Monitoring trends in waterfowl wounding 2022

Game Management Authority

Acknowledgment

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1 Executive Summary

The Victorian Sustainable Hunting Action Plan 2021 – 2024 (SHAP) committed to implementing a monitoring program to measure the success of management interventions aimed at reducing waterfowl wounding in duck hunting. In response, an ongoing program using radiography to detect embedded shotgun pellets in ducks as an index of the incidence of wounding commenced in Victoria in 2022.

Trapping was conducted at five sites in the south and north-east of the state following the end of the 2022 duck season. In total, 596 game ducks were captured and radiographed. We were able to trap and examine birds from five of the eight game duck species.

In total, 3.4 per cent (20) of the ducks were shown to be carrying embedded pellets and involved three of the five species that were trapped: Pacific Black Duck, Grey Teal and Chestnut Teal. First year birds had almost three times the infliction rate of adult birds (7.5 per cent vs 2.6 per cent, respectively) yet accounted for only 16 per cent of the total number of ducks radiographed. Pacific Black Ducks were found to have the highest rate of infliction, with 6.5 per cent of trapped birds carrying embedded pellets. Almost 50 per cent of all birds carrying pellets had them embedded in the rump, with the remainder distributed between the neck, wing, breast and back.

The overall infliction rate of 3.4 per cent cannot be interpreted as the actual rate of wounding as the birds sampled in this study are representative of the apparently small proportion that survive being wounded and are available for examination. The infliction rate can only be used as a proxy index to monitor trends in waterfowl wounding. Direct studies, such as observations of hunters in the field, should be used to determine the actual rate of wounding more accurately.

2 Background and purpose

Wounding can be an unintended consequence of duck hunting. A wounded bird is defined as one that is struck by shotgun pellets and not recovered by the hunter. Factors that can contribute to wounding include poor shooting skills, long-range shooting, incorrect equipment choices, shooting into flocks and the lack of an effective retrieval strategy.

The SHAP committed to implementing a monitoring program to measure the success of management interventions aimed at reducing waterfowl wounding in duck hunting. A strong-evidence base will help to ensure informed community discussion on waterfowl wounding, guide management actions and allow the success of actions to be reviewed.

Denmark has instituted a program to monitor wounding by x-raying live trapped birds to identify the proportion carrying embedded shot. This has been used effectively to measure the success of a targeted plan to reduce waterfowl wounding caused by hunting. A similar program was also conducted in Victoria between 1957 – 1973 (Norman 1976). In response to the SHAP commitment, an ongoing wounding monitoring program using x-raying (radiography) will be reinstated in Victoria. While this approach cannot be used to determine actual level or rate of wounding, it can be used as a proxy measure to monitor trends in the rates of wounding (Clausen *et al.* 2017) in a less resource intensive way than some other forms of monitoring.

This wounding monitoring program commenced with a trial in June 2021 to test our ability to capture and x-ray wild-caught game ducks. Learnings were then applied to the program in 2022. Ducks were trapped immediately following the end of the 2022 duck season and x-rayed to document the proportion of birds carrying embedded shotgun pellets (the infliction rate). First-year birds were the focus as they provide a more accurate measure of the incidence of wounding compared to adult birds that can accumulate pellets over several hunting seasons (Norman 1976; Noer and Madsen 1996, Noer *et al.* 2017). To raise awareness, ensure transparency and motivate hunters to act, findings of this monitoring program will be reported annually on the Game Management Authority's (GMA) website. This is the first of these reports.

3 Methods

3.1 Targeted species

In Victoria, there are eight species of game ducks (see below) which may be hunted during the prescribed open season. Any of these species that were captured were processed:

- Grey Teal (*Anas gracilis*)
- Australasian Shoveler (*Spatula rhynchotis*)
- Pacific Black Duck (*Anas superciliosa*)
- Australian Wood Duck (*Chenonetta jubata*)
- Chestnut Teal (*Anas castanea*)
- Australian Shelduck (*Tadorna tadornoides*)
- Pink-eared Duck (Malacorhynchus membranaceus)
- Hardhead (Aythya australis)

3.2 Survey locations

All animals were wild-caught at five locations in two regions in Victoria, which can be generalised as the north-east (Oxley, Thoona and Wangaratta) and south (Lara and Point Wilson). At the north-east sites, ducks were trapped using cage traps on small dams (< one hectare), on private property at Oxley and Thoona and adjacent to a settlement pond at a Wangaratta sewage treatment plant (STP). In the south, cannon-netting was carried out at a wetland at Point Wilson and cage trapping was conducted at a wetland at Lara.

3.3 Capture systems and methods

3.3.1 Cage traps

Sites for duck capture were selected based on access to secure trap sites and where large concentrations of ducks had been previously observed.

Wire mesh cage traps and/or cannon-netting were used to capture game ducks at five sites across two bioclimatic zones of Victoria: south (in close proximity to Lara) and north-east (in close proximity to Wangaratta). Traps and the target netting zone were baited with grain (whole/cracked corn, wheat or barley) for up to two weeks prior to trapping, to familiarise ducks with the equipment and trapping site. Baiting continued throughout the trapping period with the use of a game feeder and with grain placed directly in and around the traps by hand. The feeder was programmed to automatically dispense a small amount of grain at times that coincided with duck feeding activity and when trapping was planned to be undertaken (early-morning and late-afternoon). This 'free feeding' also allowed observation of duck numbers and species as well as the prevalence of non-target species.

On the day of trapping, traps were baited and activated by securely covering the tops with nylon mesh (cage traps) and/or closing the backs, narrowing the entrance of each trap to minimise ducks escaping once they had entered. Traps were monitored from a distance to minimise disturbance. When sufficient numbers of birds had entered the traps, researchers secured the entrance with cable ties to prevent captured birds from escaping. Birds were then removed from traps and held in commercial poultry transport cages prior to being individually transported a short distance for processing (Figures 1 and 2). While waiting to be processed, the poultry cages were covered with a cotton sheet to keep the birds calm. When ready for processing, ducks were then individually placed in cotton pillowslips, weighed, measured and radiographed to screen for embedded shotgun pellets.

Figure 1: Approaching captured ducks

Figure 2: Extraction of ducks from cage traps

Trapping occurred immediately after the conclusion of the duck season to ensure that ageing of first-year (immature) birds from plumage characteristics was more achievable (Rogers *et al.* 2019) and while immature birds retained certain plumage characteristics prior to moulting into their adult plumage. Given trapped birds were approaching 12-months of age, this was not always possible and multiple characteristics were considered to determine age using Rogers *et al.* 2019 as a guide. There were eight traps set at Lara. All other sites where cage traps were deployed only used a single trap. Trapping commenced in mid-June and was completed by mid-August, however, the bulk of trapping was completed by the end of June 2022. Traps were only activated when researchers were in attendance and were left open at all other times so birds could move freely in and out of them.

Ducks were caught with rectangular wire cage traps with funnelled (tapered) entry as per McNally and Falconer (1953), Norman (1976) and current research studies led by Deakin University. These traps were positioned to allow ducks to enter the trap from the water's edge but have access to solid ground or shallow water inside the trap (Figure 3). This also helped to prevent non-target species from entering the trap on account of avoiding water. A maximum of three consecutive days of trapping in the same location occurred, to prevent trap wariness.

Figure 3: Cage trap placement

Cage traps with a funnelled entry allow ducks to enter through a small opening which is funnel-shaped (tapered) making it difficult (but not impossible) for the bird to escape (Figures 4 and 5). Larger circular or irregularly shaped wire cage traps were also used (Figures 6 and 7). These traps were constructed with 75 x 50mm wire mesh with nylon mesh tops to avoid injury should birds fly into the top of the cage. These cage traps were placed to enable ducks to enter via shallow water or from land. Traps were placed in shallow water so bait could be seen on the bottom of the water by ducks. In addition, floating bait platforms were also included in some of the cage traps.

Figure 4: Cage trap with funnelled entry

Figure 6: Large cage trap baited

Figure 5: Funnelled entry with bait

Figure 7: Cage trap on water's edge

De-activated traps (i.e. traps that remained open so birds could freely move into and out of them) were usually placed in position at approximately four weeks prior to trapping to help to acclimatise birds to the structures. Free feeding followed to help concentrate birds in the area. Grain was also broadcast at southern trap locations with a programmable game feeder (Figure 8).

Figure 8: Programmable game feeder

Captured birds were placed in a pillowcase and radiographed using a portable wireless digital radiography system and screened for the presence of embedded shotgun pellets. All captured ducks had their species, age (<1 year of age = hatch year, or >1 year of age = after hatch year), weight and, where possible, sex recorded. Uniquely numbered leg bands supplied by the Australian Bird and Bat Banding Scheme (ABBBS) were secured to the left leg of each duck by appropriately authorised members of the Victorian Wader Study Group (VWSG) or Deakin University under their permits. When authorised banders were unavailable to band, short-lived identification marks (picric acid) were placed on a tail feather to allow identification of birds that were trapped multiple times. Morphometric measurements were also recorded to gather a body of data and assist with future age and sex determination. Once processed, birds were released at the site of capture and within three hours.

The study also allowed for opportunistic assessment of other non-game duck species that were trapped in the process of capturing game ducks. Non-game waterbird species were radiographed and then immediately released back into the same habitat. There was expected to be some bias in the sample of trapped birds given some species are known to be attracted to the bait more than others; the types of traps used can favour some species due to location and design, and species density and age could influence the frequency of capture.

3.3.2 Cannon netting

Cannon-netting involves firing projectiles attached to a net out over a group of birds. It is a technique widely used to capture live birds and other animals. This method is capable of capturing many birds in a single event. The VWSG has over 30 years of experience in cannon-netting and is appropriately authorised to conduct the activity. The VWSG were contracted by GMA to use cannon netting to capture ducks on three occasions at the Point Wilson site. Roosting locations at potential trapping sites were observed and a suitable area selected for trapping. A site adjacent to water and clear of tall vegetation that had a direct line of sight adjacent to the landing area of the net was chosen so the 'catch zone' was easily observable from a safe distance and clear of obstructions.

As with cage trapping, the area in the 'catch zone' was pre-baited with grain for two weeks prior to the planned day of capture with the programmable game feeder and by hand. In the days preceding capture, the area in the 'danger zone' (i.e. close to where the net starts its propulsion) remained unbaited, concentrating ducks away from the front of the net where injury could occur (Figure 9). These maximal and minimal distances of the landing zone of the propelled net were visually marked using naturally occurring (and therefore non-threatening) objects, such as sticks and rocks, allowing easily identification (and presence of ducks) from a distance. This allowed observers and an assigned Safety Officer to instruct the firer (person who remotely detonates the cannons, propelling the nets) when, or when not, to fire, contingent on the location of ducks within the catch zone.

On each day of capture, observers viewed the ducks and trapping area from a distance, to avoid disturbing the birds. The Safety Officer decided when the location of birds within the catch zone was suitable for the cannons to be fired and the net deployed safely.

Communication between the Safety Officer and firer occurred via UHF radio, at a distance of up to 100 metres, while other investigators waited at a distance to avoid disturbing the ducks. When a sufficient number of birds congregated in the catch zone and no birds were in the danger zone, the Safety Officer directed the firer to remotely deploy the nets. Upon deployment, investigators quickly moved to the net and extracted the ducks (Figures 10 and 11) and placed them into poultry transport crates before being moved a short distance to be processed (Figure 12).

Figure 9: Cannon net and baited 'catch zone'

Figure 10: Moving captured ducks from the water

Figure 11: Duck processing stations

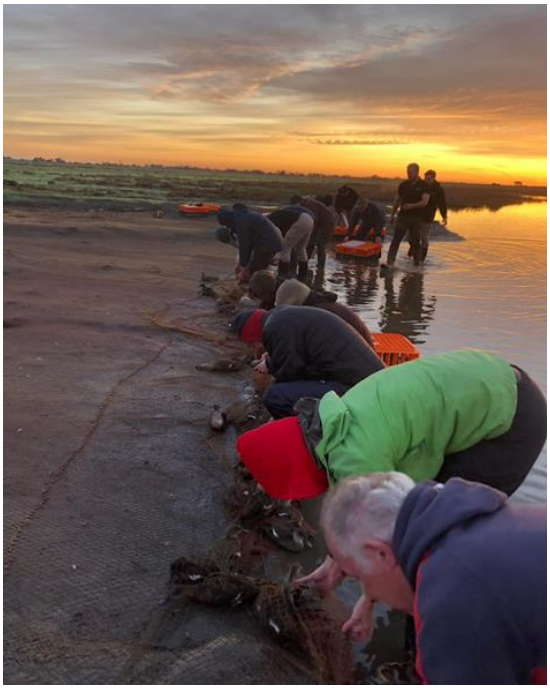

Figure 12: Extracting ducks from the net

3.4 Determination of sex and age

Where sexual dimorphism and plumage variations between the sexes were not apparent, sex was determined where possible using specific plumage characteristics detailed in Rogers *et al.* (2019). Morphometric and weight measurements were collected as part of this process, which may assist in ageing and sexing birds once a sufficient body of data has been collected.

3.5 Radiography procedure

Radiography was undertaken to identify the presence/absence of embedded shotgun pellets. The number and anatomical location of embedded pellets in each wounded duck was recorded and will be used to monitor trends in wounding over time.

Upon removal from the poultry transport crates, each duck was contained in a breathable cotton pillow slip and placed in a clear plastic tub to minimize movement and keep the bird in the x-ray field. The duck and tub were then placed on a 25 x 30cm digital x-ray plate (Exprimer EVS 2430) and radiographed with an Atomscope TR9020B portable veterinary x-ray unit suspended on a surveyor's tripod (Figures 13 and 14). Settings of 68 kV and 1.05 mAs, with a focal distance of approximately 50cm, were used. Each digital image was immediately viewed and, if necessary, subsequent radiographs were taken. Each radiograph was dorso-ventral in orientation as conscious animals will automatically 'right' themselves, eliminating the possibility of lateral images being taken without chemical or more stressful physical restraint methods being employed. All radiography was performed in a discrete area where personnel access was restricted and at least five metres away from other investigators.

Figure 13: Field radiography station at Point Wilson

Figure 14: Field radiography at Wangaratta

3.6 Other procedures independent of wounding assessment

Collaborators from Deakin University under their own authorisation collected blood samples and buccal and vent swabs to screen for strains of avian influenza as a part of a long-term disease surveillance program in waterfowl.

3.7 Relevant licences, permits and approvals

This project, entitled '12.20 Monitoring the frequency of waterfowl wounding in Victoria', has been approved by the Wildlife and Small Institutions Animal Ethics Committee. A Department of Environment, Land, Water and Planning research authorisation permits the GMA to undertake this research under the *Wildlife Act 1975* (Permit No: 10009542). A *National Parks Act 1986* permit was also granted to the GMA, allowing work to be undertaken on land managed by Parks Victoria.

The Principal Investigator involved was issued a Radiation Use Licence issued under Section 43 of the *Radiation Act 2005* (Licence No. 100214596). The GMA was issued with a Radiation Management Licence under Section 5 of the *Radiation Act 2005* (Licence No. 300085326). A safe work plan detailed tasks, potential hazards, risks and control measures for relevant employees and contractors.

4 Results

4.1 Total capture and demographics

A total of 596 ducks were captured and radiographed at five sites from 14 June to 22 August 2022. Of these, 380 ducks were caught using cannon-netting and 218 were caught in cage traps. Cannon-netting accounted for approximately 64 per cent of the total number of ducks captured and averaged approximately 126 ducks per catch event. Cage trapping across all sites averaged 16.6 ducks per capture day, ranging from 8 to 96 birds. Non-target waterbird species were captured at several sites with both cage traps and cannon netting. There were six Purple Swamphens (*Porphyrio porphyrio*) captured during a single cannon-netting event and four during cage trapping which were extracted and released immediately. Two Plumed Whistling Ducks (*Dendrocygna eytoni*) were also captured in the north-east of the state.

There were no injuries or mortalities as a result of trapping or handling recorded from cage trapping and a single mortality (an immature Chestnut Teal) as a result of cannon netting. Excluding recaptures and waterbirds that escaped during extraction from nets and cages, this represents a mortality rate of less than one percent (0.17 per cent).

There were 472 ducks captured and radiographed in the southern sample sites (Point Wilson and Lara) and 124 in the north-eastern sites (Wangaratta, Thoona and Oxley). Of the 472 ducks captured and radiographed at the southern sites, 457 were fitted with uniquely numbered leg bands supplied by the ABBBS. There were four ducks re-captured during subsequent trapping events at Lara and eight ducks re-captured at Point Wilson. The breakdown of duck captures by site is shown in Table 1.

Table 1: Location, method of capture and number of game ducks radiographed in 2022

Location	Method	Trap days	Dates of capture	Total	Average per day
Lara	Cage trap	7	14-16 and 22 June, 10-13 July	92	13.1
Point Wilson	Cannon net	3	21 and 28 June and 5 July	380	126.7
Wangaratta STP	Cage trap	2	20 and 22 August	16	8
Oxley	Cage trap	1	19 August	86	86
Thoona	Cage trap	3	18, 19 and 21 August	22	7.3

Of the eight declared game duck species, five were able to be captured and radiographed: Australian Shelduck, Australian Wood Duck, Chestnut Teal, Grey Teal and Pacific Black Duck. No Pink-eared Duck, Australasian Shoveler or Hardhead were caught during trapping.

Species composition varied by region. Capture events in the south of the state were comprised of a greater proportion of teal species compared with the north-east. Grey Teal and Chestnut Teal accounted for 53.8 and 37.5 per cent of the captured ducks respectively in the south, whilst Pacific Black Ducks only made up 6.8 per cent of ducks captured. Conversely, Pacific Black Ducks accounted for 60.5 per cent of ducks captured in the north-east and Chestnut Teal and Grey Teal combined accounted for 33 per cent of the remainder.

There were significantly higher numbers of adult ducks (>1 year) than immature or first-year birds (<1 year), which only accounted for 16 per cent of all ducks captured across all sites. There was some difficulty in distinguishing first (or hatch) year birds from adults given the timing of trapping (many were nearing 12-months of age) and their plumage began to resemble that of adults. There were insufficient numbers of Australian Shelduck and Australian Wood Duck to detect a sex bias in overall capture, but male Pacific Black Ducks and Australian Wood Ducks accounted for 62.6 and 78.7 per cent of the total catch respectively. The breakdown of sex and age of ducks by species is shown in Table 2. It was not possible to sex Grey Teal from plumage characteristics.

Table 2: Sex and age of ducks captured at all sites in 2022

Species	Male	Female	Unknown	Adult	Immature	Total
Australian Shelduck	5	5	0	10	0	10
Australian Wood Duck	3	2	0	2	3	5
Chestnut Teal	140	38	0	155	23	178
Grey Teal	NA	NA	294	252	42	294
Pacific Black Duck	67	33	7	82	25	107
Plumed Whistling Duck	1	1	0	2	0	2

4.2 Pellet infliction by species, age and location

Of the 596 ducks captured and radiographed, 20 (3.4 per cent) were shown to have embedded shotgun pellets.

Pacific Black Ducks were the species found to have the highest rate of pellet infliction, with 6.5 per cent of birds (7 of 107) carrying embedded pellets. Grey Teal (8 of 294) and Chestnut Teal (5 of 178) were found to carry embedded pellets at 2.7 and 2.8 per cent respectively. No other species captured in 2022 were found carrying embedded pellets. A breakdown of pellet infliction by species, age and sex is shown in Table 3.

Of the 20 inflicted birds, seven (35 per cent) were immature (<1 year) and 13 (65 per cent) were adult birds. Of the 93 immature birds examined, the seven inflicted birds represented 7.5 per cent of the total number of immatures. Of the 503 adult birds examined, the 13 inflicted birds represented 2.6 per cent of the total number of adults. Therefore, immature birds had almost three times the infliction rate of adult birds.

All ducks had single embedded pellets with the exception of a Pacific Black Duck which carried two embedded pellets which were of equal size (see Figure 15 and 16).

Of those birds carrying pellets, almost 50 per cent (nine out of 20) had pellets embedded in the rump. The remainder of pellets were distributed between the neck, wing, breast and back. Figures 15-20 show indicative images of birds carrying embedded pellets.

There were six ducks found to be carrying embedded pellets out of 124 caught in the north-east of the state and 14 ducks out of 472 in the south, accounting for 4.8 per cent and 3 per cent infliction rates respectively.

Figure 15: Black duck (multiple pellets)

Figure 16: Black duck (pellet in back)

Table 3: Sex and age of game ducks carrying embedded shotgun pellets

Species	Male (<1)	Male (>1)	Female (<1)	Female (>1)	Unk. (<1)	Unk. (>1)	Total
Aust. Shelduck	0	0	0	0	0	0	0
Aust. Wood Duck	0	0	0	0	0	0	0
Chestnut Teal	1	3	0	1	0	0	5
Grey Teal	0	0	1	0	2	5	8
Pacific Black Duck	2	2	1	2	0	0	7

5 Discussion

This is the first direct large-scale assessment of waterfowl wounding conducted in Victoria since the 1950-70s (Norman 1976) with 596 game ducks examined for signs of wounding (embedded pellets) at two different geographic areas (south and north-east) in Victoria. This work will be part of an ongoing monitoring program to track trends in waterfowl wounding over time.

There are eight species of native duck available for game hunting in Victoria. Two were not permitted for hunting in 2022 (Australasian Shoveler and Hardhead). Australasian Shoveler have been prohibited from hunting in Victoria since 2016. Of the six remaining game duck species available for legal harvest in 2022, five were captured and radiographed in this study.

In total, 3.4 per cent (20) of the 596 ducks examined where shown to be carrying embedded pellets. Three species were affected: Chestnut Teal, Grey Teal and Pacific Black Duck. Only small numbers of Australian Shelduck and Australian Wood Duck were captured and radiographed, and none were found to be carrying embedded pellets. Pink-eared Ducks, Australasian Shovelers and Hardheads were not captured in 2022.

Pacific Black Ducks were found to have the highest rate of pellet infliction, with 6.5 per cent of trapped birds carrying embedded pellets. Grey Teal and Chestnut Teal were found to carry embedded pellets at 2.7 and 2.8 per cent respectively. This may be due to larger species of duck being more likely to survive wounding than smaller species and, therefore, are more likely to record a higher rate of pellet infliction (Norman 1976; Loyn 1989).

The infliction rate of 3.4 per cent cannot be interpreted as the actual rate of wounding caused by waterfowl hunting. The method of assessment used here can only sample the portion of birds that are sub-lethally wounded and survive. A limited number of studies have shown that the majority of wounded birds will die and, as a consequence, are not available to be sampled (Van Dyke 1980; Kirby 1981). Also, radiographs can only detect those birds carrying embedded pellets but does not detect those animals that have been shot and pellets have passed through the body. Examples of this were observed in a small number of ducks that had evidence of apparent gunshot injuries to their bills and feet. Therefore, the infliction rate can only be used as a proxy index to monitor trends in wounding over time. Direct studies, such as observations of hunters in the field, should be used to determine the actual rate of wounding more accurately.

Of the 596 ducks captured and radiographed, 93 were immature (first year) birds and had only been subjected to a single duck hunting season, providing a more accurate indication of the occurrence of wounding. Immature birds had almost three times the infliction rate of adult birds (7.5 vs 2.6 per cent, respectively) yet accounted for only 16 per cent of the total number of game ducks examined.

This is the first year of an ongoing program to monitor the extent of pellet infliction among wild-caught game ducks in Victoria. Recent restrictions to hunting due to COVID-19 may have influenced the detected level of infliction, in addition to the limited number of study sites and lack of larger game duck species in the radiographed sample. Efforts to increase the number of study sites and sampled birds, including larger species, are required to ensure the game duck population is adequately sampled. Future monitoring will address this.

6 Acknowledgements

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7 References

Clausen, K. K., Holm, T. E., Haugaard, L., and Madsen, J. (2017). Crippling ratio: A novel approach to assess hunting-induced wounding of wild animals. *Ecological Indicators* **80**, 242-246.

Loyn, R. H. (1989). *The management of duck hunting in Victoria: A review. Technical Report Series No. 70.* Department of Conservation, Forests and Lands: Melbourne, Australia.

Moloney, P. D. and Powell, Z. (2019). *Estimate of duck and stubble quail harvest in Victoria for 2019: results from surveys of Victorian game licence holders in 2019.* Department of Environment, Land, Water, and Planning: Melbourne, Australia.

Moloney, P. D. and Flesch, J.S (2019). *Estimate of duck and stubble quail harvest in Victoria for 2021: results from surveys of Victorian game licence holders in 2021*. Department of Environment, Land, Water, and Planning: Melbourne, Australia.

McNally, J., and Falconer, D. D. (1953). Trapping and banding operations Lara Lake, 1952. *Emu-Austral Ornithology* **53**, 51-70.

Menkhorst, P., Stamation, K. and Brown, G. (2019). *Hunters' bag survey: 2019 Victorian duck hunting season.* Department of Environment, Land, Water, and Planning: Melbourne, Australia.

Noer, H. and Madsen, J. (1996). Shotgun pellet loads and infliction rates in pink-footed goose *Anser brachyrhynchus*. *Wildlife Biology* **6**, 65-73.

Noer, H., Madsen, J., and Hartmann, P. (2007). Reducing wounding of game by shotgun hunting: effects of a Danish action plan on pink-footed geese. *Journal of Applied Ecology* **44**, 653-662.

Norman, F. I. (1976). The incidence of lead shotgun pellets in waterfowl (Anatidae and Rallidae) examined in South-Eastern Australia between 1957 and 1973. *Wildlife Research* **3**, 61-71.

O'Brien, M., Lee, R., Cromie, R, and Martin J. (2016) Assessment of the rates of injury and mortality in waterfowl captured with five methods of capture and techniques for minimising risks. *Journal of Wildlife Diseases* **52**(2) Supplement 2016, pp. S86–S95.

Rogers, D., Menkhorst, P. and Davies, J. (2019). *Ageing and sexing Victorian native game birds using plumage characters. Arthur Rylah Institute for Environmental Research Technical Report Series No.294.* Department of Environment, Land, Water and Planning, Heidelberg, Victoria.

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