INVESTIGATION INTO THE POTENTIAL FOR BROAD-SCALE CONTROL OF MYNAS BY TRAPPING AT COMMUNAL ROOSTS

FINAL REPORT

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Front Cover: Flying myna, Pic by Toby Roscoe.

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Summary

This report summarises the outcomes of a five-year investigation into methods for minimising myna (*Acridotheres tristis*) populations, particularly the potential for broad-scale control by trapping at communal roosts. The main conclusion from this study is that it is not technically feasible to trap roosting flocks of mynas and hence this does not have potential as a control method. A trap that could be used to enclose roosting flocks was built, but the wind resistance of the structure, that includes a very large net, along with the need for it to be portable, meant that it could only be operated in very slight winds (<15 km/h). Such conditions occur rarely, and are difficult to predict with currently available meteorological information. The size and complexity of the trap meant that its operation could only be considered at near-horizontal sites with few obstacles, such as other trees, buildings etc – another rare set of circumstances in most areas. Added to these technical difficulties is the very high plasticity in myna roosting behaviour, leading to very low fidelity to particular roosting sites, except in rare circumstances, and a tendency for flocks to disperse and move in presently unpredictable ways. Preferences for certain types of trees, that seemed apparent in the first years of the study, over time proved to be insignificant; mynas are highly adaptable and their behaviour varies greatly according to circumstances.

Positive outcomes from this investigation are: (1) the development of valve traps that can be used by community members to selectively trap mynas without endangering non-target wildlife; (2) the establishment of many community groups set up to minimise mynas by selective trapping, mostly in concert with local government; (3) a demonstration that carbon monoxide (CO) from cooled petrol engine exhaust is a safer, cheaper and more humane agent for euthanasia of trapped mynas (or other pest birds) than the currently recommended carbon dioxide (CO_2); (4) development of a range of portable carbon-monoxide generators, including a very small unit (5.6 kg) that can be used to euthanase nesting mynas or starlings in suburban or reserve nest-boxes. These methods have been, or are about to be, published and are undergoing further trials. A

final, very important result to come from the research is the establishment of a PhD study, now in its third year, to evaluate (1) the impact of mynas on native wildlife and (2) the efficacy of community-based myna trapping programmes in reducing myna numbers – and impacts on amenity and native wildlife. These are important questions to answer, given that there is some scientific and community questioning of the desirability and efficacy of myna control.

The overall conclusion from this study is that, at this stage, there appear to be no potential control mechanisms worth considering for mynas, other than removal with valve traps and/or nestboxes. Both methods are selective and humane; whether they can impact on myna numbers – and whether this ultimately benefits amenity and native wildlife, remains to be seen. This can be resolved only by careful monitoring and evaluation of the outcomes. Monitoring and record keeping are poorly done by most community groups involved in myna trapping; the process is tedious and the activity is not rewarded with a "kill" – or a local reduction in mynas, and hence improved amenity, as comes from valve trapping. Bird-oriented groups commonly take note of events over a wider area than myna trappers and often keep better records. Future integration of records from the two groups may enable better-informed decisions to be made. For the time being, the way in which myna trapping is being undertaken by community in concert with local government seems appropriate, so long as it is done with an emphasis on ongoing monitoring and evaluation – and animal welfare. So far, neither of these issues has been dealt with adequately by community groups involved in myna trapping. Ultimately, there is no point in continuing public support for myna trapping if it is ineffective, nor is there reason to continue it if it results in no increase in amenity or benefits to native wildlife beyond the backyard level.

Note: A very large amount of data was collected during this study; data on myna roosts is given in summary form only, because ultimately it was deemed not useful. Full data sets are available upon request to interested parties.

Are mynas a problem?

This study was initiated following concern that expanding populations of Common Mynas, *Acridotheres tristis*, in eastern Australia were becoming a problem by impacting adversely on native wildlife and amenity (see, eg, Davey 1991). In 1995 it was reported that mynas were interfering with breeding of the critically endangered, hollow-dependent, Seychelles Magpie Robin, *Copsychus sechellarum*, that had been reduced to a very small population on a single island (Komdeur, 1995). Two years later it was reported that mynas seriously disrupted breeding of hollow-dependent native parrots in urban nature reserves in Canberra (Pell and Tidemann, 1997a & b). Mynas have been introduced to many parts of the world other than eastern Australia (Feare and Craig, 1998) and in many of these places their populations are expanding, sometimes with undesirable consequences for the environment and economy.

In 2000 Common Mynas were listed by the World Conservation Union as one of the world's 100 worst invasive species (Lowe et al, 2000). In 2004 the Myna was voted in an ABC survey as Australia's most unpopular pest animal (http://www.abc.net.au/tv/wildwatch/results/award.htm), ahead of other likely contenders such as the Cane Toad and Feral Cat. The massive unpopularity of mynas in Australia has resulted from publicity surrounding the adverse effects of mynas on biodiversity and amenity; negative effects on human and livestock health have been postulated, although without much evidence (Tidemann, 2005). Mynas are easily identified by lay people because of their conspicuous behaviour – and they are extremely common in most cities of eastern Australia, which is where most of the human population lives. Cairns, for example, supports over 500 mynas per square kilometre (this study).

The fact that mynas are so unpopular leaves little doubt that, for many people, they impact negatively on amenity, although their impacts on biodiversity are less clear and, almost certainly, vary from place to place. Harper et al (2005) found that in urban vegetation remnants around Melbourne mynas usurped native birds from nesting hollows, as had been demonstrated by Pell and

Tidemann (1997a,b) in vegetation remnants around Canberra. However, there is no evidence of a decline in such hollow-dependent species in Canberra, or elsewhere in Australia, as might be expected if mynas were reducing overall breeding success (Veerman, 2002; Barrett et al, 2003). Parsons et al (2006) examined bird populations in Sydney, where mynas were the most common species encountered, and found that "None of the species of small birds was negatively associated with the presence of common mynas". Crisp and Lill (2006) found little evidence of foraging disruption by mynas to other birds in urban Melbourne and Olsen et al. (2006) opined that "Common Mynas probably have little effect on native birds and occupy urban niches that would otherwise be bereft of birds."

Mynas undoubtedly exploit resources provided by humans and reach their highest densities in and around cities, but the second part of Olsen et al's (2006) statement about mynas being confined to urban areas is not borne out by the evidence. Where cities are bordered by forest, that may be the case, for mynas will not enter areas of closed canopy (this study), but the evidence indicates that the species is capable of occupying almost any human-modified woodland (see, for example, Davey et al, 2009) – that includes much of eastern Australia. In the Murrumbateman area, NSW, mynas have begun to occupy areas used for breeding by threatened Superb Parrots (Tidemann, 2005) and mynas are undoubtedly spreading across their range (Barrett et al, 2003). In recent years individuals or small groups of mynas have made their way to northern Tasmania and to Perth (Olsen et al, 2006). Wildlife authorities in these areas have very quickly moved to destroy any such birds, so far with complete success (Tidemann, 2005). The fact that these incursions cause such a high level of concern indicates that, despite some reports of little or no effect by mynas on biodiversity, conservation agencies are very keen to limit their spread into areas where they are not already present – either out of concern for impacts on biodiversity – or horticulture – or both.

Elsewhere in the world, mynas have been taken very seriously, especially in areas where threatened species co-occur, and in a few cases there is good evidence (ie, experimental area compared with a control) that myna removal has had a beneficial effect. In the Seychelle Islands, complete myna removal (eradication), along with the removal of other threats, provision of nestboxes and other habitat improvements, has allowed the reintroduction of the hollow-dependent Seychelles Magpie Robin to four islands, previously restricted to just one in the 1970s. The IUCN conservation status of *Copsychus sechellarum* has recently been downgraded from Critically Endangered to Endangered (Nature Seychelles, http://www.natureseychelles.org, accessed 28 February 2010). In New Zealand, myna removal from the 80 ha Motuora Island, showed an increase over a control island in numbers of Tui *Prosthemadera novaeseelandiae*, Grey Warbler *Gerygone igata*, and Blackbird *Turdus merula* (Tindall et al, 2007). None of these species is hollow-dependent, suggesting an impact of mynas beyond that of hollow competition/depredation, although the experiment has thrown up as many questions as hard answers about the impacts of mynas and benefits, if any, of their removal. Tindall et al (2007) concluded that "The historical decline of many species in the North Island of New Zealand may have been related to the concomitant increase of the myna, and control of this species may be warranted in some cases, especially where restoration of the native fauna is the objective." This statement is substantially speculative and many other factors could have been involved (see Major and Parsons, 2010). Saavedra (2009) described the recent removal (not eradication) of mynas by trapping and other methods from Ascension Island, in the Canary Archipelago, to protect threatened birds. Monitoring of impacts has not, so far, been addressed.

Valve Trapping of mynas in Feeding Areas

Complete eradication, or substantial reduction, of mynas from small islands, such as has been done in the Seychelles and Motuora Island is one thing. What, if anything, can be done to minimise myna populations in eastern Australia, where numbers are probably in the millions? Research in the prelude to this study showed that it was possible to manufacture live traps that were made selective for mynas and Common Starlings (another pest species) by means of valves; an entrance valve through which mynas and starlings, but not other birds, would walk to access bait in a base chamber, and a second squeeze-through valve that collected birds in a sheltered disposal chamber, in which they could be euthanased; the emphasis in the system was on the highest standards of animal welfare (Tidemann, 2005). This design was commercialised and made available via a retailer in 2004 (Myna Magnet http://www.mynamagnet.com). Guidelines for use and instructions for humane treatment of captives, including euthanasia, were provided with the traps and via a supporting website (http://fennerschool-associated.anu.edu.au/myna, accessed 28 February 2010). This website is updated periodically as new information comes to hand. A Myna Magnet trap is illustrated in Figure 1. Detail of construction is provided by Tidemann (2005).

Figure 1: Commercial version of Myna Magnet valve trap for mynas and starlings. Ideally, a second cage with decoy birds is placed alongside the actual trap. Pic by D. Claridge.

Trap availability, coupled with widespread public antipathy toward mynas, has meant that shortly after the traps became available, community groups formed to utilize them. The Central Coast Indian Myna Action Group was established in 2004, the Canberra Indian Myna Action Group in 2006 and many others between and since. In 2007 the NSW North Coast Indian Myna Action Group convened a workshop in

Coffs Harbour on myna minimization that was attended by many such groups, along with representatives of local government, Landcare, Catchment Management Authorities etc. (Rogers and Nesbitt, 2007). A similarly well-attended workshop was convened by the Canberra Indian Myna Action Group in Nowra in 2009 (http://www.indianmynaaction.org.au).

Does valve trapping reduce problems caused by mynas?

In parallel with the formation of community groups set up to trap mynas, many "alternative" trap designs, nearly all utilising the original two-chamber/two valve design, have also appeared, some effective at catching mynas, some less so, eg: http://www.indianmynaeradication.com; http://www.indianmynaaction.org.au. Many mynas are being caught with valve traps, CIMAG, for example, reported that total mynas removed in Canberra from April 2006-September 2009 was 26,400. But the question remains: are these activities having any impact on myna numbers overall, and, more importantly, on reducing the negative impacts of mynas?

The first thing to say is that valve trapping undoubtedly improves amenity at the backyard level; valve traps can quite quickly reduce the number of mynas visiting a particular backyard or its vicinity (King, submitted ms). How far beyond the backyard the effect reaches is presently unknown and is not easy information to get. Myna trappers seem to be particularly poor at keeping records, even of the number of birds they have trapped, and seem reluctant to undertake monitoring, even of numbers at the backyard level (Bill Handke, personal communication). This situation is not particularly unusual with pest control activities in Australia, particularly where community groups are involved, but it needs to change if solid scientific information about the efficacy of control programmes is to be gained (Reddiex and Forsyth, 2006).

To determine if myna trapping is having an overall impact it is necessary for monitoring to be undertaken at a landscape scale, such as, for example, is done by the Birds in Backyards programme in Sydney (http://birdsinbackyards.net). The BIBY scheme has 8740 members contributing data (Holly Parsons, personal communication). Canberra has a parallel programme in place, the Canberra Garden

Bird Survey (http://garden.canberrabirds.org.au), but in 2009 only 82 individuals were involved in the data collection (Martin Butterfield, personal communication). Accordingly, recent claims by CIMAG, based on GBS counts, that the trapping programme is "working" need to be viewed cautiously. GBS data do provide a reliable index of bird numbers where there are enough observers; a comparison of myna numbers deduced by transect counts and GBS records from suburbs with four or more observers showed an almost perfect correlation ($R^2 = 0.998$). Kate Grarock, a PhD student at the ANU is presently investigating the impact of trapping on myna numbers in Canberra, principally by conducting transect counts in suburbs where CIMAG trapping is occurring – and control suburbs where it is not (http://www.indianmynaaction.org.au). Concurrently, she is attempting to address the question of whether mynas impact on biodiversity. The Canberra Garden Bird Survey provides useful information on these questions, but would be much more useful if the density of observers could be increased.

Most individuals who persist with valve trapping experience a marked reduction in myna numbers in their backyards, hence an improvement in amenity, but there are indications that this effect may wane over time, as mynas learn to avoid dangerous situations (King, submitted). Griffin (2008) and Griffin and Boyce (2009) have experimentally demonstrated that mynas learn to avoid threatening situations and have commented that this ability is likely to impact on the long-term success of trapping programmes. Similarly, Dhami and Nagle (2009) have reported that mynas learn to avoid places where shooting is carried out. Only time – and adequate monitoring will tell if trapping is ultimately a useful activity.

Tindall et al (2007) found valve-trapping, with decoys, to be superior to poisoning as a control method in islands in New Zealand, whereas in the Seychelle Islands Millett et al (2004) reported that trapping was not as useful as poisoning, or shooting, although they also found that mynas learnt to avoid shooters over time. In some circumstances it is known that valve traps are not a useful means of myna control. In Cairns, Qld., for example, it was found during this study that mynas were not attracted to the bait in traps, apparently because an overabundance of other food was available; similar problems would apply to baiting. Clearly, the success or otherwise of different control methods depends on the circumstances. Mynas are an extremely adaptable species and vary their behaviour depending on the environment and how many of them there are. It is probable that more than one method will be required to minimize myna populations across the board.

Is valve trapping a humane activity?

There is an increasing demand from society that any animal control activities be done humanely (see, for example, Littin et al, 2004; Thiriet, 2007; Giggliotti et al, 2009). This is especially important if the activity is being conducted with government support, but it is also very clearly in the interests of community groups involved in control activities to ensure that their methods are humane and hence acceptable to the public at large. The original valve traps (Myna Magnets, http://www.mynamagnet.com) were designed to maximize bird comfort and minimize stress by providing a sheltered top chamber with perches, thereby mimicking conditions inside a natural roost (Tidemann, 2005). Some of the traps now in use by community groups, eg Pee Gee traps (http://www.indianmynaaction.org.au) are too small to satisfy this requirement, and do not provide any shelter from inclement weather or predators. If many birds are caught at once in Pee Gee traps the confined space can easily lead to highly stressed captives because they are unable to avoid each other; more aggressive birds in the trap can inflict serious damage on others. Similarly, Myna Magnet traps provide shelter from weather and predators, whereas Pee Gee traps (at least in their present configuration) do not. Davey et al (2009) reported the loss of a significant number of birds to predators, especially goshawks. It would not be difficult to modify Pee Gee traps to address these shortcomings – which is something that should be done if myna action groups are to retain credibility with animal welfare organizations and the public at large.

Euthanasia of trapped mynas

The method initially recommended for euthanasing mynas trapped with Myna Magnet traps was gassing inside a canvas sleeve with carbon dioxide (CO_2), as recommended by Sharp and Saunders (2008). Methods that require individual restraint, such as cervical dislocation or lethal injection, are inappropriate for large numbers of birds, firstly because they are highly stressful to the birds and secondly because they greatly increase the risk of accidental escape. Additionally, such methods are too time-consuming to be generally useful. Recently it has been found that carbon monoxide (CO) from cooled four-stroke petrol engine exhaust is a more cost-effective and humane euthanasia agent than any of the above methods (Tidemann and King, 2009). This study also found that community groups involved in myna trapping, by and large, did not use CO_2 because of the inconvenience and cost; instead most used CO piped from a petrol car exhaust. This method seems acceptable, provided the exhaust is drawn from a cold engine (because of issues with catalytic converters), although present official recommendations in this regard would benefit from review.

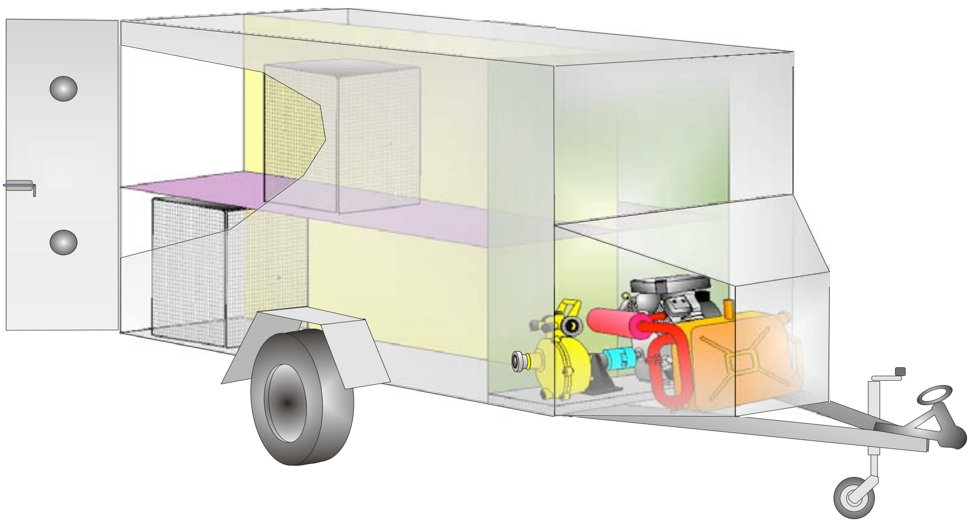

Figure 2: Schematic diagram of the Euthanaser Van that was developed to process the very large numbers of birds that were expected to result from roost-trapping. The front end of the rig contains a stationary 630 cc air-cooled four-stroke engine producing exhaust containing 9% carbon monoxide (CO). Exhaust is cooled by passing through an expansion chamber (red) and a water-bath (orange) before being directed to chambers in the rear of the rig. Four euthanasia chambers are accessible from the rear after purging with fans to clear residual CO from the system. Pic by D.H. King.

Mobile euthanasia systems - Euthanasia van

Part of the equipment developed to service the very large numbers of birds that were expected to result from roost trapping was a trailer-mounted euthanasia system, with the potential to euthanase several hundred birds at once, without the need for any individual handling (Figure 2). A 630 cc air-cooled four-stroke engine mounted at the front of the rig, produced exhaust which contained 9% CO and was cooled by passage through a water bath. Exhaust could be directed, via taps at the front of the rig, to one or more of the four gassing chambers, that were accessed from the rear and could be purged of CO prior to opening with forced-air ventilation. The system was designed to permit drafting of birds from roost traps into modular cages, each of which could accommodate up to 50 birds for short periods. The modular cages were essentially a modified Myna Magnet top chamber, of 220 litres, constructed from 25 mm galvanized steel mesh, the top half provided with perches and covered with shadecloth. Cages of this design were tested by Tidemann and King (2009) and found to promote calm amongst trapped birds, with space enough for more aggressive birds to be avoided by others. Each of four gassing compartments in the euthanasia van could hold up to three modular cages – twelve cages in total, potentially holding 600 birds. This sort of catch was never achieved – see next section – but the system was tested with smaller numbers of birds and found to be highly effective, safe and humane (see Tidemann and King, 2009). This sort of system undoubtedly has potential application well beyond the euthanasia of mynas; it could easily be adapted for use with any pest animal that could be fitted inside the euthanasia chambers.

Euthanasia Wand and Nestbox Trapping

A recent outcome from the present study is the development of nestbox traps for use in conjunction with a euthanasia wand (Figure 3). The wand is based on a 25 cc air-cooled four-stroke petrol engine, the exhaust from which is air-cooled and can be delivered directly to a nestbox via a long pipe. This device produces cooled gas containing 3% CO and has proven highly effective for euthanasing nesting mynas, eggs and chicks (Tidemann et al, in preparation). The euthanasia wand weighs only

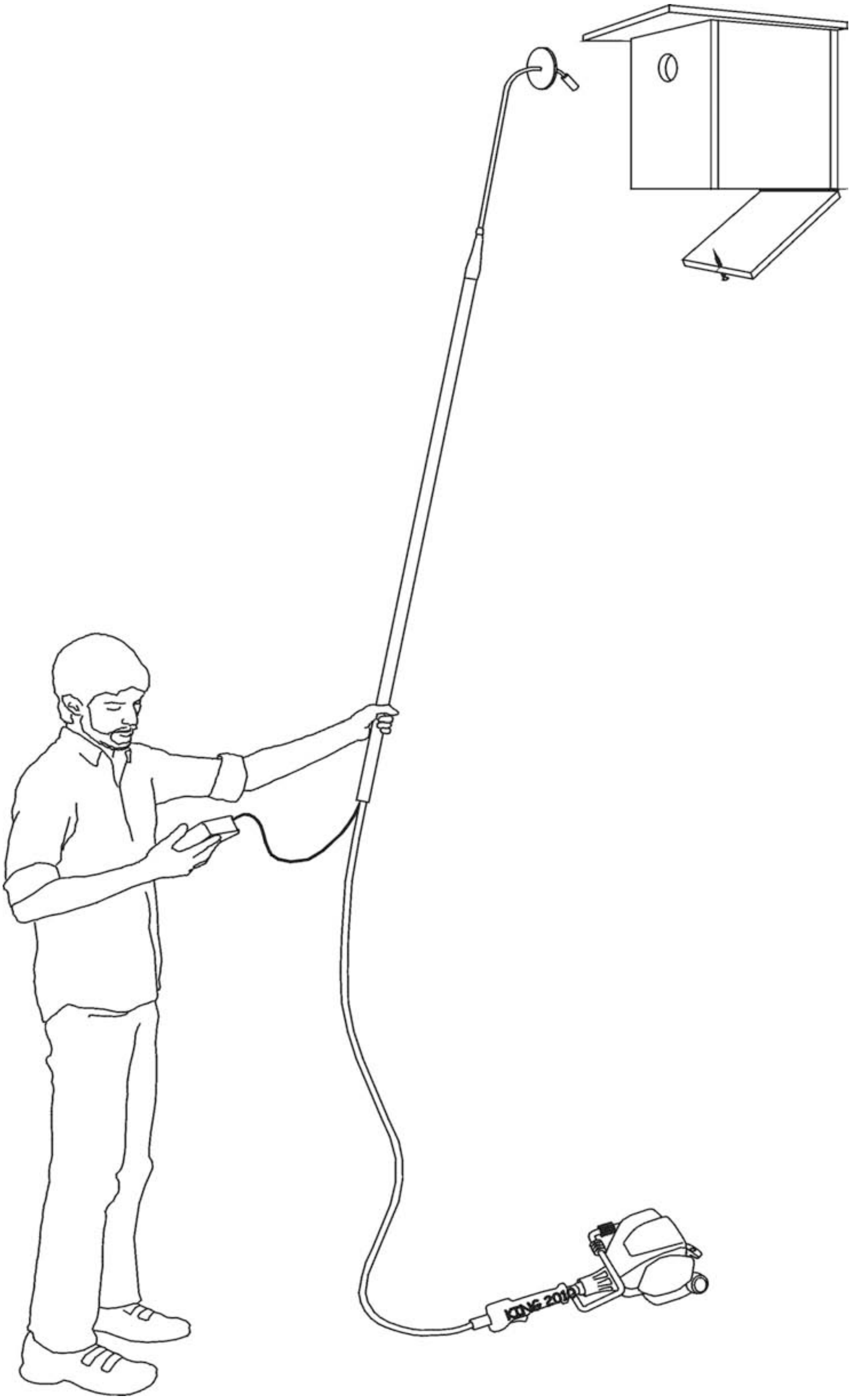

Figure 3: Portable euthanasia wand and drop-floor nest-box. The 25 cc air-cooled engine produces carbon monoxide that can be piped to the nest-box via the wand, that also includes a closed circuit TV camera and monitor. Pic by D.H. King.

5.6 kg and hence can easily be carried from nestbox to nestbox. Accidental euthanasia of non-target species of wildlife is completely avoided by observing the box occupants via closed-circuit television prior to starting the engine. Nestbox trapping may provide a useful additional tool in the myna minimization armoury, as it can be used to target breeding birds and those that may have become trap-shy through experience of valve trapping. There is a relatively high labour cost for constructing and installing nestboxes, but once this has been done it takes a small investment of additional labour to euthanase nesting birds – if monitoring can be done by community members.

A nestbox trapping scheme is currently being trialled in Canberra by ANU researcher Kate Grarock (http://fennerschool-associated.anu.edu.au/myna/research.html). In this scheme initial monitoring of nestbox usage, and presence of mynas or starlings, is provided by nestbox owners (community members), who were recruited and report via a web portal to the researcher, who then directs subsequent investigation of nestbox occupants by a trained operative. The operative euthanases the sitting bird with the euthanasia wand if it is a pest species, and the entire contents of the nestbox, adult, eggs, chicks and nesting material can be dumped via a hinged floor in the nestbox. This clears the box of impediments for subsequent nesting by other birds. Millett et al (2004) found that nestboxes, fitted with banks of nylon nooses were useful for removing mynas on the Seychelles, especially individuals that had become gun-shy or could not be poisoned. The system described here, ie, euthanasia wand and drop-floor nestbox, provides a more humane way of destroying nesting birds, again without the need for individual handling that is very distressing for the birds – and bystanders.

Field surveys of myna roosting behaviour

The first investigation of myna roosting behaviour in Australia was carried out in Wollongong, by Wood (1995), who found a relatively high degree of selectivity for particular tree types – in this instance, palms – and a relatively high degree of roost

Fig 4: Pencil pine in the Canberra suburb of Campbell that has been used repeatedly over more than 5 years as a roost site by up to 100 mynas; pic by Toby Roscoe.

site fidelity. A second survey, of myna roosts in Canberra suburbs (Politi, 1998), also found a very high degree of selectivity; of a total of 117 roosts, 58% were in conifers, 52% in pencil pines alone (Figure 4; Table 1). There also appeared to be a relatively high degree of roost site fidelity, ie mynas kept returning to the same roosts over extended periods of time. These findings led to the concept that it might be possible to trap mynas at roost sites by completely enclosing roosting trees with large nets. Such an activity could be fairly straightforward if mynas kept returning to the same trees and the trees to be enclosed were pencil pines, or similar, because of their simple shape, and the fact that many stood alone, away from other trees or buildings.

These preliminary findings, however, were not repeated upon extended examination of myna roosts in Canberra and in Cairns. Overall, it emerged that there was a very high variance in the types and heights of trees used as roosts, with little evidence of a preference for particular species, and a very low site fidelity to particular trees. In some rare instances, it was found that mynas repeatedly used particular sites over extended periods – the pencil pine shown in Figure 4 is one such example, but this was not the broader pattern. Table 1 shows trees used as myna roosts in 1998 (from Politi, 1998), compared with a similar sample in 2005-2007, and a random sample of available trees in 2005-2007. It can be seen that although mynas were still preferentially using pencil pines in 2005-2007, the very strong preference observed in 1998 was not repeated. Of particular note was the very large number of deciduous trees used as roosts in the second sample; several instances were observed of mynas roosting over winter in deciduous trees that were completely devoid of leaves, at odds with the earlier findings that had suggested that dense foliage cover (and hence thermal protection) was a very important habitat criterion.

Table 1: Trees used as myna roosts in Canberra in 1998, compared with trees used as roosts in 2005-7, and with a random selection of trees in 2005-2007.

ACT	**1998**	**2005-2007**	**2005-2007**
	Roosts	**Roosts**	**Random**
Sample size	117	127	40
Deciduous	8 (6.8%)	65 (51.2%)	25 (62.5%)
Eucalypt	14 (12.1%)	24 (18.9%)	7 (17.5%)
Pencil Pine	60 (51.7%)	28 (22.0%)	nil
Other	29.4%	7.9%	20%

Table 2 summarises the top heights of trees used as myna roosts in Canberra and Cairns, alongside comparison random samples. A wide range of tree heights was used in both locations, although the differences simply reflected what was available at each location; trees used, and trees available, in cyclone-prone Cairns tended to be lower than those in Canberra, which is not subject to cyclones.

Table 2: Top heights (mean ± SD) of trees used as myna roosts in Canberra and Cairns in 2006-7, compared with a random selection of trees at each location.

Category	Sample size	Top Height (m) (mean ± SD)
ACT roost	132	14.5 ± 5.2
ACT random	40	11.4 ± 5.4
Cairns roost	78	10.6 ± 3.5
Cairns random	60	9.7 ± 3.6

Table 3 shows tree species used as myna roosts in Cairns, compared with a random sample of what was available. There is little evidence of selectivity. As had been found in Canberra, with very rare exceptions, mynas in Cairns changed roosts frequently; roosts were observed pre and post-cyclone Larry – mynas stayed for short times in trees that had not been damaged by the storm – otherwise they simply moved to alternatives nearby. Roosts tended to contain fewer birds in Cairns than in Canberra, but there were more of them.

Table 3: Tree species used as roosts by mynas in Cairns 2006-7 compared with a random selection of trees.

Tree	Roosts (n=85)	Random (n=60)
Ficus sp.	10 (11.8%)	2 (3.3%)
Mangifera indica	14 (16.5%)	3 (5%)
Palm	19 (22.4%)	26 (43.3%)
Syzigium sp.	10 (11.8%)	3 (5%)
Other	52.5%	56.6%

The investigation of myna roosting behaviour in the wild was intended to give insight into the design of the roost trap – a device that could be used to completely enclose roosting flocks, and euthanase them with the mobile euthanasia van. Aviary trials of myna roosting behaviour were conducted with the same objective.

Aviary trials of myna roosting behaviour

A large outdoor aviary, 30 m long x 5 m wide, was constructed from timber and 25 mm galvanised steel wire mesh. Each end formed a "turret" 5 m high, and provided with perches and covered with tarpaulin to mimic conditions inside natural roosts (Figure 5). Foodd and water was provided *ad libitum* in the body of the aviary. A "flock" of around 100 wild-trapped mynas was then maintained in the aviary, with the objective of determining what conditions inside the roosts were preferred. This followed early observations that seemed to indicate a preference for brightly-lit locations, eg as provided by proximity to street lights, and locations with protected microclimates, as eg by proximity to heated buildings or in dense foliage.

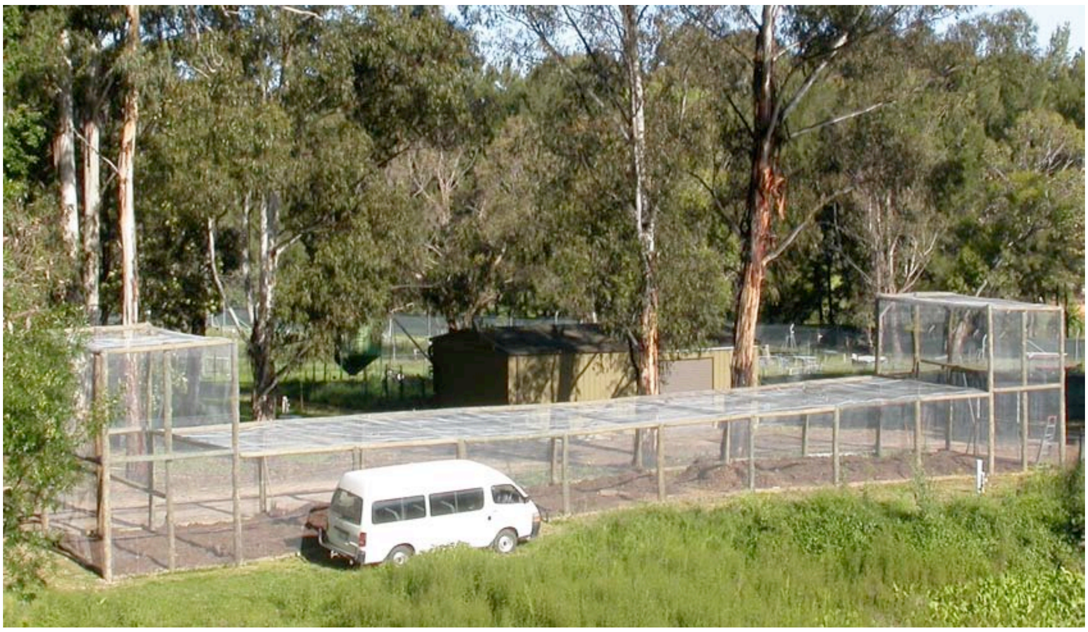

Figure 5: Outdoor aviary, 30 m long x 5 m wide, with a 5 m high turret at each end. Perches were provided in each turret and this was covered with tarpaulins, designed to simulate conditions inside a natural roost. Pic by Toby Roscoe.

Figure 6: View from a Moultrie "game camera" inside a roost turret.

Evidence of preference for particular sets of conditions was sought by monitoring the behaviour of the birds via closed circuit TV and "game cameras". A view inside one turret is shown in Figure 6 and inside the body of the aviary in Figure 7. The outdoor aviary trials were abandoned when it became clear that (1) there was little or no evidence of a real preference for particular roosting conditions in wild roosts and (2) it was found that mynas in the aviary showed a preference for one turret over the other, presumably because of differences in tree cover, or some other site feature(s) that masked any preference that may have been evidenced by the experimental treatments.

Fig 7: Flying mynas inside the body of the outdoor aviary, where food and water were provided *ad libitum*. Mynas were able to fly freely between the two roosting turrets. Pic by Toby Roscoe.

Moving roosting flocks of mynas

Preliminary investigations (Mock, 1998) suggested that it might be possible to cohesively move (herd) roosting flocks of mynas from one tree to another, in the same fashion that roosting flocks of flying-foxes have been herded over short distances (Tidemann, 2003). The advantage of this, if it were possible, would be that birds roosting in an inopportune location could be moved to another tree that was more amenable to trapping, ie, perhaps lower or with less clutter. In a pilot trial Mock (1998) cohesively moved a roosting flock of around 50 birds from one tree to another about 25 m away by banging the trunk of the original tree and using call-playback of myna chorusing to attract the flock to the target tree. In this instance the flock remained together. In later trials it was found easy to move birds out of the tree they were occupying, with a variety of cues, eg, call-playback of myna distress calls, banging of metal objects and high intensity lasers, such as are used to displace birds from airports. However, the other part of the equation, namely attracting the flock to another target tree with call-playback of myna chorusing, proved to be ineffective. In some cases the flock remained cohesive, but ended up in a non-target tree; in others they dispersed into sub-groups. The investigation was abandoned when it became clear that it was unlikely to be useful for routinely moving flocks from one place to another to facilitate roost trapping. However, it may be that these techniques, particularly lasers, would be useful to deter birds from roosting in particularly inopportune locations, where, eg, fouling was a significant problem. The use of deterrents would be less costly and disruptive than, for example, lopping roost trees, as has been trialled in Singapore (Yap et al, 2002; Lim et al, 2003) and could be used on roosts in shopping centres.

Development of a myna roost trap

The objective of the earlier investigations of myna roosting behaviour and attempts to establish roosting habitat preferences in the aviary was to inform the development of a myna roost trap: a device that could be used to enclose roosting flocks of mynas *in situ*, and remove the occupants for euthanasia in a controlled and humane fashion. The mobile euthanasia van was developed to service this need. The trapping device needed to be portable and easy to assemble and disassemble at multiple sites, to enable trapping of successive roosts. After much experimentation, such a device was built – two trailer-mounted 15 m high masts that supported a very large net that could be set up on site during the day and the net lowered remotely once birds had settled into the roost for the evening. The entire rig was trailer-mounted – making a total of four separate trailers (Figure 8), although one mast trailer could ride piggyback atop the other (Figure 9). The trap was loosely modelled on a 15 m high harp trap developed to catch flying-foxes (Tidemann and Loughland, 1993) and used the same aluminium yacht masts, although with more and stronger rigging.

A tandem-wheeled trailer was used to carry an 800 litre water tank to provide ballast for each of the two 200 litre tanks on the mast-trailers, a large rotating drum to carry the 40 kg net, and a nosepiece that fitted to the snout of the enclosure net to extract birds prior to euthanasia. The nosepiece was equipped with lights and an electric fan to guide birds exiting the net. Once the roost site was selected the two mast-trailers were placed in position, 21 metres apart, one either side of the roost tree. Each trailer was secured in position with wheel chocks and the masts were stabilised by means of steel wire ropes to the trailer frames and outriggers, in addition to the stability provided by the 400 kg of water on each trailer (Figure 10). The overall weight of the net and supporting yardarms was 62 kg.

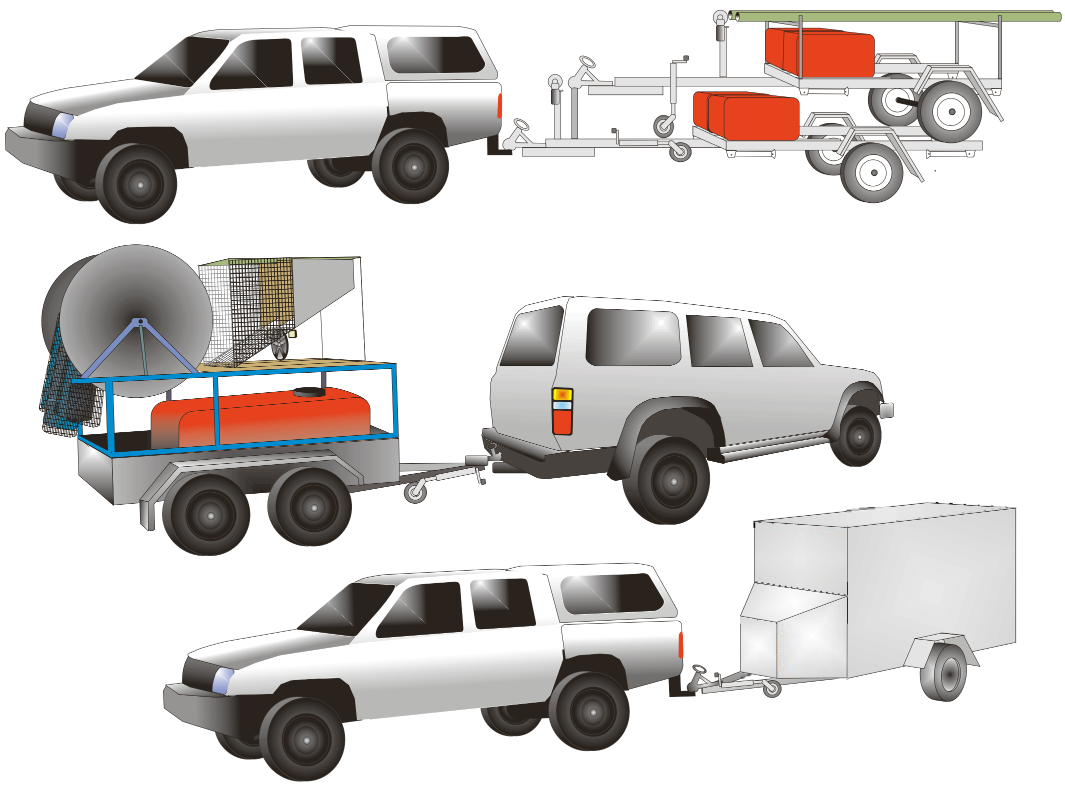

Fig 8: The roost trap disassembled and packed for transport. The top vehicle tows two mast-trailers, one piggybacked on the other; the small red devices are 200 litre ballast tanks, two per trailer, to provide stability for the mast once it was erected; the middle vehicle tows an 800 litre water tank (large red) to fill the ballast tanks on the mast-trailers, a net drum and an extractor; the third vehicle tows the mobile euthanasia van. Pic by Daryl King.

Fig 9: Mast-trailers with ballast tanks, masts on top rack. Pic by Chris Tidemann.

Fig 10: Enclosure net mounted between the assembled masts. Pic by Daryl King.

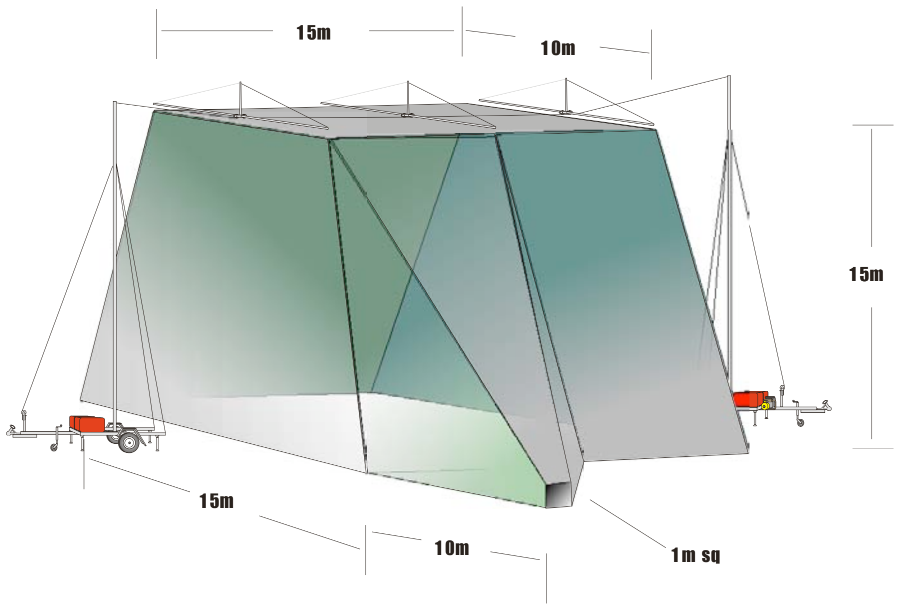

Fig 11: Enclosure net showing dimensions and nose-piece. The extractor docked with the 1 m^2 nose-piece and lights and an electric fan were provided to guide the enclosed birds from the enclosure net, via the extractor, into holding cages, prior to drafting into the modular euthanasia cages.

Erection of the entire trap assembly was eventually achieved after a great deal of experimentation to achieve a mast-stay combination that was strong enough to support the combined weight of the net and the supporting yardarms (62 kg). Three prime movers and four trailers were necessary to move it and four people were required to operate it. The dimensions of the trap were calculated as adequate to achieve enclosure of trees up to 14.5 m high and 14.5 m wide, which based on the earlier analysis of wild roost sites, was deemed able to enclose a useful number of roosts.

What did not become apparent until the whole structure was fully assembled was its massive wind moment. Although the net was constructed of mesh, because of its very large area, its total wind moment proved so strong that, without stays mounted to earth anchors or similar, the assembly was deemed impossible to use safely, except in almost windless conditions, < 15 km/hour winds. Conditions such as these are extremely infrequent on a daily basis, are usually restricted to short windows on particular days when they do occur – and are difficult to predict with available meteorological information. Erection of the device was attempted at various times of the day, particularly early morning, when light winds seemed likely, but almost invariably it needed to be taken down later in the day to prevent it blowing over. Most erection attempts were made in a controlled location; partial erection was achieved at an actual roost site with ideal access and few obstructions nearby (Figure 4), but by the next day, when it was planned to complete the assembly, the birds had left the roost. It is not known if this was as a result of the partial trap assembled on site or a spontaneous move. Earlier assembly of various mast-mounted speakers and other such devices near roosts suggested that the move may have been a spontaneous one – as had been observed many times at this and other sites.

Consideration of (1) the frequency of roost moves; (2) how few actual roost were suitable for trapping because of access and lack of obstructions; and (3) the extreme difficulty experienced with wind, led to the unpalatable conclusion that it was not profitable to proceed further with the quest for a myna roost trap.

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