Annual Review of the

NPWS Policy on Flying-fox and Mitigation of Commercial Crop Damage for the

2000 - 2001 Fruit Growing Season

Acknowledgments

This report was prepared by Kelly Waples, Wildlife Management Unit, Biodiversity Research and Management Division, with the assistance of numerous Regional and Head Office staff. Regional staff from the South Coast, Sydney South, Sydney, Sydney North, Blue Mountains, Central Coast/Hunter Range, Hunter, North Coast, and Northern Rivers have provided the data presented in this report.

1 Introduction

There has been conflict between flying-foxes and fruit growers in Australia since European settlers began growing fruit trees (Tidemann *et al*. 1997). Although flying-foxes feed preferentially on the fruit, blossoms and nectar of native vegetation, when natural food resources are scarce, they may seek out alternative food resources. This often places flying-foxes into competition with fruit growers in agricultural and urban areas and has led to loss or damage to commercial and domestic fruit crops. A variety of management techniques have been used over the years by farmers to address this problem including mass exterminations of flying-foxes (Lunney and Moon 1994) and the adoption of various deterrents (e.g. noise, smell, lights) to reduce damage. However, the most consistently used and widespread method has been shooting flying-foxes either in the orchard as they attack fruit crops, or at a local camp (Loebel and Sanewski 1987).

There are 3 species of flying-fox with ranges in NSW, the Black Flying-fox *Pteropus alecto,* the Little Red Flying-fox *Pteropus scapulatus* and the Grey-headed Flying-fox *Pteropus poliocephalus*. While all three species will forage in fruit crops, the Grey-headed Flying-fox is most often implicated by farmers. The term 'flying-fox' in this report will refer to all 3 species except where specified.

Flying-foxes have been protected under NSW legislation since 1986. Since that time legal harm to flying-foxes may only occur where a licence is issued by NSW National Parks and Wildlife Service (NPWS) under s121 or s120 of the *National Parks and Wildlife Act 1974* (NPW Act).

In 1995 the Black Flying-fox was listed as a vulnerable species under the *Threatened Species Conservation Act 1995* and licences were no longer issued to harm this species. A brief moratorium was placed on the issue of licences to harm all species (including the Grey-headed and Little Red Flying-fox) in 1997. This moratorium ended prior to the 1998 fruit growing season in conjunction with the development and implementation of the NPWS *Policy on Flying-fox and Mitigation of Commercial Crop Damage* (Mandelc 2000). In the Policy NPWS advocates the use of exclusion netting as the only reliable means to avoid crop damage by flying-foxes. However, it is understood that netting is not always feasible for all farmers and the NPWS Policy includes provisions for licences to be issued under s121 of the NPW Act to harm a limited number of the Grey-headed and Little Red Flying-fox by gunshot only. Licences have been issued with the proviso that farmers are to shoot to scare and it is accepted that this practice will lead to some direct and/or indirect mortality. The Policy requires preparation of an annual Statewide report after the completion of the fruit growing season. This report assesses the licensed activity of that season and draws comparison with previous seasons to develop the NPWS's understanding of flying-fox distribution and the impact both on the farming community and on the flying-fox population. Recommendations are made to amend the policy where necessary.

This Policy is a component of a broader conservation and management strategy on flying-foxes which will be developed by the NPWS in consultation with key stakeholder groups. In addition to damage mitigation, the strategy will consider, for example, roost site management on and off Service estate, conservation of foraging habitat and the integration of these factors into environmental planning and assessment processes.

A review of the implementation of the Policy was prepared after the 1998/99 and 1999/00 seasons (Mandelc, 1999, 2000) and a number of recommended changes were made to the policy based on these 2 years of information.

In November 2000, the NSW Scientific Committee made a preliminary determination to list the Grey-headed Flying-fox as a vulnerable species. As a result the NPWS Policy was

amended to limit the length of licenses to a maximum of 30 days, pending a final determination. This measure was taken to ensure that no long-term licence would be in operation when a final determination was made. In May 2001 the NSW Scientific Committee made a final determination to list the Grey-headed Flying-fox as a vulnerable species. This has several management implications for NPWS, namely the current policy is no longer appropriate for the Grey-headed Flying-fox. This report will present the Statewide summary of licensed activity under the current NPWS Policy in the 2000/01 fruit season and will draw comparisons over the last 3 fruit seasons. Finally, future direction for management will be discussed.

2 Review Summary

Below is a summary on s121 (Occupier's) and s120 (General) licences issued in the 2000/01 fruit growing season. Information is provided on the number of licences issued, the number and species of flying-fox permitted to be harmed and the number actually harmed according to return sheets provided by licensees and the type of crop and area affected according to initial licence applications. A summary of information by Region and State is presented in Table 1.

Although accurate information is available on the number of licences issued and the number of flying-foxes allowed to be harmed, not all return information requested of farmers was supplied either on the original application (e.g. type and area of crop) or on the flying-fox record sheet (e.g. number, gender and species of flying-fox harmed). Thus, numbers applying to actual counts and estimates of animals harmed and crops damaged are minimum estimates at best.

This Policy has been in use by the NPWS since the 1998/99 season and comparison is made between the three years on the distribution and extent of crop damage and licensed harm to flying-foxes. This comparison highlights the variation that occurs between years both in the scale and intensity of damage, thus caution should be exercised in interpreting these figures for any single year in future management.

2.1 State-wide Results 2000/01

2.1.1 Licence numbers

- A total of 67 s121 licences were issued to 59 growers between September 2000 and May 2001. Eight growers were issued with second licences. These 67 licences authorised the shooting of a maximum of 2313 Flying-foxes.
- Northern Rivers Region, Northern Directorate, issued more licences than any other Region (28% of all licences) which accounted for 39.5% of the total number of animals authorised to be harmed State-wide.
- Joint property inspections were undertaken by NSW Agriculture and NPWS staff to confirm damage by flying-foxes on 5 of the 8 properties that applied for a second s121 licence and confirmed damage to between 20 and 80% of the crops inspected.

2.1.2 Affected Crops

- The s121 application form requests information on the area of total fruit crop potentially vulnerable to flying-fox damage and on the area damaged. 46 farmers (78% of licensees) reported a total of 417.3 hectares of fruit trees susceptible to damage.
- 61% (28) of these 46 applicants had 5 ha or less of fruit crops. The largest crop area identified was 57 ha, and the smallest 0.5 ha.
- In all, 44 farmers reported a total of 263.0 ha of damage on first application (63% of the reported crop area).

- 50% (22) of these 44 applicants reported crop damage of 2 ha or less at the time of their 1st licence application.
- The fruit crops identified as damaged were: stonefruit (including nectarine and peaches), guava, lychee, mango, banana, avocado, coffee, cherry and apple.
- Statewide damage per crop, as reported by 44 growers, was: stonefruit=210 ha, guava=8 ha, lychee=43 ha and coffee=0.5 ha.
- The largest area of crop identified as damaged, under a single licence was 40 ha, and this amount of damage was reported for 2 stonefruit crops and one lychee crop. The minimum area of reported damaged was 0.5 ha of coffee.

2.1.3 Licencees – Flying-fox Record Sheet (FFRS)

- 61% (41) of FFRS were returned.

2.1.4 Flying-foxes harmed

- Under the authority of 67 licences, 2313 flying-foxes were licensed to be harmed.
- This consisted of 1793 Grey-headed Flying-foxes (GHFF); 430 Little red Flying-foxes (LRFF) and 90 of either species.
- 1114 flying-foxes were shot as reported in the 45 FFRS returned.
- This consisted of 864 GHFF; 88 LRFF; and 169 unidentified.

2.1.5 Section 121 Licence Duration

- The maximum duration of a licence was 141 days.
- The minimum period was 5 days.
- 40 licences (60%) were issued for 2 months (62 days) or less and 24 of these were issued for 1 month or less (31 days).
- The earliest licence issued was on 17 September 2000 and latest licence issued was 1 May 2001 (both were issued in the Northern Directorate).

2.1.6 Section 120 licences to shoot flying-foxes

- 29 s120 licences were issued to 19 properties.
- the number of s120 licences issued per s121 licence ranged from 0-5

2.2 Regional Results 2000/01

2.2.1 NPWS Northern Directorate

- 4 Areas in 3 Regions of Northern Directorate issued licences under this Policy. Overall, 26 licences were issued to 22 properties (4 second licences were issued).
- Information on crop, area and area of damage was provided by 17 applicants. A total of 154 ha of fruit crop were covered by the 17 licenses and 74.1 ha were reportedly damaged at the time of first application. Regional totals for area of crop and (area damaged) by crop type were approximately: stonefruit= 89.7 (22.6), guava= 16 (8), and lychee= 48 (43) and coffee ? (0.5).
- Lychee and guava crops were unique to Northern Directorate. Damage to crops containing banana, mango and avocado were also reported, however no figures were provided on crop area or damage.
- The largest area of crop identified as damaged, at the time of a licence application was 40 ha of lychee; and the minimum area was 0.5 ha of coffee.
- 18 FFRS (69%)were returned.
- Licences were issued to harm up to 1050 flying-foxes (i.e. 620 GHFF; 430 LRFF).
- FFRS indicated 378 flying-foxes were shot (163 GHFF; 88 LRFF; 127 unk).
- 82% (14) of 17 applicants had a total of 5 ha or less of fruit crops.
- The average duration of a s121 licence was 45 days with a range of 5 to 86 days.
- 36% (8) of s121 licensees had 1 s120 licence issued for use on their property.

2.2.2 NPWS Central Directorate

- 5 Areas from 5 Regions in Central Directorate issued licences. Overall, 39 s121 licences were issued to 36 properties (3 second licences were issued).
- Information on crop, area and area of damage was provided by 28 licensees. 260 ha of fruit crop were covered by the 28 licenses and 186 ha of damage was reported on first application. Regional totals for area of crop and (area damaged) by crop type were approximately: stonefruit= 258.1 (184.5); loquat= 1.5 (1.0). Cherry and apple crops were reported from one orchard, but no information was given on total crop area or damage. Loquats were unique to Central Directorate.
- The largest area of crop identified as damaged, at the time of a licence application was 40 ha of stonefruit; and the minimum area was 0.2 ha of stonefruit.
- 25 FFRS (64%) were returned.
- Licences were issued to harm a maximum of 1223 flying-foxes (i.e. 1133 GHFF; 90 either GHFF or LRFF).
- FFRS indicated 715 were shot (680 GHFF, 35 unk).
- 46% (13) of 28 applicants had a total of 5 ha or less of fruit crops.
- The average duration of a s121 licence was 71 days, range 17-141 days.
- 14 s120 licences were issued to 9 properties.
- The number of s120 licences issued per s121 licence ranged from 0-3.

2.2.3 NPWS Western Directorate

- No licences were issued this season.

2.2.4 NPWS Southern Directorate

- One Area in Southern Directorate issued licences this season. Two licences were issued to one property.
- The licensee indicated the total area (ha) of crop was 3.4 ha, with 3.4 ha of damage reported on application.
- The crop was stonefruit.
- Two FFRS (100%) were returned.
- Licences were issued for 40 GHFF.
- FFRS indicated 21 GHFF were shot.
- Licences were issued for 113 and 32 days respectively.
- 5 s120 licences were issued for this property

Table 1 Summary of information from licence applications and licences issued I the 2000/01 fruit season by NPWS Regional divisions.

Directorate	Region & Area	1st s121 Lic issued	last s121	Average licence duration	No s121 Licenses issued	No 2nd s121 issued	No. S120	FFRS returned	Max.Nos licenced to harm	Total No. Shot*	GHFF shot (est)	LRFF shot (est)	Total crop area (ha)	Total area damaged (ha)-1st lic	% licences with info on crop
NORTHERN	**Northern Rivers**														
	Richmond River	20/09/00	1/05/01	53	18	2	9	11	840	224	24	73	142.0	72.0	88
	Tweed	2/10/00	20/10/00	33	2	1	0	2	75	48	33	15	2.0	2.0	100
	North Coast														
	Coffs Coast	17/09/00	28/01/01	33	5	1	1	5	115	106	106	0	5.0	0.5	25
	Hunter														
	Upper Hunter	16/11/00	16/11/00	5	1	0	0	0	20				5.0		100
Sub Total		**17-Sep**	**1-May**	**45**	**26**	**4**	**10**	**18**	**1050**	**378**	**163**	**88**	**154.0**	**74.5**	
CENTRAL	**Central Coast-Hunter**														
		8/11/00	14/12/00	81	12	2	2	10	500	418	383	0	44.0	49.0	80
	Sydney North														
	Lower Hawkesbury	13/10/00	3/01/01	61	17	1	11	13	570	282	282	0	142.0.0	81.0	94
	Sydney														
	Cumberland North	2/11/00	2/11/00	38	1		0	1	15	15	15	0	20.0	4.0	100
	Sydney South														
	Nattai	2/11/00	14/12/00	101	5			0	88			0			0
	Blue Mountains														
	Hawkesbury	20/10/00	10/11/00	53	4**		1	1	50	0		0	54.0	52.0	100
Sub Total		**13-Oct**	**2-Nov**	**71**	**39**	**3**	**14**	**25**	**1223**	**715**	**680**	**0**	**260.0**	**186.0**	
SOUTHERN	**South Coast**														
	Ulladulla	10/10/00	29/12/00	73	2	1	5	2	40	21	21	0	3.4	3.4	100
Sub Total		**10-Oct**	**29-Dec**		**2**	**1**	**5**	**2**	**40**	**21**	**21**	**0**	**3.4**	**3.4**	**100**
STATE TOTAL		***17 Sep***	***1 May***	***59***	***67***	***8***	***29***	***45***	***2313***	***1114***	***864***	***88***	***417.4***	***263.9***	

*Note, figures here are estimates, based only on the FFRS actually received.

**3 licences were issued to shoot to scare only and limit of 0 GHFF and LRFF to be harmed.

3 Review Discussion

3.1 Comparison over the past three fruit growing seasons

The fruit growing season typically occurs between September and June, depending upon the crop and success of the growing season. The seasons covered by this review are September to June 1998/99, 1999/00 and 2000/01.

3.1.1 Licence numbers

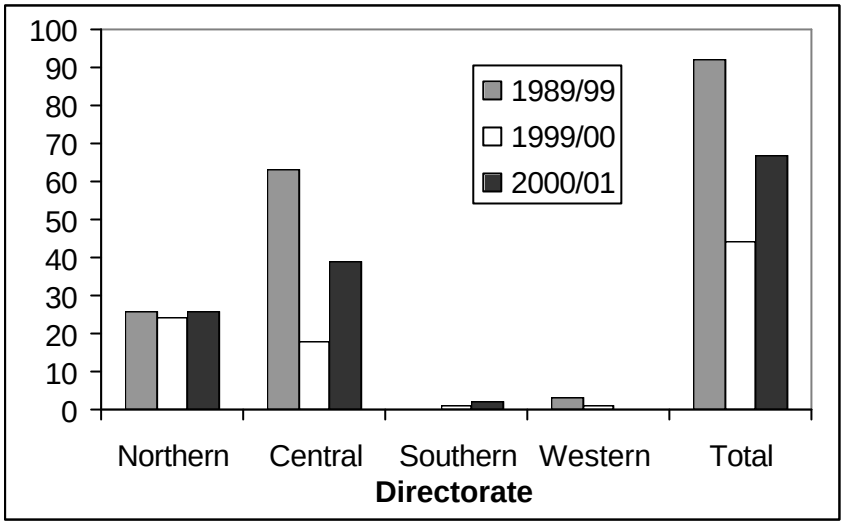
An average of 56 licences (range 44-92) were issued each season between 1998 and 2001 to an average of 49 properties (range 38-80). Distribution of licences is not uniform across the State, rather more applications are received and licences issued in certain areas. Most licences have been issued in the Northern and Central Directorates, with several issued in the Southern Directorate and few occasionally issued in the Western Directorate. The pattern of distribution of licences across NSW mirrors the known distribution of the Grey-headed Flying-fox. While this species is highly mobile, and moves in response to available food resources, it is typically found east of the Great Escarpment in NSW (Eby 1995).

The pattern of licence distribution across NSW is generally consistent year to year, with some variation in the total numbers of licences issued (Figure 1). This variation is typically attributed to the quality of the fruit growing season and the availability of native food resources. For example, the 1999/00 fruit growing season was described as the poorest for many years and native food sources were available throughout the stone fruit season (M. Smith pers comm. NPWS, Mandelc 2000). Consequently, fewer licences were issued than in the previous season. The 2000/01 season has been a much better fruit growing season, however native food sources have not been available in abundance, leading to increased invasion of fruit crops by flying-foxes and an increase in the issue of licences. Other reasons for changes in the number of licences issued each year have included adoption of netting by more orchardists and use of other damage mitigation methods (Mandelc 2000).

Figure 1 also demonstrates that the variation from year to year in total number of licences issued can be attributed to variation within Central Directorate alone. The number of licences issued in the Northern Directorate has remained consistent and relatively high over the last 3 years while the number of licences issued in Southern and Western Directorates has been consistently very low. In contrast there has been a large change in the numbers issued in Central Directorate over the past 3 seasons (64, 20, 39). The core area of the GHFF is in the northern part of the State and animals may move into more southern areas in response to the sporadic availability of natural food resources and/or seasonal native food shortages in the north. Thus, the Northern Directorate can expect a consistent and relatively high level of damage by flying-foxes each year while southern and western areas can expect a consistently low level of damage. Central areas of the State however may only experience extensive damage in years when native food sources are scarce in the north and flying-foxes travel further afield in search of food and thus can expect inconsistent levels of damage based on available resources.

The above Statewide summary, and those from previous seasons, suggest that only a small proportion of fruit growers suffer significant damage from flying-foxes statewide during 2000/01. That is, while an average of 56 licences have been issued each year to an average of 49 growers, the Australian Bureau of Statistics (ABS) 1999 Year Book indicated that in NSW there were 222 pome fruit, 461 stone fruit and 1839 unclassified fruit growing establishments. Thus, either a low percentage of orchards are affected each year, or not all farmers seek licences for flying-fox damage mitigation. In the past a number of farmers have operated outside the NPWS licensing system which has resulted in a likely high, yet unquantifiable, annual mortality of flying-foxes on fruit crops (Richards 2000, Antcliff 1998, Wahl 1994). Antcliff (1998) further noted that the 1997 moratorium on flying-fox licences by NPWS was ineffective because farmers continued to use this mode of deterrence to protect

Figure 1 Total number of s121 licences issued from NPWS Directorates over the last three fruit growing seasons.



their crops. While unlicensed activity is one explanation for the low number of licences issued each year, other explanations include an increase in the number of properties that have been netted and the quality of both the fruit growing season and available native food resources.

3.1.2 Licencees - Flying-Fox Record Sheets

Compliance with the condition requiring that farmers return a FFRS has improved over the 3 years from 41% in 1998/99 to 67% in the most recent season. However, there is still not 100% compliance. While most fruit growers complete all entries, items most likely not to be included were animal gender and species and number of flying-foxes in the crop per night.

The condition addressing return of FFRS in the policy was reviewed and the Policy amended in 2000 to include a point under enforcement (3.5) that the breach of a licence or failure to submit a FFRS would be taken into account in determining any future licence application. It is likely that this addition, coupled with effort on the part of NPWS staff to retrieve FFRS, has led to improved compliance in the 2000/01 season.

3.1.3 Flying-foxes harmed

The NPWS Policy allows for each licence to be issued to harm a maximum of 50 flying-foxes. Regional staff may approve a number lower than this depending on specific circumstances and needs. A landowner may apply for no more than 2 licences per season, or a total of 100 flying-foxes. Licences have been issued for an average of 2229 flying-foxes per year in the past 3 years, with the majority of this amount issued for GHFF (Table 2). The exact number of animals actually harmed in each season can not be determined as not all licencees return their FFRS. Over all three years the percentage reported shot was less than the percentage allotted in the licences where farmers did return their FFRS. For example, in the most recent season 67% of the licensees returned their FFRS. The harm to flying-foxes reported in these records accounted for 48% of the total number of flying-foxes permitted to be harmed. Thus it would seem that fewer animals are shot than are permitted per licence, according to the completed and returned FFRS.

Table 2 The number of flying-foxes licensed to be harmed in each of the 3 growing seasons and the number reported harmed according to flying-fox return sheets (FFRS) received by NPWS from licensed orchardists.

Species	**1998/99**		**1999/2000**		**2000/01**	
	Allowed	Harmed	Allowed	Harmed	Allowed	Harmed
Grey Headed	1959	516	895	202	1793	864
Little Red	420	105	500	93	430	88
Unspecified	180	31	120	78	40	169
TOTAL	**2859**	**652**	**1515**	**373**	**2313**	**1114**
% of total allowed actually harmed	**23**		**25**		**48**	
FFRS recieved (%)	**48**		**44**		**67**	

3.1.4 Affected Crops

Although a variety of fruit crops may be affected, the predominant crops grown by orchardists requesting licences have been stonefruit and lychee. Damage is also reported to guava, mango, banana, pome fruit and coffee crops. The variety in crops affected varies from year to year, although stonefruit is consistently the crop most often reported damaged (Figure 2). Farmers have reported an average of 243 ha of damage (range 115-320) to 446 ha of available fruit crop (range 269-651 ha) over the past 3 seasons (Figure 3). These areas are relatively small given there was some 38,000 ha of orchard and tropical fruit Statewide in 1994 (McLennan, 1996). Typically a large percentage of applicants indicate they have less than 5 ha of fruit crop; 61% in the recent year compared to 42 % in 1999/00. The increase in percentage of small holdings over this period suggests that commercial viability limits their option to use other more expensive and effective options such as netting.

This information suggests that either only a small proportion of fruit growers are impacted by damage from flying-foxes or farmers are operating outside of the NPWS licensing system. While a maximum of 92 licences have been issued in any one year, there are over 2000 fruit growers in NSW (Australian Bureau of Statistics, 1999). It is, thus, difficult not to conclude that while the cost to individual growers can be high, the impacts of flying-foxes on the fruit growing industry at a regional and state level are minimal. This may explain the lack of ongoing interest and financial support from agricultural industry bodies for deterrent research beyond netting.

Figure 2 Type of fruit crops and areas they cover (hectares) that have been vulnerable to flying-foxes over the past 3 seasons.

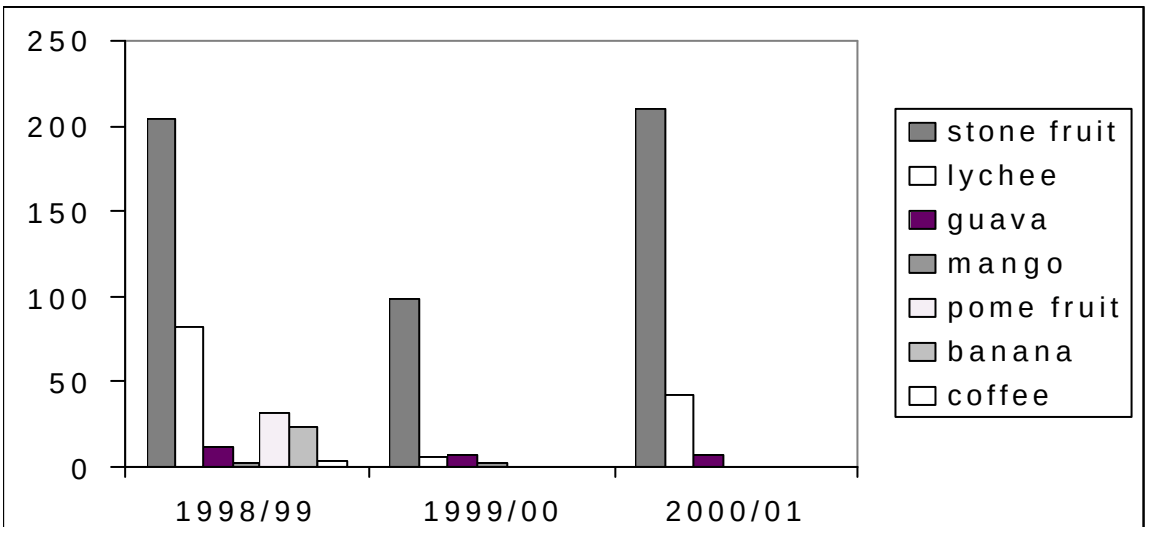
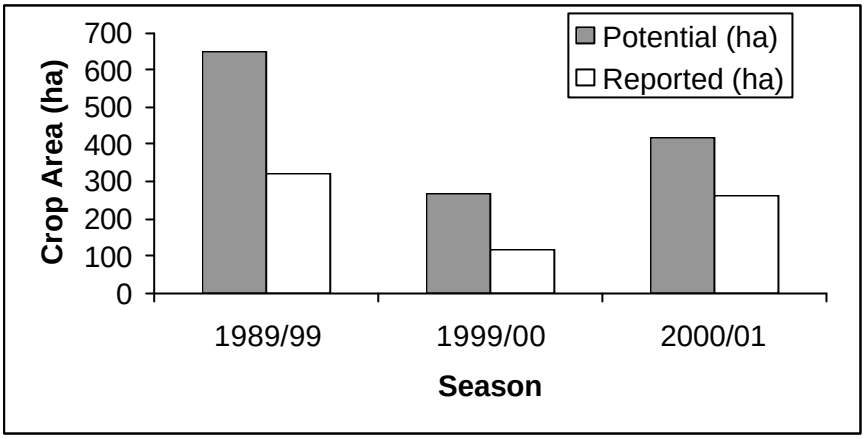


Figure 3 Area of crop (ha) with the potential to be damaged and reported damaged at the time of licence application for the past 3 seasons.



3.1.5 Section 121 Licence Duration

The past three fruit growing seasons have demonstrated differences in the intensity of flying-fox damage statewide. This is again noted in the duration for which licences were issued each year and the timing throughout the season. For example, in 1998/99, 62% (56) of licences were issued in the month of November while in 1999/00 and 2000/01 the majority (78%) of licences were issued between the months of October (21%), November (38%) and December (19%). Further, licences have been issued between September and May. This suggests that within the Policy framework, licensing is responding to individual orchard management arrangements and localised impact levels.

3.1.6 Section 120 licences

Only 20% of s121 licences issued were accompanied by additional s120 General Licences to shoot flying-foxes. A range of 1 to 5 s120 licences have been issued to these properties.

As in previous seasons there is no apparent correlation between the number of s120 licences issued per s121 licence and the:

- total area of crop potentially vulnerable to damage;
- total number of flying-fox licensed to be harmed; or
- total number of flying-fox reported to have been shot.

The Service recognises the number of s120 licences required by some growers may relate to individual orchard operations management and the Policy notes that, where determined appropriate, NPWS staff may request written justification from s121 licensees for the proposed number of s120 licensees.

3.2 2000/01 Regional Directorate Comparison

The Directorate summaries indicate regional differences in the:

- number of licences issued;
- timing of the issue of licences;
- crops affected;
- number of licensees with 5 ha or less of potentially vulnerable crop;
- species licensed to be harmed;
- FFRS return compliance; and
- number of shooters per s121 licence.

The main NPWS Directorates involved in licensing are Northern and Central. Northern can receive applications some 3 months earlier (August) than Central with the ripening of tropical fruits. Fruit crop damage from flying-foxes can extend into March/April in both Directorates,

with a second ripening season for different tropical fruits in the North and continuation of stone and pome fruit ripening in Central. The unique crops to Northern Directorate are guava, mango, coffee and lychee and in Central Directorate, loquats.

While only 37% (9) of licences in 1998/99 in Northern Directorate were for small holdings, 63-64% of licences issued in 1999/00 and 2000/01 were to farms of 5 ha or less. This may suggest that larger and/or more commercially viable growers are netting crops in Northern Directorate. In Central Directorate the trend was the opposite with only 36% (13) of licensees having a total of 5 ha or less of fruit crops in 2000/01 but 52% (27) of licenses issued were for small holdings in 1998/99. While reports from Central Directorate support the view of a much lower impact from flying-foxes in 1999/00 compared to the previous season, it is not clear why there would be proportionally fewer small growers over time.

The majority of licences were issued to harm the GHFF in both Directorates in the last two seasons. Significantly more licences are issued, however, for LRFF in Northern Directorate, reflecting their distribution in NSW.

The return rate of FFRS is not consistent between Directorates, nor is this pattern consistent over time (Table 2). There are likely a number of reasons for these changes such as the number of licensees per Region and Directorate, the resources available to undertake liaison with farmers and the effort put in by Regional staff to encourage compliance.

Table 2 Percentage of FFRS returned each season by each of the Directorates.

Directorate	**1998/99**	**1999/00**	**2000/01**
Northern	42	25	69
Central	44	61	54
Southern			
Western			N/A

4 Management context 1999-2000

Following are the main management issues regarding this Policy that have developed during the 2000/01 season.

4.1 Population Assessments

Assessments of the conservation status of bat populations have been hindered in many countries, by a lack of information on the abundance and distribution of these mobile animals, and by a lack of standard techniques for measuring these parameters (O'Shea and Bogan 2000). The need to standardise population assessments has received attention in both the U.S. and Great Britain, where various techniques for monitoring populations are being assessed (O'Shea and Bogan 2000).

Both the GHFF and LRFF have extensive ranges through northern and eastern Australia and the BFF has a limited range in northern NSW and more extensive range through Queensland. However, the mobility of these species' and their variable pattern of abundance across their range has made population assessment particularly difficult. In order to estimate population size, attempts have been made to conduct synchronised counts of animals throughout their range.

The Australasian Bat Society (ABS) have coordinated such counts each year to systematically assess the size of the GHFF population. These assessments found that animals were highly concentrated during the winter months, for example, approximately 72%

of the population occupied 18 colonies between Maroochydore and Ballina and over 99% of the NSW population occurred in 9 camps, at this time. These animals were feeding primarily on flowering Forest Red Gum, *Eucalyptus tereticornis,* Swamp mahogany, *E. robusta* and melaleuca *Melaleuca quinquenervia*. This seasonal distribution highlights the GHFF's dependence during winter on coastal forests and woodlands in northern NSW and southern Queensland (Eby *et al*. 1999). This remnant lowland vegetation is predominantly privately owned and being cleared rapidly (Catterall *et al.* 1997, 1998, Sattler and Williams 1999).

The ABS continues to coordinate synchronous assessments of the abundance and distribution of GHFF in NSW, Queensland and Victoria. These assessments have compared the results across seasons, documented the extent of movement between NSW and Queensland and documented changes between years in distribution during autumn. The current population size of GHFF is estimated to be between 320,000 and 340,000 based on the ABS counts (P. Eby pers. comm.). The NPWS will continue to support the ABS where possible in these counts as this information is vital to the development of a conservation strategy for the species and assessment of the policy on damage mitigation.

The NPWS has coordinated a roost site mapping project, undertaken by Dr P. Eby, to map all known GHFF roost sites in NSW. This information may be used by relevant Government agencies in environmental planning and assessment processes. A copy of the mapping project will be distributed to NPWS Regional Conservation Planning and Programs Divisions and to other relevant Government agencies.

4.2 Conservation Status and implications

The Black Flying-fox has been listed as vulnerable under the TSC Act since 1995. The GHFF has been listed as vulnerable in the Action Plan for Australian Bats (Duncan et al. 1999) and the LRFF listed as lower risk, least concern in the same document. The NSW Scientific Committee received a nomination to have the GHFF listed as Vulnerable in NSW in 1999 and a preliminary determination was made on 17 November 2000. The determination was made final on 4 May 2001 and the GHFF was added to the Schedules of the TSC Act. This listing means that the NPWS is now responsible for the development of a Recovery plan for the species.

This listing has ramifications for the NPWS policy on damage mitigation, as a s121 licence may not be issued for a threatened species. The NPWS is in the process of developing a revised policy in consultation with stakeholders for implementation in the 2001/02 fruit season. As part of this process a Forum was hosted by the Royal Zoological Society in July 2001 to discuss the management of the GHFF. The forum was well attended by community, conservation, industry and government representatives. A range of issues were addressed including damage mitigation, the NPWS draft damage mitigation policy, the need for reasonable non-lethal alternatives to deter flying-foxes, community perception of the issue and roost site management. While there are opposing sides on the management techniques that may be used, there was general support that this is a serious issue that needs to be faced and addressed together. The NPWS will seek to build on the positive outcomes of the forum and engage stakeholders in the development of a conservation strategy for flying-foxes in NSW. This is likely to include support for research on non-lethal deterrent techniques and on the general biology and ecology of the species.

4.3 Legal Action

In 1999 the Humane Society International (HSI) took legal action against the NPWS in the Administrative Decisions Tribunal. HSI requested that the Tribunal provide them with access, under the *Freedom of Information Act 1989*, to the names and addresses of persons licensed by NPWS to harm flying-foxes to prevent fruit crop damage in October and November 1998. HSI indicated that they wanted the information for the purpose of conducting research on

flying-foxes. The NPWS opposed access and argued that: the information provided as part of the licence application process was related to the personal and business affairs of orchardists and was provided to the Service in-confidence; the identity of people having access to the information and the use of the information could not be controlled; and the disclosure of the information may discourage land holders to apply for licences in future, which would limit the capacity of the Service to monitor the number of flying-foxes harmed by those landholders in NSW. The Tribunal gave a final decision on 19 September 2000 in favour of the HSI. Their finding was that this information was not unlike similar information available upon request or on public register for threatened species. The NPWS complied with the court order but would continue to challenge similar requests in the future.

4.4 Crop Damage Mitigation

4.4.1 Exclusion Netting

The only reliable protection for fruit crops from damage by flying-foxes, is full exclusion netting as recommended by NSW Agriculture. This also prevents significant damage caused by birds and hail storms. Two primary reasons stated by growers for not using netting is cost and in some instances topography. Quotes on the cost per hectare vary from $16,000 (Slack & Reilly, 1994) to $30,000 (NSW Farmers, 1998). There have also been reports from northern NSW that suggest access to netting contractors is limiting the rate of installation of netting. NPWS has sought clarification on this matter from NSW Agriculture (Williams *pers. comm.* 2000).

Since April 1999 growers can take out a low interest loan for netting to prevent crop damage from flying-foxes. The NSW Rural Assistance Authority (RAA) administers the scheme and a number of conditions apply. The availability of the RAA low interest loans now allows for eligible growers to borrow up to $100,000 for exclusion netting at a 4.5% interest rate approximately. The criteria for these loans include: the farming enterprise must provide at least 51% of total gross income of the applicants; and the applicant must be in working occupation of the farm and be of moderate means (net assets of up to $1.2 million). The Service is advised that the RAA have received 20 applications since April 1999. All of these applications have been processed and13 loans approved. Eighteen of the loans were applied for and 12 granted in the NPWS Northern Directorate. One application was received from Central Directorate and one from Southern Directorate. Only one of these loans was granted but information provided by RAA does not indicate which NPWS Directorate.

4.4.2 Other Non-lethal Deterrents

The Service is aware that some growers have trialed different deterrent mechanisms but is not aware of any systematic deterrent studies for flying-foxes being undertaken in orchards over the last year. However, the Sydney Royal Botanical Gardens have employed a consultant to investigate deterrent techniques for roost sites in the gardens. Trials are underway and it may be possible to trial successful techniques to fruit crops in the future. NSW Agriculture have advised that they will pursue opportunities to evaluate new technology wherever there is funding support from affected industries to do so.

5 Future Initiatives

As a result of the listing of the GHFF the current NPWS policy must be amended to make provisions for management of threatened species where they come in conflict with humans. This policy is currently being developed in consultation with Regional staff and stakeholders. It will be finalised for implementation in the 2001/02 fruit season.

The 1998/99 review recommended the establishment of a NSW Flying-fox Consultative Committee. Such a committee would provide a forum for Government, community and industry consultation on flying-fox conservation and management in NSW. A similar organisation exists in Queensland. The inaugural meeting of the NSW Flying-fox Consultative

Committee is scheduled to be held on 24 August 01 and will be attended by representatives from all key stakeholder groups including NPWS, NSW Agriculture, NSW Farmers Association, horticulture industry, flying-fox ecologists and conservation agencies. Liaison with the Queensland Flying-fox Consultative Committee will also be established.

At this time, the impact of lethal harm for fruit crop damage mitigation purposes, on the abundance of Grey-headed, Black and Little Red Flying-foxes is unknown. The NPWS will investigate opportunities for research in collaboration with fruit growers on the impact of current lethal harm strategies on flying-fox populations. The Service will also support, wherever possible, abundance assessment surveys and will undertake an assessment of the impact of culling on the long term survival of the GHFF over the next year.

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