealed hides, observing those same hunters and estimating cripple rates. The Canadian Wildlife Service staff observers counted 5 to 8 cripples for every 10 birds bagged (which also includes wounded), but hunters admitted to only about 2 cripples for 10 bagged.[9] Orchardists have no incentive to ensure that flying-foxes are killed or to retrieve the body, in contrast to the incentive of duck shooters to do so.

There is no monitoring or observation of farmers shooting flying-foxes, whereas in some circumstances there is observation of duck shooters (particularly monitoring by wildlife officers on opening day), which would increase the incentive for accurate shooting.

13. HOW EASILY AND EFFECTIVELY, AND HOW ROUTINELY, ARE THE GROUNDS OF SHOT ORCHARDS IMMEDIATELY INSPECTED TO FIND INJURED ANIMALS?

It would often be difficult to find injured flying-foxes, as they would be inclined to crawl up a tree and hide amongst branches. One morning I helped rescue a shot flying-fox from an orchard only because we saw it as it crawled towards a tree (it had to be euthanased). I do not know whether fruit-growers inspect their orchards for injured flying-foxes, but there seems to be little incentive for them to do so.

14. HOW FREQUENTLY ARE FOUND, INJURED FLYING FOXES EUTHANASED? BY WHAT METHOD?

I do not know. Orchardists are warned not to touch flying-foxes for health reasons. For example, in the DPI document *To Net or Not to Net,* there is a prominent heading, which says LEAVE SICK OR INJURED FLYING FOXES ALONE. Shooting an animal twice may be considered to be an unnecessary expense. It is possible that, found, an injured flying-fox animal would be hit with a blunt instrument or a shovel (this is a common, albeit inhumane, method of dispatching animals when no other method is available). There is no information available about the means of disposal of the bodies.

15. WHAT % OF SHOT FLYING FOXES ARE NURSING MOTHERS CARRYING BABIES? HOW FREQUENTLY ARE SHOT FLYING FOXES INSPECTED TO SEE IF THEY ARE CARRYING A BABY?

The ripening and harvesting of a considerable proportion of the Queensland fruit crop, particularly lychees and mangoes, coincides with the near-term pregnancy of flying-foxes, the carrying of dependent young and dependent young crèche in the colony. The mother carries her baby with her for about the first three weeks after birth. A significant proportion of shot flying-foxes are likely to be carrying babies during the time when shooting occurs. It seems highly unlikely that orchardists would inspect flying-foxes to see if they are carrying a baby. After all, they are warned not to touch flying-foxes for health reasons. It would usually be necessary to manipulate a flying-fox to find a baby, who would be gripped on to the nipple and wrapped within a wing. It is quite difficult to see juvenile flying foxes when they are suckling under the female's wing, especially in the dark.

[9] Geoff Russell (nd) "Duck Rescue Home Page",< http://www.animalliberation.org.au/ducks.php>, citing studies by Nieman.

16. HOW FREQUENTLY ARE BABY FLYING FOXES WHICH ARE FOUND ON INJURED OR KILLED MOTHERS EUTHANASED? BY WHAT METHOD?

There is no information available on this. I suspect that babies are either not observed or disposed along with the mother without being euthanased or left on the ground. Babies are extremely hard to detach from the nipple, even for experienced carers, so euthanasia would need to be done while the animal was still attached.

INDUSTRY IMPACT

17. GIVEN THE RELATIVELY SMALL NUMBERS OF FLYING FOXES PERMITTED TO BE SHOT ON ANY ONE PERMIT PER MONTH, HOW EFFECTIVE IS SHOOTING IN REDUCING OR PREVENTING THE IMPACT OF PREDATION?

It has long been acknowledged that shooting, even when large numbers were permitted to be killed, is not an effective method of crop protection, as discussed with previous questions (also see Appendix 2). Those who claim it is effective rely on the fallacious theory of killing scouts, but in reality they probably simply do not suffer heavy flying-fox predation. As researcher Dr Len Martin says:

> We consider that the idea of "scouts" is one largely generated by fruit growers... Unfortunately, a perennial problem in evaluating efficacy of anti-flying-fox fruit-protection systems is the year-to-year variability in the pressure on flying-foxes to attack fruit crops. It is accepted that “bad” flying-fox years for growers are associated with failure of the animals’ natural food resources. Thus a grower may switch a grid on early in a “good” year, when relatively few flying-foxes are driven into orchards, and late in a “bad” year, and attribute the apparent success of early switch-on to selective killing of scouts.

There has never been any reliable assessment of the extent of crop damage/loss caused by a flying-fox. The best that can be done to assess the effects of shooting 15-30 flying-foxes per month (the number permitted under the quota, depending upon the species) is to estimate the extent of fruit that could potentially be saved by killing that number of flying-foxes. An adult flying-fox in care eats 200-350g fruit per day. If we assumed that, in addition, a flying-fox damaged that same amount of fruit, and if we assumed that all 15-30 flying-foxes were killed on the first night of the month, preventing loss of fruit for the rest of that month to those individuals, the maximum savings would be 315-630 kg fruit/month. An average lychee orchard yields 7.7 tonnes of lychees per hectare.[10] Therefore, on a 7 hectare orchard (considered the minimum commercially viable size of a lychee orchard), killing the permitted numbers of flying-foxes on the first night of the month over a period of 2 months would have saved the grower about 2% of the crop, a miniscule saving.

Potentially negating this small benefit, however, is the likelihood that other flying-foxes would move in to that area, replacing the animals shot. As noted below, in my observations on a property with electric grids, a high level of flying-fox presence and killing was maintained over a 2-week period, suggesting that other flying-foxes moved in to replace those killed. If killing is continued, the orchard functions as a ‘sink’, or as Dr Len Martin has put it, a ‘pteropucidal black hole’.

[10] C. Menzel and C. McConchie (1998). Lychee and Longan. In *The New Rural Industries:* A *Handbook for Farmers and Investors.* Rural Industries Research & Development Corporation: Canberra. URL: <http://www.rirdc.gov.au/pub/handbook/lychee.html>

18. IS THIS EFFECTIVENESS ONLY FOR THAT IMMEDIATE NIGHT, OR IS IT SUSTAINED? IF SUSTAINED, FOR HOW LONG?

The killing of flying-foxes does not bring sustained crop protection benefits. Flying-foxes are highly mobile, and so reduction of numbers in one locality by killing may be transient, as other flying-foxes move into that locality. I observed one orchard in north Queensland that was electrocuting 300-500 flying-foxes each night over a period of 2 weeks, and the numbers of flying-foxes targeting the orchard and deaths of flying-foxes were not noticeably affected by the high rate of killing.

Sustained effectiveness of killing as a method of crop protection is only realised long-term when flying-fox populations are reduced to the extent that they no longer exist in large numbers. There has in fact been considerable decline in flying-fox populations, as recognised by the listing of two species as threatened, and this has in part been caused by high rates of mortality in orchards. It was in recognition of this decline that the quota system for damage mitigation permits was introduced.

19. CAN THE BENEFIT TO INDUSTRY OF SHOOTING BE QUANTIFIED? HOW MUCH MORE DAMAGE TO FRUIT WOULD THE INDUSTRY SUSTAIN IF CONTROL BY SHOOTING WAS TO CEASE?

Some fruit growers claim massive losses to flying-foxes, so the shooting of the quota numbers would yield negligible benefit to the industry. In general, as discussed in response to other questions, killing is an ineffective method of crop protection.

APPENDIX 1: EXTRACT FROM A LETTER BY THE QUEENSLAND OMBUDSMAN, APRIL 2006

The following is extracted from a letter by the Queensland Ombudsman written to Carol Booth in April 2006, summarizing the results of an investigation of complaints made about the EPA's response to the killing of large numbers of flying-foxes on electric grids.

6 Effectiveness of the DMP system

The EPA stated in a report to the Ombudsman that:

The manner in which DMPs are considered have been improved and now provide an open, transparent and acceptable method of assessment of applications, mitigation of unacceptable levels of impact and decision making. For example, there has been a separation of powers between the assessing officer and the decision maker in the DMP assessments and decisions and, an assessment checklist has been produced using s112 of the NCA. In addition compliance monitoring and data returns are formally scrutinised.

It is not unreasonable to concur that prior to 1999 there were systemic inconsistencies in the way in which DMPs have been handled.

Some issues relating to the present effectiveness of the DMP system arose from our interviews with QPWS officers.

In general terms, the DMP system presently allows:

.permits to be issued for taking flying foxes by shooting, or

.in some cases, the use of non-lethal electric grids.

Permits are no longer issued for the use of electric grids to kill wildlife.

6.1 Reduction in number of permits

QPWS officers commented that, in their view, there had been a substantial reduction in the number of applications by farmers. They were unable to estimate the extent to which growers who had previously obtained DMPs are taking wildlife without permits. We were advised that QPWS officers continue to undertake inspections where they receive information a farmer is acting or has acted unlawfully.

It appeared to the Ombudsman that no strategic approach has been taken to investigate how farmers, who have ceased applying for DMPs, are now mitigating damage by flying foxes.

In response to the Ombudsman's provisional report, the EPA confirmed that the number of applications for DMPs is reducing and asserted that that is as a result of non-lethal deterrents becoming more widely available and cheaper to install (for example, the use of netting, smoke generators, noise or lighting). The EPA says that it undertakes strategic monitoring before and during the growing seasons. However, it did not describe the extent of the monitoring or any basis on which it measures the effectiveness of the monitoring.

Although the information and submission provided by the EPA do not provide a sufficient basis for concluding that the reduced participation of growers in the DMP system does not mean growers are taking more flying foxes illegally, the Ombudsman made the following recommendations.

RECOMMENDATION 3

The QPWS conduct an audit to ascertain the extent of the reduction in the numbers of participants in the DMP system and investigate the reasons for the reduction.

RECOMMENDATION 4

Based on the results of the audit and investigation, the QPWS develop a program to proactively inspect the properties of those persons who had previously applied for a permit but who have ceased to do so, to ascertain their present methods of wildlife control.

The Ombudsman indicated that as the farm the subject of the investigation is located in the northern region of the EPA, it would be appropriate for the audit to be conducted of growers in that region.

The EPA has indicated qualified acceptance of the recommendations and will be providing a report to the Ombudsman on implementation by 31 May 2006.

6.2 Long term viability of the DMP system

The Ombudsman's report made a number of recommendations to improve the effectiveness of the existing DMP system. Specifically, he indicated the ongoing viability of the scheme needs to be addressed having regard to the following factors:

. the confirmed reduction in the numbers of growers participating in the system;

. the small number of protected animals permitted to be taken under DMPs (including under an agreement with the Commonwealth for some species);

. the improbability that taking small numbers under DMPs offers effective crop protection;

. the difficulty in killing animals the size of flying foxes by shooting them;

. concerns about the suffering of animals not killed outright by shooting; and

. the impracticality of enforcing compliance with the terms of the permits issued.

The Ombudsman suggested it may be appropriate for the QPWS to consider phasing out the system over time.

In its response to the Ombudsman's provisional report, the EPA indicated that it had already planned to conduct a review of the DMP system and that this review is to be a priority for the 2005-2006 financial year.

The Ombudsman formed the following opinion and made the following recommendation.

OPINION

Sufficient evidence exists to question the ongoing viability of the DMP system for flying foxes.

RECOMMENDATION 5

The QPWS undertake a review to ascertain the ongoing viability of the DMP system and ensure that the review has regard to any findings from the audit conducted in compliance with my recommendations 3 and 4.

The EPA has indicated acceptance of the recommendation and will report to the Ombudsman on implementation by 31 May 2006.

6.3 Electric grids

The EPA has stated the following in relation to electric grids:

The use of electric grids to control flying foxes was ceased in 2001 and all growers that had previously used grids were informed that their use was no longer permitted. The EPA undertook an extensive surveillance program (by air and on ground) to identify the location of all grids, including any that the Agency may not have been previously aware of. A strategic compliance program involving random inspections was also conducted.

The EPA has no authority to require the removal of structures, however, the use of grids as a lethal deterrent remains unlawful. Ongoing liaison with growers has provided no evidence that the grids are being used for unlawful purposes.

The Ombudsman indicated your concern that the grids have not been disabled or dismantled and that it would be simple for farmers to activate the grids at any time.

The EPA's response to the Ombudsman's provisional report indicated that a register is held by QPWS and includes all properties for which a DMP had previously been issued for the use of electric grids in the northern region (where grids are most prevalent). The EPA also advised that it has conducted targeted compliance operations during the 2004-2005 growing season and that inspection reports are recorded.

Information provided by the EPA confirms the existence of a register listing a number of properties in the northern region. The register contains information on the grower, address, grid location, status, comments and when a DMP was issued.

Given the relatively small numbers on the register and the risk that the grids may be turned on the Ombudsman believed it would be appropriate for the EPA to inspect these growers' properties at least once annually during the growing season.

RECOMMENDATION 6

The QPWS inspect each grower's property listed on the register at least once on an annual basis during the growing season.

RECOMMENDATION 7

The QPWS record the inspection history of each property in the register.

The EPA has indicated that it has concerns with the resourcing implications of this recommendation having regard to its wider enforcement activities and risk issues. The Ombudsman is negotiating the implementation of this recommendation with the EPA.

In the Ombudsman's provisional report he stated that a longer term and more cost effective solution may be to direct the removal of the grids. This may require an amendment to legislation.

RECOMMENDATION 8

EPA investigate options to prohibit the use of electric grids and require the removal of existing grids,.. including the option of pursuing appropriate amendments to the NCA (or other relevant legislation).

The EPA has indicated that it is not yet in a position to investigate options to prohibit the use of the grids and to require the removal of existing grids. The Ombudsman is awaiting a further response from the EPA based on its consideration of the outcome of the decision of the Court of Appeal in *Booth v Frippery pty Ltd* & *Ors (2006) QCA* 74 and any subsequent decision of the Planning and Environment Court on the rehearing of the proceedings against Mervyn and Pamela Thomas.

APPENDIX 2: ON THE QUESTION OF FLYING-FOX "SCOUTS" BY DR LEN MARTIN

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I address the issue of flying-fox “scouts” by citing evidence presented at two court cases involving Queensland orchard electrocution grids, and my opinion derived from my expert witness testimony in these cases and further discussions with colleagues.

It is often asserted that an orchard electrocution grid - like shooting - protects fruit crops from flying-foxes because it selectively kills “the scouts” - a hypothetical category of animals that allegedly guide the main body of “ordinary” bats to the orchard, and without which, said ordinary bats would not find the orchard. Culling of scouts is believed to have the benefit of reducing the total cull. Thus, p.46 of (Rigden et al., 2000) relating to a North Queensland rambutan grower reads, “*The grids are switched on as soon as the fruit starts to colour up about 8 weeks before picking, this policy ensures that any scouts entering the orchard are culled. Culling the scouts ensures that other flying-foxes are not led to the orchard, thus the total cull of flying-foxes is reduced. If grids are switched on too late 50% losses can occur, when the system is used to its optimum effect losses are reduced to 2%*”.

To my knowledge there is no scientific evidence for a specific category of scouts. In this, my colleagues, Dr P. Eby and Dr L. Hall concur. We also agree that it is so impractible to do the appropriate scientific experiments that it is essentially impossible to provide the necessary scientific evidence for the existence of "scouts". We consider that the idea of "scouts" is one largely generated by fruit growers, as cited above. Unfortunately, a perennial problem in evaluating efficacy of anti-flying-fox fruit-protection systems is the year-to-year variability in the pressure on flying-foxes to attack fruit crops. It is accepted that “bad” flying-fox years for growers are associated with failure of the animals’ natural food resources. Thus a grower may switch a grid on early in a “good” year, when relatively few flying-foxes are driven into orchards, and late in a “bad” year, and attribute the apparent success of early switch-on to selective killing of scouts.

That said, the hypothesis of "scouts" is *not* consistent with what we *do* know about the navigational abilities of flying foxes and their long and short distance movments.

While flying-foxes lack the sophisticated sonar used by micro-bats to navigate and catch prey, they have large eyes and good night vision, excellent hearing and acute sense of smell. They are highly intelligent, inquisitive creatures capable of accurate long-distance navigation and of remembering specific locations. I can personally cite two cases involving *juvenile* flying-foxes. One orphan carer-reared youngster escaped by accident in the northern suburbs of Brisbane. It had returned to its "home" in the southwest suburbs of Brisbane within a few days. In the second case, an apparently abandoned juvenile found on a house verandah in one Brisbane suburb was returned to its putative human carer's home some suburbs away, only to be found on the same distant verandah the next day.

Radio-tracking research (Eby, 1991, 1996) has demonstrated that individual flying-foxes can return precisely to specific locations, after long periods of time, and over long distances. In other words, flying-foxes have an excellent spatial sense and spatial memory - maps-in-the-mind, as it were. Eby’s research gives no support to the theory that specific “scouts” lead other bats into orchards. On the contrary it indicates that all flying-foxes are individually capable of locating their own food sources.

Other radio-tracking studies described at the recent Bat Conservation Symposium demonstrated how individuals from the Sydney Botanic Gardens colony would each fly to its own specific tree over several nights. This is entrely consistent with my own numerous observations of animals flying out from the Indooroopilly colony - widely dispersed across the sky, the flight lines radiating out in all directions, with animals at widely differing heights - the highest apparently purposefully continuing off into the distance, the lower ones, slower, peeling off, circling and descending with great precision into local trees to feed. Frequently an individual would appear in the one patch of blossom each night at roughly the same time.

Clearly, individual flying-foxes will vary in their navigational and food-finding abilities and presumably older and more experience animals will be more competent, and inexperienced animals may well follow them. Thus these data and observations do not exclude the possibility of *some* knowledge sharing, or of *some* leadership, but indicate that orchard attacks are not *dependent* on the hypothetical "scouts", as many fruit-gowers seem to believe.

Perhaps the best evidence against the importance of hypothetical scouts comes from the two orchard electrocution grids involved in the court cases. Firstly it must be emphasised that such grids *do* kill many flying foxes. But are they effective in protecting fruit crops? Effective protection might support the scout hypothesis.

The affidavit from the respondent in one case states, "*Since 1986 I have... maintained electric fences... There are now... 14 erected electric fences... and consist of 20 verticle [sic] wires from 4.4 metres to 9 metres in height. The total length of fences is 6.4km... The fences are operated during the harvesting season only. In the current year... from 2 November 2000 until the end of the harvest... This amounts to less than eight weeks operation... about my average use... On average the orchard yields approximately 250 tonne... per year. The actual yield... fluctuates between nil and 450 tonne... To date [12 December 2000] we have harvested between 75% and 80%... The financial break even point... this year will be... the sale of approximately 100 tonne of fruit... I am expecting a harvest of only 70 - 75 tonne... The low harvest... is mostly due to... flying-fox raids. I estimate the loss of fruit this year attributable to the flying-fox raids to be in the vicinity of 100 to 120 tonne*" [my emphases].

So, despite use of grids from November 2 onwards, there were crop losses of "100-120 tonne" attributed to flying-foxes. A loss that indicates that, despite use of the grids, large numbers of flying-foxes continued to enter the orchard and feed even though the grids were on and killing many bats - and presumably any putative scouts.

This was corroborated by counts of freshly dead bats made in this orchard. Four once-nightly counts of newly-killed bats (made over a two week period) were: 409, 499, 305 and 297, giving a mean ± standard deviation of 378 ± 96 bats per night, and 95% confidence limits of 226-530 (ie., 95% probability that the mean lies within these limits). It is noteworthy that the grid had operated for some weeks before the first counts were made and a large number of bats were *still* being killed two weeks after the first counts were made, indicating that the grid had had no measurable deterrent effect on the flying-fox population attracted to this orchard. The numbers counteract the theory that "selective" killing of hypothetical "scouts" reduces flying-fox incursions into orchards.

It is apparent from the Appellants' evidence in the second case, that significant crop losses regularly occurred despite use of grids. For example they describe, "*The damage suffered by the Appellants to their crops each year from flying-fox invasions*", and refer to, "*having identified in their permit application a monetary loss of up to $10,000 and in previous applications losses of up to $40,000*". These statements indicate that large numbers of bats were involved, and make one query the likely

effectiveness of killing 75 bats (the number requested by the appellants for their damage mitigation permit) over a period of 92 days - less than one hypothetical scout per night. Just isn't realistic.

I conclude that, on the balance of probabilities, the hypothesis of "scouts" is not supported, and that any method of killing flying-foxes in or around orchards, whether by shooting or electrocution - will not be an effective deterrent (dead bats don't learn!) and will also be indiscrimate in killing old and young, male and female, pregnant and nursing females alike. Given that the birthing and suckling season of three of our four species of flying-fox coincides with the fruit harvesting season, (McIlwee and Martin, 2001; Martin and McIlwee, 2002) it is likely that a high proportion of animals entering orchards in search of food will be lactating mothers with young attached, or left in a creche. This raises the issue of cruelty to the young. In the event of death or injury of females with young attached, many of the latter may survive, albeit with the injuries, to die slowly of trauma and starvation and in considerable pain. Orphaned young in the creche will simply die by starvation.

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APPENDIX 3: INFORMATION ABOUT BODY DENSITY BY JENNIFER PARSONS

How would the frequency of injurious, non-lethal shots compare between flying fox and duck shooting?

The shooting of ducks for recreation and as an agricultural control measure has led to controversial ethical debates about the humane nature of shooting (Bennet and Whitten, 2003). There is evidence that a high proportion of shooting attempts result in a high rate of wounding instead of direct kills, and that these wounds cause pain and suffering to the injured birds (Norton and Thomas 1994). Here I provide information on aspects of flying fox physiology that may contribute to the likelihood of non-lethal shots occurring when shooting is used as a control method in orchards.

Unlike birds, flying foxes do not possess pneumatised bones or air sacs making them much denser (in the true sense of mass per unit volume). In addition, the body mass of a flying fox substantially exceeds that of a similarly sized bird (see Table 1). This finding is supported by my PhD research which is looking at the impact of flying foxes to the aviation industry. Flying foxes are rated much higher on the scale of damage caused to aircraft. While similar sized birds such as the galah (Cacatua roseicapilla) rate at around a 17.5% likelihood of causing major damage upon striking an aircraft, flying foxes cause major damage in around 25% of bat strike cases (ATSB, unpubl. data).

Owing to their denser bodies, flying foxes are therefore likely to suffer a higher rate of non-lethal shots than would similarly sized birds such as ducks, all other factors being equal. This will be so because shots will not penetrate flying fox muscle mass to the same extent as they would in less dense bodies such as ducks.

Other considerations when estimating the likelihood of flying foxes being subject to non-lethal shots are: the shooting occurs at night when shooter vision is impaired; shooting also takes place in orchards where trees will also impair vision; and flying foxes have a large wing span compared to their actual body size. For example, the little red flying fox (Pteropus poliocephalus), a small flying fox, has a wing span that can range from 815 – 1005mm and a head to body length of 122 – 200mm (Churchill 1998).

Please do not hesitate to contact me for any further information

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Table 1 – Mass of Australian flying fox and bird species of similar size . Flying fox weights from Churchill (1998) and bird weights from Garnett (unpubl. data).

Type	Species Name	Common Name	Mass (g)	Mean
BAT	Pteropus poliocephalus	Grey-headed flying fox	700 - 1000	645.25
BAT	Pteropus alecto	Black flying fox	590 - 880	
BAT	Pteropus conspicillatus	Spectacled flying fox	500 - 850	
BAT	Pteropus scapulatus	Little Red flying fox	142 - 500	
BIRD	Podargus strigoides	Tawny frogmouth	123 - 555	305.1667
BIRD	Vanellus miles	Masked lapwing	191 - 410	
BIRD	Ninox novaeseelandiae	Southern boobook	182 - 370	