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Wilsons Promontory National Park Hog Deer Control Program

Game Management Authority

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Contents

Background

Wilsons Promontory National Park (WPNP) is one of Victoria's iconic National Parks located in southwest Gippsland. In 1898, land was temporarily set aside to form WPNP with it being permanently reserved and gazetted in 1905 extending into half of the Yanakie parish.

Parks Victoria (PV) is the state's responsible land manager for WPNP, managing it in accordance with the *National Parks Act 1975*.

WPNP provides sanctuary for a number of protected flora and fauna species. It also has a historical population of introduced Hog Deer (*Axis porcinus*) residing in the park.

Hog Deer, a listed game species, are highly sought after by hunters and are critically endangered in their native range.

However, they are introduced fauna and in some circumstances can contribute to negative impacts on native biodiversity.

The *National Parks Act 1975* compels PV to manage introduced fauna.

Historically, recreational hunting of Hog Deer occurred in the WPNP until the 1960's when all hunting ceased. Since this time the population has remained undisturbed by recreational hunting.

In recent years, PV has noticed an increase in visible Hog Deer sightings at the WPNP, specifically around populous places. It is accepted that further scientific monitoring needs to occur to get a robust measure of the scale of the increase in abundance or density of the deer at WPNP.

Given this, PV decided to work with peak hunting stakeholders and the Game Management Authority (GMA), the state's regulator of game hunters, to run a controlled operation to remove deer from specific sites where high value environmental and cultural assets where at risk from the Deer

Introduction

PV had become concerned by the perceived increase in Hog Deer numbers. The rise in the population was thought to be having negative impacts on vegetation and browsing competition with native macropods, mainly Swamp Wallaby (*Wallabia bicolor*), Eastern Grey Kangaroo (*Macropus giganteus*) and Common Wombat (*Vombatus ursinus*).

The eruption in the Hog Deer population appears to have happened relatively quickly. Many people attribute recent large-scale bushfires as the likely catalyst. There were two recent fires in WPNP, occurring in 2005 and 2009.

These fires create two situations: the first was forced dispersal where deer moved to unburnt areas; the second was extensive regeneration of vegetation.

This process often produces more palatable plants at the start of recovery providing an ideal food source. These two factors may have assisted Hog Deer spreading into new habitats and provided them with a significant increase in nutrients, allowing them to breed successfully.

Prior to these fires, sightings of Hog Deer were uncommon unless people were specifically looking for them. PV decided that a Hog Deer control program was required to manage the overabundant population. This program was targeted to protect specific assets as opposed to a whole park management program.

Wilson Promontory National Park is a popular destination and receives some of the highest public land visitation in the state.

To implement the control program safely, public access is restricted in some control areas during operations.

Preparations included an ongoing communications strategy used for informing key stakeholders, local community groups and park neighbours.

PV engaged the Australian Deer Association (ADA) and the Sporting Shooters' Association of Australia Victorian Branch (SSAA) to assist in planning and to utilise their volunteer hunters.

The GMA was engaged to provide PV with the necessary permits to allow the removal of the deer as well as to set up an on-site checking station. Data on Hog Deer condition, size and health was collected from every animal harvested.

Pre and post population monitoring programs were also designed and implemented.

The 2016 August control operation follows the successful 2015 August operation both of these programs were large scale trials where the whole of WPNP was closed to the public.

In May 2016 and May 2017, there was a small-scale control operation based around Oberon Bay. The rest of the WPNP remained open during this operation but due to inclement weather, particularly a cold strong wind, no animals were taken in 2016 and one animal in May 2017

Method

Target sites

In 2016, PV identified four specific sites where the removal of Hog Deer would take place. These sites were:

- Tidal River campground and surrounds
- Darby River at the airstrip
- Darby River at Cotters South
- Oberon Bay

These sites were identified as key areas where the deer were either having a direct impact on the floristic composition or where there were consistent reports of deer being seen.

Monitoring

To address knowledge gaps, spotlight transect counts pre and post the program were conducted at all four sites to obtain an animal per kilometre index.

The pre and post operation transect counts were conducted on 2 August 2016 and 15 September 2016 respectively, with the control program being conducted in August 2016

In both 2015 and 2016, PV evaluated hunter Capture Per Unit Effort rate (CPUE). This is important as it monitors the efficiency and effectiveness of volunteer hunters and provides an index of relative abundance, which will be used to inform future operations.

Volunteers

Volunteer hunters from the ADA and SSAA carried out the control program for deer. Volunteers were issued with permits allowing the carriage and use of firearms in a park, the destruction and removal of Hog Deer outside of their normal season and the ability to take deer using the aid of a spotlight.

PV established pre-determined shooting zones and time periods (morning, evening and night) and, accompanied all volunteers during the spotlight part of the control operation.

The removal of Hog Deer was carried out either by conventional stalking, sit and wait hunting or spotlighting from a vehicle, although due to occupational health and safety concerns volunteers had to exit the vehicle to take any shots by foot (this was a change in method as volunteers were previously allowed to spotlight from the back of vehicles in 2015).

In order to ensure that animals were dispatched in a humane manner, all minimum firearm specifications were consistent with the Wildlife (Game) Regulations 2012.

WPNP closed public access between 23 - 26 August. PV conducted a site briefing and safety meeting with all volunteers and agency staff on 18 August.

The control operation started at 1100 hours on 23 August and concluded at 0200 hours on 26 August 2016. Permit conditions required all harvested deer to be delivered whole to a central checking station administered by the GMA.

Checking station process

All harvested deer were taken to a checking station located in the WPNP works depot. Received deer were dressed and processed. After processing and sample collection, carcasses were placed into chillers where hunters were able to butcher and remove all meat at the conclusion of the operation.

Biological samples and morphologic measurements were taken to ascertain the health and age of the animals being taken. This included the removal of the lower jaw bone which was used to age the animals. In addition, DNA samples taken from the liver were processed by La Trobe University.

Kidney fat was weighed to create a kidney fat index of all harvested animals. The kidney fat index provides a more robust measurement of animal health.

A government agricultural vet with the assistance of Monash University examined the entrails of the deer to ascertain whether they were diseased or carrying parasites, specifically those that could be transferred to live-stock. Liver, heart and fecal matter was also sampled. Vegetation matter taken from the rumen will also be examined to gauge understand the diet of Hog Deer.

A video of the process can be found at the YouTube Channel on the GMA website www.gma.vic.gov.au

Results

Animal per kilometre index

Pre control operations density estimates from spotlight transects produced an average of 6.5 deer per kilometre at Tidal River, 1.18 deer per kilometre at Darby River/Cotters South and 5.33 deer per kilometre at the Airstrip, respectively. This was considerably higher than the post operation transect which reported 3, 0.35 and 2.67 deer per kilometre for the same three sites, respectively.

This showed a 46, 29 and 50 percent decrease in the index of deer per kilometre at Tidal River, Darby River/Cotters South and Airstrip, respectively. There were no transects done around Oberon Bay.

Total deer harvested

During the operation, 44 Hog Deer were taken with 56.8 percent (25) being hinds and 43.2 percent (19) stags. Table 1 compares the 2016 operation harvest to the previous one (2015).

Table 1: Sex ratio and average age of harvested Hog Deer taken during the 2015 and 2016 control operations

Year	Number of Hog Deer Taken	Sex Ratio		Average Weight (Kilograms)		Average Age (years)	
		Male	Female	Male	Female	Male	Female
2015	42	17	25	27.7	20.7	2.4	3.9
2016	44	19	25	28.1	20.4	3.3	3.3

The hunter Capture Per Unit Effort rate (CPUE) during the 2015 operation equaled 1 deer taken per 3.07 hours of hunting. During the 2016 operation, the CPUE increased to 1 deer taken per 9.38 hours of hunting.

The afternoon session produced 42 percent of the deer; with the night and morning sessions producing 33 and 25 percent respectively. The most productive periods for the removal of deer, were the first two periods (afternoon and night) where 18 deer were taken. This equated to 42 percent of the total take of deer removed in 33 percent of the operation. This may simply be a disturbance factor but hunter effort was most efficient during the first third of the operation.

Age of deer

All deer presented at the checking station had their bottom jaw bone removed allowing harvested deer to be grouped in age classes according to tooth eruption and wear (Figure A).

The population structure of the harvested animals varied between stags and hinds. Hinds demonstrated a trend toward younger animals being taken; 60 percent of the hinds taken were three or younger, 28 percent were yearlings.

Stags, however, did not show a clear trend; the take was relatively uniform. The most numerous age group was three year old which comprised 26 percent of the total take.

Deer weight

Average weights for both control programs (2015 and 2016 combined) were 20.6 kg and 27.9 kg for hinds and stags, respectively. When compared with Hog Deer harvested during the normal April hunting season (referred to as mainland animals) in areas outside of the WPNP, both hind and stag average weights were considerably less.

Hinds taken during the normal April hunting season averaged 25.6 kg and stags averaged 39 kg from data taken in 2011 - 2016. As a percentage, this equates to hinds being 20 percent and stags being 28 percent heavier when harvested during the hunting season in areas outside of the WPNP.

Figure B compares the average weights of April hunting season harvested hinds (mainland animals) compared to WPNP harvested hinds.

Figure C shows the same comparison with harvested stags. It is generally assumed that older animals, to a point, are heavier than younger animals.

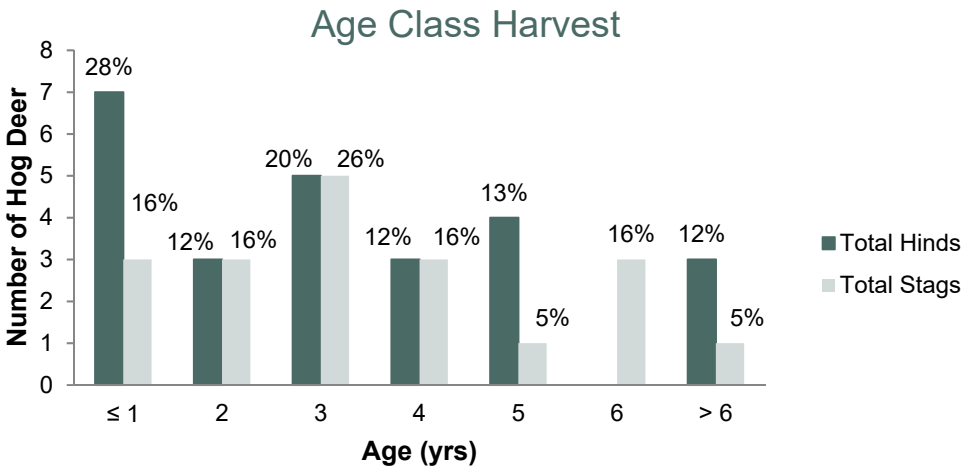

Figure A. Graph of sexes verses age class

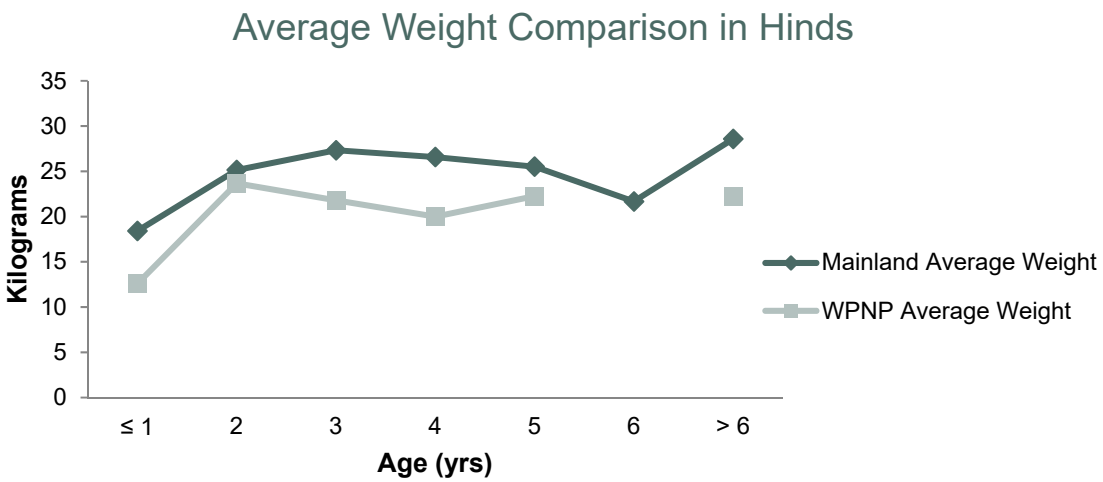

Figure B. Graph of average weights of mainland hinds compare to WPNP harvested hinds.

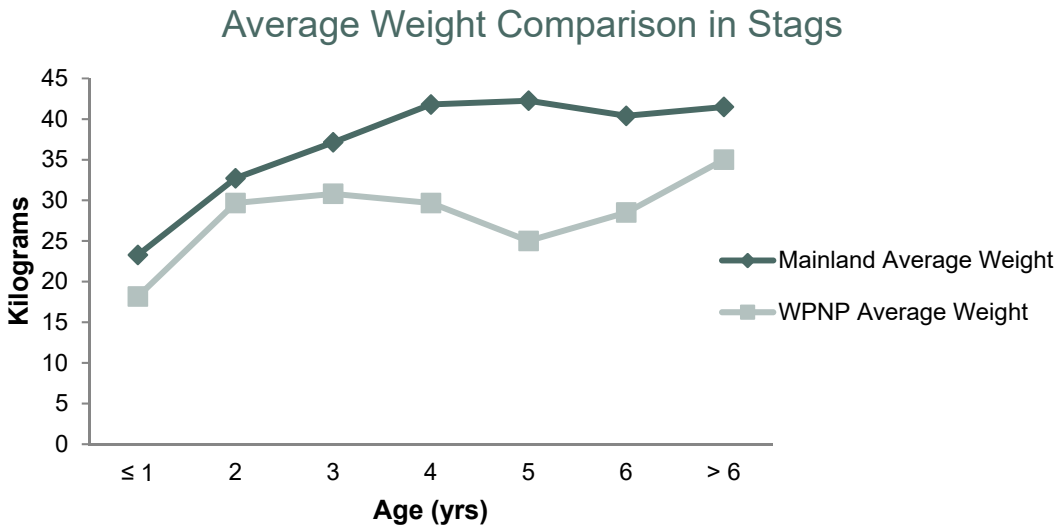

Figure C. Graph of average weights of mainland stags compare to WPNP harvested stags.

Reproductive condition

Hinds were assessed for signs of reproductive condition (e.g. lactation, signs of nursing) and the presence of foetuses. As expected none of the yearling hinds were in reproductive condition.

With three exceptions, all mature hinds (17%) were in late stages of pregnancy or newly calved.

Kidney fat index

Forty-one kidney pairs were able to be sampled. The average kidney difference between right and left was 5.1 grams. The weight of the kidney fat was averaged across all deer and found that, the left kidney fat index was 7.9 grams and the right kidney fat index was 7.4 grams.

Parasite testing

The examination of the internal organs with the exception of three livers showed no significant abnormalities, however, the hearts of the deer were significantly bigger and had thicker walls than those of domestic livestock.

The Monash University study of parasite loading observed parasite eggs in the taken samples, but at low levels. Of the 20 deer sampled, two deer were carrying a strongylid (threadworm species) infection, and two had trematode (flatworm species) eggs present. In three stags taken from the Oberon Bay area, severe disease of the liver was found. Closer inspection showed this to be a result of liver fluke, *Fasciola hepatica*. The sedimentation egg counts for fluke eggs in two of the stags were 204 and 96 eggs per gram of faeces.

Discussion

Site and harvest

It was expected to see a decline in Hog Deer sightings between the pre and post operation transects counts.

The reduction at each site show a localised population decline. The starting transect data is lower than in 2015 at Tidal river (7.75 vs. 6.5) and Darby River at the airstrip (7.33 vs. 5.33) which may indicate true population decline; however, Darby River at Cotters South showed a slight increase (0.82 vs. 1.18). These findings cannot be properly validated until more monitoring and operations in these areas are conducted. Further data is required to inform trends.

Capture Per Unit Effort (CPUE)

CPUE increased from 1 deer taken per 3.07 hour to 1 deer taken per 9.38 hours. This is a still a very low rate, as most literature discussing CPUE uses days as the unit measured, not hours. However, given that these deer have only had two control operations carried out, it is not surprising that the CPUE was so low. Further operations would except the CPUE to continue to rise, as deer become more difficult to cull in which case other strategies would need to be implemented to ensure that hunters were still efficient and effective. Another possibility on the increase in CPUE could be attributed to the changes in different culling techniques i.e. limitation to spotlighting. Although this is a valid theory it is impossible to prove without longer term datasets.

Control methods and periods

It was speculated that spotlighting would be the most effective tool for harvesting deer. This was incorrect, with afternoon hunting being the most successful period. Spotlight shooting was found to be less effective due to operational limitations on the use of the technique in this instance. Morning sessions produced fewer animals, but this was not unexpected as the sites had already had afternoon and night control operations carried out. Remaining deer were subject to two disturbances, noting that 42 percent of the total harvest had already been taken.

During this control program, each hunting session was valuable. Further monitoring in future control programs may provide better data on preferable control periods.

Morphological data

One of the likely causes of why body weights were significantly lower in WPNP compared to deer removed during the regular hunting season outside of the WPNP was over population of Hog Deer and excessive habitat competition from other macropods. The low story vegetation around the Tidal River site is heavily cropped giving the appearance of a mowed lawn.

On private land there is often heavy competition with macropods and domestic stock, however, the grazing resource is much larger.

Tidal River only has a small suitable grazing area so population densities of deer and macropods do not need to be particularly dense to create significant resource pressure.

The low kidney fat and general condition of these animals support this. However, it is noted that the animals were taken in August when general body condition will be lower as the animals are still being affected by the rigors of winter. This is compared to Hog Deer taken during the seasonal hunting period outside WPNP which occurs in April.

Animals in April are expected to be in better condition as the deer have been able to feed on rich foliage during spring and early summer that has a higher nutrient loading.

It should be noted that some condition may be lost at the height of summer when food becomes scarce and water is harder to find, however, autumn normally brings a wetter period allowing Hog Deer to regain condition, as food and water become more readily available.

Stags should lose more condition than hinds as the rut for Hog Deer occurs in February.

In this control program, it appears that stags become more elusive as they mature and are not willing to graze in the open areas around the Tidal River site, where human disturbance is higher. This was evidenced with significantly fewer mature male stags being taken (six percent from the Tidal River site).

Although there was some variation, the hinds appeared to show less behavioral modification impacted by disturbance. The number of hinds taken was consistent across all ages groups.

This is common and has been observed in other deer control programs, where hinds and younger stags can be observed in open areas and in large numbers, yet mature stags are still cryptic and rarely seen.

It was also noted that most of the mature hinds were either carrying foetuses or had newly calved. As a result, these hinds require more and higher energy food for the growing foetus or production of milk. The best source of this higher nutrient load requirement are the open grassed areas. The reproductive state of the hinds would also contribute to lean body condition.

Biological

The low kidney fat index supports the theory that these deer were lean. However, kidney fat has improved since the 2015 control program; in 2015 both kidney's average 3.6 grams of fat in 2016 the left kidney averaged 7.9 and the right 7.4 grams of fat. If this trend continues through time with further control programs this could be seen as a positive marker that the program is having an effect on the Hog Deer population in WPNP with fewer animals meaning more habitat available and less competition.

It is difficult to make any further analysis on this as kidney fat data from deer taken during different seasons has not been recorded. Generally the kidneys appeared in good condition with no obvious abnormalities.

The analysis of internal organs found all the deer to be in reasonable health, albeit lean.

Further investigation of the enlarged heart was found to be normal, and likely due to the Hog Deer coming from a wild population, being more athletic than domestic animals.

The finding of liver fluke, *Fasciola hepatica*, was an interesting discovery. This parasite is spread by a freshwater snail, that spreads the infective fluke (*cercaria*) onto vegetation. As the flukes grow inside the animal, they block the bile ducts of the liver, causing jaundice and liver failure. The disease causes significant production losses in livestock and can also infect people, classifying it as a zoonotic disease, or one that can infect both people and animals. To avoid infection, people should drink water from trusted sources only and ensure that are washed thoroughly before eating.

Before Wilsons Promontory was a National Park, cattle were grazed; there are anecdotal accounts that the cattle used to pick up fluke from grazing in that same area. Historically the land from Oberon Bay to Waterloo Bay was open grassy plains and considered good grazing country.

Summary

Both the WPNP control programs (2015 and 2016) appear to have been successful at reducing the recordable Hog Deer population at Tidal River and Darby River Airstrip. This was indicated by post operation spotlight transects which were significantly lower at these two sites. The other sites currently show no changes.

Although the deer were lean and low in weight, internal examination deemed them healthy. All but three of the reproductively mature hinds were pregnant or were showing nursing signs. No internal organ abnormalities were found and parasite loading was low. The only exception to this were three stags taken from Oberon Bay which had severe infestation of liver fluke.

However, more data from similar control programs will be required to draw any strong and significant conclusions about the effectiveness of the control.

Effective population reduction must be regular and designed to achieve the necessary animal densities to achieve the desired ecological outcomes. This requires habitat monitoring.

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