

Sustainable Management of the Grey-headed Flying-fox *Pteropus poliocephalus*

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ABSTRACT

The Grey-headed Flying-fox *Pteropus poliocephalus* is a large (to 1000 g) bat, endemic to coastal, south-eastern Australia (Queensland, NSW, Victoria). Sustainable management of *P. poliocephalus*, recently listed at State and Federal level as Vulnerable, must ensure its conservation in perpetuity - and cost-effective and environmentally and socially acceptable ways of minimising conflicts with people in rural and urban contexts. Exclusion netting can achieve this in some, although not all, orchard situations but is usually inappropriate for managing camp occupation. There is a need for the development of approaches, other than netting, to suit a variety of problem situations. Attainment of this goal has been constrained by factionalisation of stakeholders at community and government levels, inadequate resourcing and ineffective evaluation and communication. Little attention has been directed toward the apparent ability of flying-foxes to learn – and, hence, the possibility of training flocks to avoid certain areas. Potential effects could be long-lasting given the *P. poliocephalus* life-span of at least 13 years. Adequate funding, coupled with effective communication across communities and governments, could enable development and uptake of much-needed, best-practice flying-fox management through participatory trials and rigorous and transparent monitoring.

Key words: adaptive wildlife management, flying-fox, *Pteropus*, cross-jurisdictional/community coordination, affordable, acceptable

Introduction

With colleagues, I have reviewed Australian flying-fox management problems, and practices to mitigate them, in several recent papers (Sinclair *et al.* 1996; Webb and Tidemann 1996; Tidemann *et al.* 1997a, b; Tidemann and Vardon 1997; Vardon *et al.* 1997; Tidemann 1999; Vardon *et al.* 2001). In this paper I summarise those findings (many of which are echoed in other papers in this proceedings), and present results from a trial to exclude flying-foxes from camping in a rainforest patch at Maclean on the lower Clarence River in northeastern NSW, to inform future developments.

Flying-fox Management in the 20th Century

Until late in the 20th Century, when flying-foxes were afforded legal protection in all Australian States and Territories, little effort and few resources were directed toward finding solutions to flying-fox problems that took account of conservation or animal welfare issues. Monitoring was often inadequate for evaluation of their effectiveness. Responsibility for control (and, hence, resourcing) rested essentially with those experiencing the problems – until recently, predominantly fruitgrowers protecting crops (Tidemann *et al.* 1997a; Tidemann and Vardon 1997). Exclusion netting has proved to be cost-

effective in many orchard contexts, although unfortunately it is not applicable in all – nor for preventing camps from establishing in inopportune locations (see next section and other papers this volume).

Use of urban areas of eastern Australia by flying-foxes appears to have increased since protection, although it is not known whether this is due to diminishing rural and increasing urban habitat, increasing numbers of flying-foxes, or perhaps all three (Birt *et al.* 1998; Tidemann 1999; Eby this volume). Whatever the case, land managers in urban and peri-urban areas are increasingly being required to manage flying-fox camps and associated problems (urban nuisance from noise and smell; tree damage; human and livestock health risk; interruption to power supplies). Similarly, the cultivation of an increasing variety of fruit across an expanding area of Australia (see other papers this volume), means that flying-fox problems with fruit orchards are also likely to intensify with a population that, hopefully, is recovering from many years of indiscriminate persecution.

The Maclean Trial

One recent trial to resolve flying-fox management problems in a benign fashion was made at Maclean, NSW (29°28'S; 153°12'E) to deter flying-foxes from camping in a rainforest patch – and elsewhere in the Maclean township - with the presentation of orchestrated noise. The trial was initiated in April 1999; a description of methods and preliminary results were presented by Tidemann (1999). Figure 1 illustrates subsequent results, expressed as the requirement (person-hours) for noise generation over time, as dictated by flying-fox re-occupation attempts. Although the number of animals involved in these reoccupation attempts is not known, it can be seen that the requirement for noise generation at Maclean has progressively decreased since April 1999. There is some anecdotal evidence that an alternative camp-site (Farlows Swamp) is being used by increasing numbers of animals (J. Little, Maclean High School Parents and Citizens Association personal communication 2001, 2002; N. Sutton, Maclean Shire Council personal communication 2001, 2002), although this has not been formally quantified.

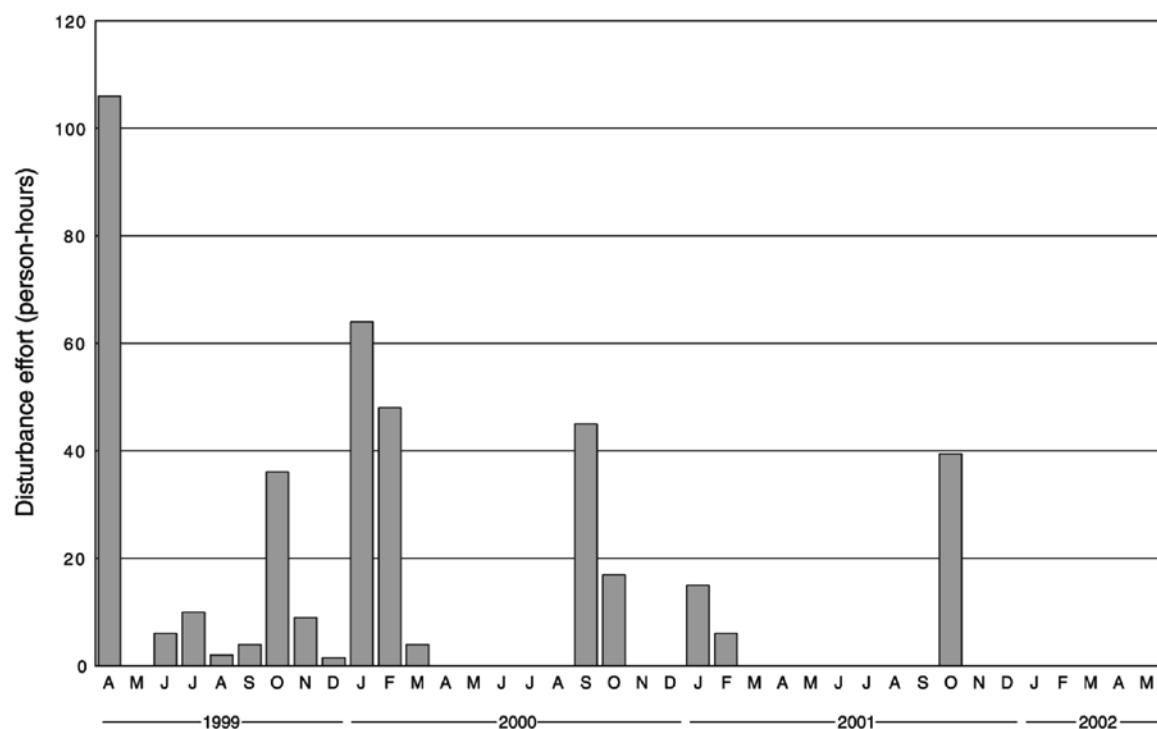


Figure 1. Requirement for noise generation (person-hours) over time, as dictated by reoccupation attempts, to exclude flying-foxes from camping in Maclean rainforest and township. Data supplied by Maclean Shire Council.

It is unfortunate (see section below) that the Maclean trial was carried out with sub-optimal monitoring, and that effort was not made simultaneously to attract flying-foxes (a carrot and stick approach to training) to a nearby alternative site, through devices such as caged animals, broadcast calls and faecal matter sprayed onto foliage. Only time (and better monitoring) will tell whether the Maclean trial has been a success, but the results suggest that it may be possible to persuade flying-foxes to move camps over short distances - if a suitable alternative camp-site is available, and if they are given clear and persistent messages that they are not welcome. Circumstantial evidence indicates strongly that flying-foxes of many species have the capacity to move camp adaptively over short distances to avoid localised disturbance (Tidemann *et al.* 1999). Opinion is still divided on whether camps can be deliberately moved to minimise management problems, and how long these effects (if any) are likely to persist (see Hall this volume; Richards this volume).

In evaluating the evidence on whether camps can be moved in a purposeful fashion, and how long potential effects may persist, it should be recognised that many attempts to move flying-fox camps in the past have been carried out with even less monitoring and documentation than at Maclean. Over and above this deficiency, the results are almost certainly confused by differing availabilities of alternative camp-sites, use of different aversive stimuli, presented in different patterns and at different stages of the reproductive cycle - and, hence, probably, with widely varying susceptibilities to relocation. Overall, it is extremely difficult, perhaps impossible, to unravel the contribution of different sources of variability to many previous attempts to move camps. Guidelines for moving camps have recently been released in two of the range States of *P. poliocephalus* (Queensland Parks and Wildlife Service 2001; Department of Natural Resources and Environment Victoria 2001) - it is to be hoped that future trials will be better coordinated and resourced to inform future management.

The extreme mobility of *P. poliocephalus* (Eby 1991a, b; Webb and Tidemann 1996; Tidemann 1999) means that for monitoring to be optimally informative, it needs to be conducted at a scale well beyond the capacity of individuals operating in isolation - a compelling reason for flying-fox management to be made cooperative. Ideally, these activities should be evaluated at catchment

level or beyond (see Eby 1995; Tidemann 1999; Palmer *et al.* 2000; Vardon *et al.* 2001 for discussion of appropriate scales). In addition to being highly mobile, some *P. poliocephalus* are also long-lived. Tidemann (1999) reported a mean (\pm SD) age at death of 40.4 ± 18.8 months for banded wild animals and a maximum age of 96 months. Since then, a banded *P. poliocephalus* has been recovered at 12.8 years of age (Tidemann unpublished data) and two captive individuals have survived for over 20 years (H. George personal communication 2000).

It seems probable that some *P. poliocephalus* survive until well into their teenage years - and if the behaviour of such individuals affects others (as also seems likely), they may serve as an important repository of learnt behaviours in the population (see Tidemann 1999 for discussion). If indeed it is possible to train flying-foxes to avoid particular signals, the effects could be long-lasting because of their longevity - and far-reaching because of their mobility. Perhaps also, it would be possible in some contexts, to redirect or manage the seed-dispersal activities of flying-foxes (Eby 1998; Palmer and Woinarski 1999; Palmer *et al.* 2000) to enhance environmental reconstruction in degraded areas.

Resolving Conflict

In spite of the likelihood that flying-fox management will become more problematic as a consequence of conserving flying-foxes, some individuals in the community have attempted to deny the existence of problems. This, in turn, has led to alienation of other significant stakeholders (those paying for control), which has been strongly inimical to achieving participatory management, with communities and governments working together. Also evident has been a tendency toward opposition to management intervention of any sort, in some cases even exclusion netting (Tidemann *et al.* 1997a; Tidemann and Vardon 1997; Tidemann 1999). Opposition to change, and trials to inform it, has greatly hampered implementation of adaptive management - the development of improved practices through iterative, small-scale, trials, informed by rigorous monitoring (Walters 1986).

The Maclean trial, for example, was delayed by two costly and unprofitably divisive legal disputes, and greatly constrained in its cost-effectiveness by on-site protestors and a

subsequent refusal on the part of community-based bat counters to release data for monitoring purposes - even when it became clear that unmanaged camping by flying-foxes had effectively destroyed a small, but significant rainforest remnant (Tidemann 1999). Similarly, recent attempts to trial non-lethal, electric barriers to exclude flying-foxes from orchards in Queensland have been hampered by opposition, apparently because of a misunderstanding of the nature of electric fencing, which has been used for many years to cost-effectively and benignly contain valuable domestic animals and wildlife (Tidemann unpublished data; H. Spencer Cape Tribulation Tropical Research Station personal communication 2001).

There have been many attempts to deter flying-foxes from feeding in particular areas in the past, and there are strong indications that particular techniques work under certain circumstances (see Tidemann *et al.* 1997a; other papers this volume). It is unfortunate that these trials, so far, have been largely uncoordinated, and monitoring has often been sub-optimal. However, there seems enough evidence to indicate that a coordinated, adaptive and participatory approach may yield solutions to the problem of flying-fox depredations in orchards that could be cheaper to install and maintain than enclosure netting.

One safe, inexpensive and simple (if licensing requirements were modified to allow it) trial would be to determine if plastic shot could be used to deter flying-foxes from feeding in orchards. Biodegradable, plastic shot would be far less polluting than lead and the use of silenced shotguns, the only type allowed by law in many European countries, could minimise noise pollution - although it may be necessary to replace the likely role of sound, in the conditioning process, with other aversive stimuli. Plastic shot, in conjunction with capsicum spray has been used to move camps of Little Red Flying-foxes *P. scapulatus* and Black Flying-foxes *P. alecto* over short distances in the Northern Territory (P. Hauser Parks and Wildlife Commission of the Northern Territory personal communication 2001). It could prove to be a simple and acceptable technique for mitigating flying-fox damage in small orchards, or where damage was too sporadic to make netting an economically viable solution.

What is needed for progress is sound information as a basis for rational and factual dialogue - and rigorous trials and transparent monitoring and reporting of outcomes. Sustainable flying-fox management clearly needs to conserve flying-foxes in perpetuity - but it must also resolve problems that may arise from this activity, by enlisting the support and collaboration of the people who experience them. "Monitoring should be a hypothesis-testing exercise that through time allows management to be improved as alternative management responses (hypotheses) are excluded" (Murphy and Noon 1991). Education can be used to enhance flying-fox conservation, but it needs to present solutions to problems, as well as the benefits of conserving flying-foxes. "With more than 60 per cent of Australia's land area under private management, conservation cannot be adequately addressed without private sector participation." (Productivity Commission 2001).

Until very recently, there has been little Australia-wide (i.e. Commonwealth) expenditure of resources to develop solutions to flying-fox management problems, other than the landmark study of Francis Ratcliffe (1931) and a recent overview of bat conservation problems (Duncan *et al.* 1999). This, however, seems likely to change, with the listing, by the Commonwealth, of *P. poliocephalus* (6 December 2001) and *P. conspicillatus* (14 May 2002) as Vulnerable Species (Environment Australia, 2002). Flying-fox problems span five Australian States or Territories (Tidemann and Vardon 1997) and, although different species dominate in each State (Duncan *et al.* 1999), most problems are generic. Resolution of one set, therefore, could (and arguably should) be used to inform resolution of others (Tidemann 1999). Coordination of activities at a continental scale would greatly expedite the development of sound management practices.

Notwithstanding obstacles to achieving sustainable flying-fox management in Australia, the recent establishment of three State-based, consultative groups to develop sustainable solutions to management (including conservation) problems in Queensland (1999), NSW (2001) and Victoria (2001) suggests that there now exists an unparalleled opportunity to make significant headway. Wide dissemination of Australian results could inform much-needed participatory, adaptive management of flying-foxes at a global level (Mickleburgh *et al.* 1992).

References

- Birt, P., Markus, N., Collins, L. and Hall, L. 1998. Urban Flying-foxes. *Nature Australia*, Spring 1998: 55-59.
- Department of Natural Resources and Environment Victoria. 2001. *Options for the Establishment of an Alternative Campsite for the Grey-Headed Flying-Fox, Pteropus poliocephalus, in Melbourne - Executive Summary*. [http://www.nre.vic.gov.au/web%2Froot%2Fdomino%2Fcm_da%2Fnrenpa.nsf/frameset/NRE+Plans+and+Animals?OpenDocument&\[/WEB/ROOT/DOMINO/CM_DA/NRECPA.NSF/aa87793615edb5d24a256a61000b5d9a/913248a053bbae784a256ae1000210b3?OpenDocument\]](http://www.nre.vic.gov.au/web%2Froot%2Fdomino%2Fcm_da%2Fnrenpa.nsf/frameset/NRE+Plans+and+Animals?OpenDocument&[/WEB/ROOT/DOMINO/CM_DA/NRECPA.NSF/aa87793615edb5d24a256a61000b5d9a/913248a053bbae784a256ae1000210b3?OpenDocument]) (6 December 2001).
- Duncan, A., Baker, G.B. and Montgomery, N. (eds.) 1999. *The Action Plan for Australian Bats*. Environment Australia, Canberra.
- Eby, P. 1991a. Finger-winged night workers: managing forests to conserve the role of Grey-headed Flying Foxes as pollinators and seed dispersers. Pp. 91-100 in *Conservation of Australia's Forest Fauna*, edited by D. Lunney. Royal Zoological Society of New South Wales, Mosman.
- Eby, P. 1991b. Seasonal movements of grey-headed flying-foxes, *Pteropus poliocephalus* (Chiroptera: Pteropodidae), from two maternity camps in northern New South Wales. *Wildlife Research* 18: 547-559.
- Eby, P. 1995. *The Biology and Management of Flying-foxes in NSW. Species Management Report 18*. NSW National Parks and Wildlife Service, Hurstville.
- Eby, P. 1998. An analysis of diet specialization in frugivorous *Pteropus poliocephalus* (Megachiroptera) in Australian subtropical rainforest. *Australian Journal of Ecology* 23: 443-456.
- Environment Australia. 2002. <http://www.ea.gov.au/biodiversity/threatened/species/index.html> (6 June 2002).
- Murphy, D. D. and Noon, B.D. 1991. Coping with uncertainty in wildlife management. *Journal of Wildlife Management* 55: 773-782.
- Palmer, C., Price, O. and Bach, C. 2000. Foraging ecology of the black flying fox (*Pteropus alecto*) in the seasonal tropics of the Northern Territory, Australia. *Wildlife Research* 27: 169-178.
- Palmer, C. and Woinarski, J. C. Z. 1999. Seasonal roosts and foraging movements of the black flying fox (*Pteropus alecto*) in the Northern Territory: resource tracking in a landscape mosaic. *Wildlife Research* 26: 823-838.
- Productivity Commission. 2001. *Harnessing Private Sector Conservation of Biodiversity*, Commission Research Paper. AusInfo, Canberra.
- Queensland Parks and Wildlife Service. 2001. *Managing Flying-fox Colonies in Urban Areas*. QPWS Policy WL – 3.2.3. Queensland Parks and Wildlife Service, Brisbane.
- Ratcliffe, E. N. 1931. The flying fox (*Pteropus*) in Australia. *Council for Scientific and Industrial Research Bulletin* 53: 1-81.
- Sinclair, E. A., Webb, N.J., Marchant, A.D. and Tidemann, C.R. 1996. Genetic variation in the Little Red Flying-fox, *Pteropus scapulatus* (Chiroptera: Pteropodidae): implications for management. *Biological Conservation* 76: 45-50.
- Tidemann, C. R. 1999. The biology and management of the Grey-headed Flying-fox, *Pteropus poliocephalus*. *Acta Chiropterologica* 1: 151-164.
- Tidemann, C., Kelson, S. and Jamieson, G. 1997a. Flying fox damage to orchard fruit in Australia - incidence, extent and economic impact. *Australian Biologist* 10: 177-184.
- Tidemann, C. R. and Vardon, M.J. 1997. Pests, pestilence, pollen and protein: the need for community-based management of flying-foxes in Australia. *Australian Biologist* 10: 77-83.
- Tidemann, C. R., Vardon, M.J., Nelson, J.E., Speare, R. and Gleeson, L.J. 1997b. Health and conservation implications of Australian bat *Lyssavirus*. *Australian Zoologist* 30: 369-376.
- Tidemann, C. R., M. J. Vardon, R.A. Loughland and P. J. Brocklehurst. 1999. Dry season camps of flying-foxes (*Pteropus* spp.) in Kakadu World Heritage Area, north Australia. *Journal of Zoology, London* 247: 155-163.
- Vardon, M. J., Brocklehurst, P.J., Woinarski, J.C.Z., Cunningham, R.B., Donnelly, C.F. and Tidemann, C.R. 2001. Seasonal habitat use by flying-foxes, *Pteropus alecto* and *P. scapulatus* (Megachiroptera), in monsoonal Australia. *Journal of Zoology, London* 253: 523-535.
- Vardon, M.J., Simpson, B.K., Sherwell, D. and Tidemann, C.R. 1997. Flying-foxes and tourists: a conservation dilemma in northern Australia. *Australian Zoologist* 30: 310-315.
- Walters, C. 1986. *Adaptive management of renewable resources*. McGraw-Hill, New York.
- Webb, N. J. and Tidemann, C.R. 1996. Mobility of Australian flying-foxes, *Pteropus* spp. (Megachiroptera): evidence from genetic variation. *Proceedings of the Royal Society of London, Series B* 263: 497-502.

QUESTIONS & ANSWERS

PEGGY EBY: I know there will be questions.

JANET UDEN: (Wildlife Ark) I'd like to ask Mr Tidemann, the heritage vegetation that you mentioned, would this be alluding to the Botanical Gardens down in Melbourne?

CHRISTIDEMANN: It would.

JANET UDEN: Well, I was recently down there and went through Fern Gully and didn't see any evidence of the six trees that they claimed they've taken out due to flying fox damage, and the 8,000 [flying-foxes] that were reported to be in there at that time, as far as I could tell, were about 2,000.

CHRISTIDEMANN: I don't speak for the Melbourne Botanic Gardens, or the Victorian government. I have seen some evidence of damage there. I have seen a lot more evidence of much more serious damage elsewhere. There is no doubt in my mind that flying foxes can and do, under certain conditions, cause damage to trees.

JANET UDEN: Right. Well, the trees that I noticed in the gardens that had been damaged were two poplars, a fig and a lillipilli. Now, the poplars aren't indigenous to Australia and I would question, you know, whether heritage trees such as those are worth killing the bats for.

PEGGY EBY: We're confining our discussions to New South Wales today. Thank you very much, however.