ARTICLES

Status and future management of the wild animal recovery industry[1]

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ABSTRACT

Aerial hunting using helicopters (i.e. wild animal recovery) has been the dominant force in the management of wild deer in New Zealand for the last 20-25 years. In that time it has made productive use of about 1.5 million animals, and has virtually eliminated the need for publicly-funded deer control. Since the early 1970s the industry has suffered a progressive decrease in productivity, and is now only marginally economic. If this trend continues, a contraction of the industry could allow animal numbers to increase again in remote areas. Central Govenrment needs to introduce effective measures to ensure the industry's continued viability, and strengthen its animal control role. It is concluded that a large-block, sole-operator option would be a long-term solution to what will otherwise be an ongoing problem.

INTRODUCTION

This paper gives an overview of aerial hunting, and an outline of the options for its future management. It is based primarily on data from the files of the Forest Research Institute. Extensive use has been made of earlier reports by the author (Challies 1974; 1985a&b; 1988a&b; 1990), without specific acknowledgement. Up-to-date information was obtained on the status and prospects of wild animal recovery (WAR) from questionnaires from 64 of 69 licensees, and a further 15 interviews.

DEVELOPMENT AND CHARACTERISTICS

History of helicopter hunting

Background

The New Zealand game-packing industry originated about 1958-59 with a series of trial export shipments of red deer venison. Substantial markets for wild venison were soon established in Europe (especially in the Federal Republic of Germany), and these have since been expanded and maintained. To supply this market deer have been intensively hunted throughout their range by ground-based hunters, and from the air using helicopters. Nearly two million carcasses have now been processed for export, and the majority have been taken by helicopter. In addition, these deer have provided a variety of by-products such as skins, hard and velvet antler, tails, pizzles, eye-teeth, and sinews.

The farming of deer became legal in New Zealand in 1969 with the introduction of the Noxious Animals Amendment Act 1967 and the Deer Farming Regulations 1969. After a slow start, interest in deer farming increased rapidly. Most of the initial farm stock were animals obtained either by pen trapping or by aerial hunting from helicopters. Aerial live capture developed as a logical extension of carcass recovery. About 100,000 wild deer have been captured, at least 85% by helicopter crews (Wallis & Hunn 1982).

Development

Helicopters were first used to service hunters on foot, lifting them into shooting areas and returning later to ferry their kill from the hillside to the nearest road or depot. About 1964, attempts were made to shoot and recover deer from airborne helicopters. This method proved practical and economic and quickly became common practice.

Aerial hunting was first used on a large scale in 1964-65 in West Otago and South Westland, where red deer were in high numbers (Osmers 1972). During the next two years its use was extended to other South Island districts where deer were readily available, and eventually to less productive areas, including those where deer had previously been controlled. Since the late 1960s, deer have been hunted from helicopters throughout their range in the South Island.

Aerial hunting in the North Island was delayed by public opposition. It was first used in the early 1970s for animal control, and commercially on private lands. Legitimate commercial operations started on the Ruahine Range in 1975, extending to part of the Kaweka Range as recently as 1984.

Up to the mid 1970s aerial hunting was used only for carcass recovery and animal control. During the late 1970s the emphasis shifted progressively to live deer capture to satisfy the increasing demand for farm stock. Initially animals of both sexes were captured indiscriminately, but since about 1980 females have been increasingly preferred because they fetch higher prices. Available males not captured were shot for their carcasses.

Aerial hunting has been used to harvest a number of other ungulate species. As the availability of deer declined in the South Island, carcass recovery operations were extended to include chamois *(Rupicapra rupicapra)* and Himalayan thar *(Hemitragus jemlahicus)*. Both species were intensively hunted from helicopters during the early and mid 1970s. Feral pigs *(Sus scrofa)* have been taken incidentally, and feral goats *(Capra hircus)* have been captured in some areas for sale to farmers.

* *The author, Dr Chris Challies, is a wildlife management consultant based in Christchurch. This paper is based on a report written in 1989 while he was on the staff of the Forest Research Institute. The full report, in which the details of the recommended management option are developed, is available from the Manager, Wild Animal Central, Department of Conservation, P.O. Box 10420, Wellington.*

1. The term "wild animal recovery" is used in the Wild Animal Control Act 1977 to describe the aerial hunting and transport of wild animals for pecuniary gain. It applies mainly to the use of helicopters for hunting and recovering wild ungulates, whether dead or alive.
2. Primarily Red Deer, Cervus elaphus.

Hunting methods

Carcass recovery

Initially the standard helicopter unit comprised four people, three crewing the machine and one supporting them from the staging point. A 'shooter' flew with the pilot to find, shoot, and pick up the deer, and a 'gutter' was left at a central point on the hillside to eviscerate the deer and assemble them into helicopter loads. The helicopters were flown mainly above timberline along the contour of the hillsides, the deer being shot were found and their bodies then taken to the gutter. Loads of carcasses were later ferried to the staging point by helicopter where they were cleaned by the support person and spread out on the ground or hung on racks. Under favourable conditions, hunting and carcass recovery continued all day. Within 12 hours the carcasses were transported to a cool store or processing factory.

The mode of these operations changed during the 1970s as costs increased, the number of deer using the alpine grasslands declined, and higher performance Hughes 500s were introduced. Typically one person filled the roles of both 'shooter' and 'gutter'. Helicopter crews searched for deer mainly along forest margins, on mid-slope clearings, and in areas of forest with a sparse canopy. The timing of hunting sorties changed increasingly to early mornings and late evenings when deer were most likely to be active.

Live capture

A wide variety of capture techniques have been used by helicopter crews. Initially, deer were caught by "bull-dogging", which involved a man jumping from the helicopter onto the animal and physically constraining it. This method became part of normal carcass recovery operations and was most suitable for catching young animals.

From the outset, considerable efforts were made to develop more appropriate and efficient capture techniques. Early trials with tranquillisers met with limited success, but with the introduction of the versatile drug 'Fentaz' (Fentanyl citrate, 10 mg/ml, and Azaperone, 80 mg/ml) in the mid 1970s, the method came into general use. Dart guns of the 'Paxarms' type were fired from airborne helicopters, which hovered until the deer became sedated. Miniature radio-transmitters were first fitted into separate darts fired alongside the tranquilliser darts and later into the tranquilliser darts themselves. These techniques enabled helicopter crews to leave darted animals and relocate them after they had become tranquillised. Nets were also tried at an early stage, with some success, but did not come into common use until the late 1970s when net guns were developed. Net guns are either hand-held or mounted on the helicopter skid (Wallis & Hunn 1982). They have proved effective, quick, and simple to operate in open country. Most crews now prefer to use net guns, although some still carry and use dart guns where suitable.

Once it is caught, the deer's legs are tied and it is ferried to the staging point in a canvas carrying bag. The deer is then untied and left standing in either a small darkened pen or in an enclosed road trailer ready for transport to a deer farm.

Controls on industry

General

Aerial hunting has been subject to few restrictions, especially on Crown-owned land. There have been no limits on the number, age, or sex of deer that could be taken, and only a few local restrictions on the seasons in which they could be hunted. Hunting methods have been governed mainly by the statutory provisions for the use of firearms and aircraft.

Initially there were few controls on the handling of carcasses; conditions were determined by what was accepted for processing by the factories. This changed in 1967 with the introduction of the Game (Packing and Export) Regulations 1967, which gave the then Department of Agriculture responsibility for periodic inspections of carcasses, storage, and processing facilities to ensure that acceptable standards were met. Conditions for the handling of carcasses became more stringent when these regulations were replaced by the Game Regulations 1975. These set maximum times for the delivery of carcasses to chillers and factories, and require that heart, lungs, liver, and kidneys remain attached to carcasses for inspection before processing. The 1975 Regulations still apply.

Access to land

Aerial hunters require permission from the owner or occupier of the land involved, irrespective of its tenure. To hunt without that "express authority" is an offence against the Wild Animal Control Act 1977, Section 8.

Permission to hunt on Crown-owned land has traditionally been given on request, without charge, and usually without regard to the number of permits already issued. Access for WAR was initially treated this way, and still is in some regions. Increasingly, area and season restrictions have been placed on the industry in efforts to limit direct competition between operators and with other users, by using the WAR permit scheme introduced in 1978 (Wild Animal Control Act 1977, Section 21). The area constraints typically take the form of sole-operator use of blocks on a short-term rotational basis. Blocks are usually allocated by ballot and are rotated amongst several operators every few months. Seasonal bans on WAR are usually confined to the main holiday periods and the deer rut, when recreational hunting is at its peak.

Access to freehold and leased lands has been obtained from the occupiers under a variety of arrangements, from free use to agreements to pay a fee, share the take, or provide some service in return.

Wild animal recovery operators have commonly hunted both conservation and non-conservation lands without the occupiers' permission. The nature of aerial hunting makes poaching relatively easy and low-risk. It has proved difficult to apprehend and prosecute offenders. In response, the enforcement powers in the Wild Animal Control Act 1977 have been progressively strengthened. Despite this, poaching has remained a problem, albeit on a reduced scale.

WAR Service licence

In 1978 the then New Zealand Forest Service introduced the Wild Animal Recovery Service licence under Section 24 of the Wild Animal Control Act 1977. This compulsory licence is still required by all WAR operators. It allows the licensee to operate in a specified zone or zones using named aircraft, pilots, and crew. The licence does not confer any right to enter land. There are two categories: a B licence permits the aerial transport of foot hunters and wild animals, and a C licence permits aerial hunting and recovery, as well as the transport of foot hunters and wild animals. These are issued annually for a fee; the current fee for B and C licences are $500 and $1000 respectively. The B licence has had little impact on animal harvest and will not be considered further.

The WAR Service licence is regulatory in its application. Its primary purpose is to allow the size of the WAR industry to be controlled at a level consistent with the maintenance of the "optimum" number of animals. The critical part of this process is determining the "maximum number of aircraft to be permitted to operate" in each area. This has traditionally been done by pooling the experience and opinions of the senior wild animal managers from the different Conservancies or Regions. As a rule, only minor changes are made between years. Licences for the agreed number of aircraft are allocated to applicants on the basis of their past experience, productivity, and conduct; recent convictions for offences against the Wild Animal Control Act are taken into account. In effect, estab-

lished operators with good records have been automatically relicensed with the shortfall being made up with the most promising new applicants from the required areas. Unsuccessful applicants have the right to appeal.

A conservative approach has been adopted in applying the WAR Service licence scheme, reflected in the consistently high number of helicopters licensed and the minimal constraints placed on their areas of operation. Between 65 and 75 helicopters have been licensed for C class WAR annually since 1978, except in 1979-80 and 1980-81 when 123 and 113 were licensed respectively. No attempt was made to reduce the size of the industry to maintain its viability, and therefore its animal control function. As a result, the profitability of WAR has declined with a corresponding shift from full-time to part-time involvement. The zoning of WAR has been done by issuing licences separately for the South and North Islands.

The main impact of the WAR Service licence scheme appears to have been social rather than operational. The industry is now more orderly than it might otherwise have been. This is a direct consequence of the limits placed on entry into the industry, and the need for established operators to conform to ensure they retain their licence.

IMPACT ON HARVESTED SPECIES

Before the development of the game-packing industry, deer populations in New Zealand varied greatly in density, well-being, and demography, depending on the length of time they had been established, and the types, timing, and intensity of hunting they had sustained. As a rule, long-established, little-hunted populations were either at high density or declining naturally as they depleted their habitat, whereas those recently established or intensively hunted for control purposes were at lower density. The general well-being of populations has declined with increasing density and time since their introduction. This pattern has changed radically during the last 20-25 years as a direct result of commercial hunting, particularly from helicopters.

Red deer

Density

The most obvious effect of commercial hunting has been the progressive and typically large-scale reduction in deer numbers over most of their range. The extent of these reductions has depended largely on the pre-hunting status of the population, the type of habitat, and the duration of the hunting. The largest percentage reductions have occurred where deer were initially near peak density, and on range with a high proportion of scrub and grassland where animals are particularly vulnerable to aerial hunting.

The following case histories demonstrate the extent to which the wild animal recovery industry has reduced deer densities in the South Island high country. The areas concerned are all mountainous and mainly forested below timberline, with extensive subalpine scrub and/or grasslands.

(a) Arawata Valley, South Westland: The South Westland red deer herds have been hunted from helicopters without restriction since the summer of 1964-65. Over this period carcass recovery rates have dropped by 80%. Deer pellet-group densities surveyed in the lower Arawata Valley between 1970 and 1980, and again in 1984 and 1985 (Fig. 1), showed that deer density decreased at a rate reducing from about 18% a year during the early 1970s to about 8% a year during the early 1980s. The overall decrease between 1970 and 1985 was 85%; this is equivalent to a decrease of about 90-95% between 1965 and 1985. Deer have made only minimal use of the subalpine grasslands since the mid 1970s. The density of the residual population is now about 5-6 deer/km^2 of forest (Challies 1977, 1989; C.N. Challies unpubl. data).

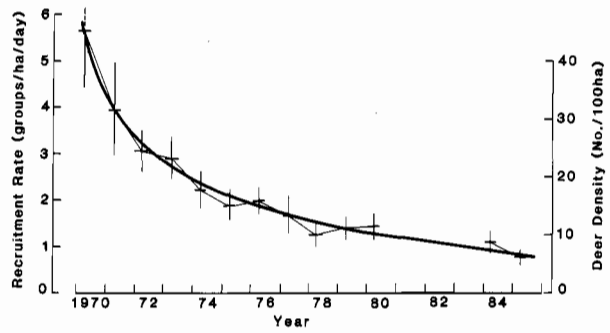

FIG. 1: Effect of sustained aerial hunting on red deer density in the Arawata Valley, South Westland. The data shown are mean estimates (with 95% CLs) for annual remeasurements of the same pellet lines. (Adapted from Challies 1989).

(b) Wangapeka, Owen, and Matiri Valleys, West Nelson: Deer in the West Nelson area have been hunted commercially from helicopters since 1966-67. This hunting has been unrestricted except for a period during the early and mid 1970s when it was limited to five months of the year, and one crew at a time on each of several blocks. Despite these restrictions, carcass recovery rates had dropped 75% by the mid 1970s. An extensive survey of deer pellet-group densities during the summer of 1982-83 showed that the residual population was confined to the forest, with an average density of 2.2 deer/km^2 of forest. The commercial harvest from the West Nelson area in 1982 was equivalent to about 0.9 deer/km^2 of forest (Clarke 1984, Hickling 1984).

(c) Murchison Mountains, Fiordland: Deer in the Murchison Mountains have been hunted since 1953 in an effort to limit their impact on takahe *(Notornis mantelli)* habitat. This has involved government-employed hunters working on foot, supplemented since 1975 with a limited amount of supervised aerial hunting. A series of four deer pellet-group surveys between 1969-70 and 1976-77 measured a 60% drop in average pellet densities. Most of this change apparently occurred about 1975, coinciding with the start of hunting from helicopters, and an increase in the number of ground-based hunters. Judging from the subsequent changes in kill and recovery rates, the decrease in deer numbers has continued. Between 1976 and 1984, the kill rate dropped by 80% for ground-based hunters to 0.1 deer/hunter day, and by 65% for helicopter crews to 1.2 deer/machine hour, despite a halving in the hunting effort. The combined annual kill dropped 75% during this period, and in 1984 was equivalent to 0.5 deer/km^2 of forest (Parkes *et al.* 1978, New Zealand Forest Service, unpubl. data).

(d) Wapiti Area, Fiordland: The mixed red deer/wapiti population in the central part of the 'Wapiti Area' has been hunted from helicopters since 1973. This hunting has been selective against red deer and obvious red deer x wapiti hybrids (except in 1982 and 1983), and is limited to one company or consortium at a time. Deer pellet-group surveys in the 'Wapiti Area' during the summers of 1969-70, 1975-76, and 1984-85 showed that deer numbers decreased at an average rate of about 30% a year between 1973 and 1975-76, and 7% a year between 1975-76 and 1984-85. This amounted to an overall decrease of 81%. In 1984-85 the residual populations in the different catchments ranged in density from 2.4 to 6.4 deer/km^2 of forest, and averaged 3.5 deer/km^2. The recorded harvests from these areas during the preceding year ranged from 0.9 to 2.9 deer/km^2 of forest, and averaged 1.6 deer/km^2 (Nugent *et al.* 1987).

Despite the differences in the intensity and duration of hunting in the four areas, its impact on the deer populations appears to have been similar. Sustained aerial hunting has, or would eventually have, reduced the deer in these areas to $\leq$10% of their nominal peak densities. Similar reductions have

probably been attained throughout the predominantly forested high country of the South Island. The residual densities would be in the order of 2-6 deer/km^2 of forest. At these levels populations would produce harvestable annual increments of about 0.5-1.6 deer/km^2 of forest.

In comparison, there is little quantitative information on the effects of aerial hunting on densities of North island deer populations. Its effects have been confounded with those of recreational and commercial ground-based hunters, and in some places with control operations. Available survey results and hunting statistics indicate that aerial hunting has generally reduced deer numbers. It is not known whether these populations are being maintained at the lower levels.

Local distribution

Aerial hunting has virtually eliminated deer from the extensive areas of native scrub and grassland that once formed a major part of their habitat. The surviving animals are confined mainly to areas of forest. The few deer that venture into the open during daylight are soon taken. Within the forest, densities generally increase with distance from the accessible forest edges. Highest numbers are now found in the larger unbroken expanses of forest, and locally in forested valley bottoms and lower slopes (Challies 1977; Hickling 1984; Nugent *et al.* 1987). In these areas densities are typically 3-10 times higher than those in the forests near timberline (Fig. 2).

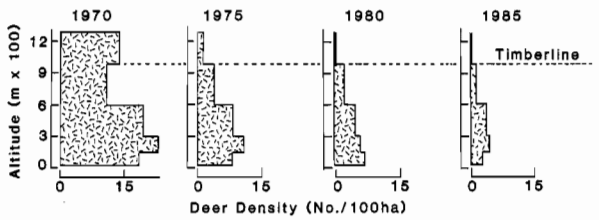

FIG. 2: The changes in the altitudinal distribution of red deer resulting from sustained hunting from helicopters. (Adapted from Challies 1989)

Condition

As deer numbers have been reduced, the physical well-being or condition of the survivors and their offspring has improved as a result of the increased availability of food per capita. This has been especially pronounced in long-established populations which were near the carrying capacity of their range (Challies 1978).

The most noticeable effect has been the increase in the growth rates of young deer and the consequent larger body sizes of animals born since commercial hunting started. Progressive increases in growth rates have been recorded in all populations in which body size has been monitored (Challies 1978, South Westland; S.D. Kelton unpubl. 1983, Tararua and Ruahine Ranges). The lean body weights of young deer are now up to 35% higher on average than those of comparable animals taken in the same areas in the mid 1960s. There have been associated increases in antler size, because of the positive, age-for-age relationship between antler and body size. The body fatness and general condition of deer has also increased, particularly in non-breeding adult females and in adult males before the rut (Challies 1978).

Calving rates have also increased significantly as a direct result of improved nutrition. In most populations, about 95% of adult females now breed annually, and on average 90% of the calves born survive to two months of age. The greatest changes have occurred in the two-year-old, first-breeding age class, where calving rates have increased from about 10% to 60-70% in populations previously in poor condition. Improved nutrition has probably minimised calf mortality from natural causes, but this has not been quantified. Calves now enter the winter well grown and with an adequate food supply.

Demography

Commercial hunting has directly affected the demography of red deer populations: life expectancy has been reduced by removing animals before they would have died naturally, and males have been removed at a younger age than females. The surviving populations, therefore, have a low mean age, and a sex ratio excessively biased in favour of females.

Kill data collected from South Westland populations during the late 1970s after they had been intensively hunted from helicopters for 10-13 years are the best information available on the compositions of commercially hunted deer populations. Only 31% of male and 47% of female calves survived to two years of age, 5% and 14% to five years, and <1% and 1% to 10 years of age (Fig.3). The mean age of males and females one year and older during the season of births was 2.1 and 2.8 years respectively; and the all-age sex ratio (after one year of age) was 62 males to 100 females. Populations hunted from helicopter for the first time typically yielded about 80 males to 100 females.

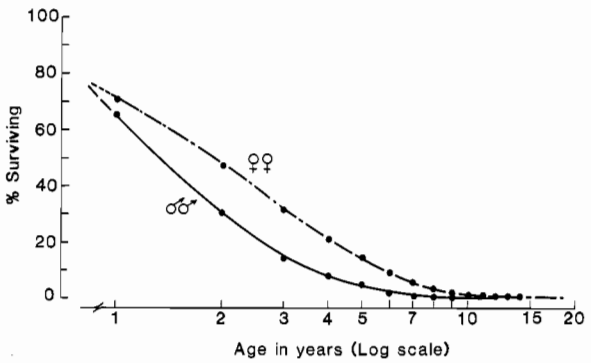

FIG. 3: Estimated age and sex composition of a red deer population that has sustained continual aerial hunting. Based on kill data collected in South Westland during the late 1970s.

The productivity of commercially-hunted populations has altered as calving rates and age and sex ratios changed. Initially, productivity increased as calving rates improved and the adult sex ratio shifted further in favour of females. During the late 1970s the South Westland populations were producing about 43 calves for every 100 deer one year and older at the start of the season of births (nominally December 1). This ratio has since reduced to about 34 calves/100 deer as numbers of females in the young, non-breeding age classes increased (Fig. 3). This equates to a reduction in the harvestable annual increment from about 33% to 26% of the number present at the start of the season of births. The increment that can be expected from populations intensively hunted from helicopters for >20 years is therefore about 26%.

Other ungulates

Wild animal recovery has had similar effects on several other wild ungulate species. Both thar and chamois numbers were substantially reduced during the early and mid 1970s. Since then they have been hunted only sporadically. A moratorium on "all commercial carcass recovery" of thar has been in force since August 1983. By then thar had been virtually eliminated from much of their range in Westland (Parkes & Tustin 1985), and were in very low numbers east of the main divide. In part of the Rangitata catchment they were reduced to 4% of their 1965 level by a combination of aerial and recreational hunting. Numbers have increased since the moratorium at a rate of about 18% a year (Challies & Thomson 1989). Chamois

appear to have followed a similar pattern, but there is no quantitative information to confirm this.

All the minor deer species have been hunted commercially at one time or another, and are now generally at low numbers. Most herds have been subjected to both WAR and ground-based hunting, and it is not always clear which has had the most effect. The white-tailed deer *Odocoileus virginianus)* on Stewart Island are the exception; they have remained at high densities despite continual recreational hunting and periodic WAR operations.

It is unlikely that WAR has had any lasting effect on feral pig or feral goat numbers because they have rarely been hunted intensively. Both species can replace losses quickly.

CURRENT STATUS AND PROSPECTS

Status of the industry

Size and composition

The Department of Conservation (DOC), which assumed responsibility for the WAR Act from April 1, 1987, issued 60 C class Wild Animal Recovery Service licences during the 1987-88 licensing year, 36 for use in the South Island, and 24 in the North Island. Fifty-four were issued to operators using one helicopter, and six to operators using two or more. Overall, 69 helicopters were licensed for aerial hunting. Eight of these (seven licences) were not used at all for wild animal recovery, and at least 19 others (16 licences) were used only on a casual basis, i.e. recovered <100 deer during the year.

The helicopters used were the ultra-light, piston-engined Hughes Series 200/300s and Robinson R22, and the light turbine-powered Hughes Series 500 (Table 1). Most of the Hughes 200/300 were model 300C (15 of 19), while the Hughes 500s were a 2:1 mix of models 500C and 500D. On average the operators using Hughes 300s and R22s recovered 20% more deer during the year than those using Hughes 500s. Of the 12 most productive operators, six used Hughes 300s, two Robinson R22s, two Hughes 500s, and two a combination of a Hughes 500 and an ultra-light machine.

TABLE 1. Number of helicopters used by C class WAR operators during the 1987-88 licensing year.

	South Is.	North Is.	Combined
Piston-engined helicopters:			
• Hughes Series 200 & 300	8.5	10	18.5*
• Robinson R22	5	0	5
Turbine-powered helicopters:			
• Hughes Series 500	24.5	12	36.5
• Bell 47 conversion	1	0	1
TOTALS :	39	22	61

* Some operators used two helicopters of different models when licensed to use one; these were counted as half a machine each.

Production

C class WAR operators recovered 19,410 deer during the 1987-88 licensing year, 17,070 by aerial hunting, and 2340 by servicing other operations (Table 2). Of these, 56% were taken in the South Island, and 44% in the North Island.

The patterns of deer recovery in the two islands differed. A higher proportion of animals were taken alive by aerial hunters in the South Island than in the North (39% : 23%); and more ground-based operations were serviced in the North Island than in the South. These differences probably reflect the different nature of the deer range in the two Islands.

TABLE 2. Number of deer recovered by C class WAR operators during the 1987-88 licensing year.

	South Is.	North Is.	Combined
Recovered by aerial hunting:			
• As carcasses	6150	5420	11570
• Alive	3890	1610	5500
Recovered by servicing other operations:			
• As carcasses from ground-based hunters	370	610	980
• Alive from pen traps	440	920	1360
TOTALS :	10850	8560	19410

The number of deer recovered by individual helicopter crews ranged from 9 to 1360, and averaged 318 (Fig. 4). Only 12 crews recovered >500 deer in the year, and only two >1000 deer. Of these, four were based in the southern half of the South Island, and eight in the central North Island. It is clear from these figures that WAR is now mainly a part-time industry; most operators do other aerial work and/or have other jobs such as farming.

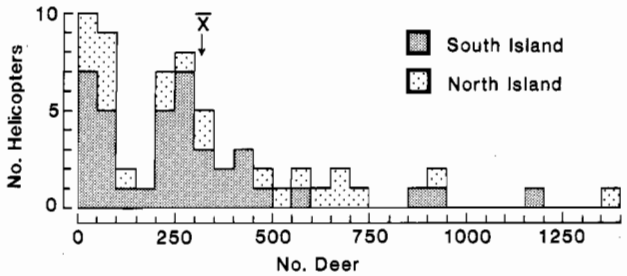

FIG. 4: The number of deer recovered by 61 helicopter crews during the 1987-88 licensing year.

Market trends

Live deer

The prices paid for live deer sold as breeding stock declined by about 80% during the period 1985-89. This substantially reduced both the differential between the live and carcass value of deer, and the time WAR operators can afford to spend capturing individual animals. As a result, most males and increasing numbers of females are being taken as carcasses. Aerial hunters shot at least 36% of the females they took during the 1987-88 year (Table 2; assuming a 50:50 sex ratio). Most operators questioned expected to take more carcasses (35 of 44), and fewer live deer (32 of 43) in the 1988-89 year. It is generally accepted within the industry that this trend will continue and is probably irreversible.

There is unlikely to be much demand for captured deer in the future. The recent decline in the value of live deer resulted from a combination of three factors: the introduction of a new system of livestock taxation; the development of a more conventional, less speculative attitude to deer farming; and the general downturn in the rural economy. Enough young animals are probably being bred on existing deer farms to satisfy future demand for stock.

Carcasses

With the decline in live capture, the economic future of the WAR industry is becoming increasingly dependent on the value of deer carcasses. Prices paid for carcasses during the summer 1988-89 ranged from $1 to $4/kg (average c. $3.25) of 'German market carcass' weight, inclusive of the tail, pizzle, and sinews. Three factors determine the price for an individual animal – carcass weight, where in the body it has been shot,

and the cost of transporting it to a Game Packing House. Top prices are paid for large-bodied animals (i.e. >60 kg) that were shot through the head or neck and were delivered to the processing factory (Source: price lists supplied by Mair Venison Ltd). An average wild red deer carcass returned about $160 to the hunter; about 60% of the return for similar-sized farm deer sold for slaughter.

Deer carcasses have increased in dollar value progressively over the years despite the downturn in supply and consequent reduction in the processing industry. Whether current prices can be maintained or increased in real terms will depend on how well WAR and the marketing of its products adjust to changing circumstances. Of major concern is the extent to which the rapidly increasing supply of farm venison will affect the demand for wild venison. The potential farm output is currently attracting considerable investment in Deer Slaughter Premises, and in marketing. Wild venison is unlikely to be able to compete in the market place on the same terms as farm venison; it lacks both the uniformity of product, and the level of certification acquired with anti-mortem inspection of stock. As the volume of farm venison increases, wild venison risks being relegated to a low-priced, second-grade product. If this is to be prevented, continuity of supply needs to be ensured and wild venison needs to be marketed in its own right.

The future of WAR is linked to the game-packing industry in a supply-demand relationship of mutual benefit. At present only three factories are processing wild deer for venison, one each at Mossburn, Hokitika and Rotorua; all three have both Game Packing House and Deer Slaughter Premises licences. They are the remnants of a larger industry that was cut back first when the Game Regulations 1975 were introduced, and then by rationalisation as the supply of carcasses declined. With the increase in the number of farm deer available for slaughter, these factories could stop processing any wild venison. At present, the processing of wild deer is treated almost as a profitable sideline that occupies otherwise excess capacity. The biggest problem is the irregular supply of carcasses, which affects both the programming of work in the factory, and the viability of carcass collection. Wild deer carcasses have to be inspected and either processed or frozen within 72 hours of death.

There is no reason why other companies cannot apply for Game Packing House licences (excepting the provisions in Section 20, Game Regulations 1975). Three of the WAR operators interviewed said they had investigated the possibility of setting up a small factory to add value to their product. The main limiting factor is the lack of guaranteed access to a suitable supply of deer.

New Zealand's wild venison has traditionally been exported to the high-volume, commodity markets of Europe, especially the Federal Republic of Germany. In recent years increasing quantities of New Zealand's farm venison has also been shipped to these markets. All venison has been sold as 'game', with the consumers usually being unaware of its farm-bred component. This is likely to change in the near future. The Game Industry Board is promoting farm venison as a separate product by advertising its positive qualities. As part of this programme, they have developed an industry mark for farm venison. If wild venison is to retain a place in its established markets, it should be similarly promoted and possibly have its own industry mark. Its principal quality is that it is truly 'game'.

Prospects and future management

Operators' views

Wild animal recovery operators consider that their long-term prospects are dependent on factors largely outside their control, such as the availability of markets, the amount of competition, access to the resource, and how the industry is controlled. Understandably there is not much incentive to invest in the industry other than on a year-by-year basis. The current licensees fall into two broad groupings. A hard core are gambling on being able to make an income from WAR on the medium-term, and are making an effort to maximise their opportunities. Most of the others remain in the industry for historic rather than commercial reasons – they like the lifestyle, or it is the only job they know or are equipped for, or because they are 'locked-in' financially. While they all hope that the outlook for WAR will improve, few expect it to happen in the near future.

The operators interviewed were asked how they would prefer to have WAR regulated in the future. Their views were conservative. Most opted for either free competition or a rotating block system, along with limits on further entry into the industry. These are the options with which they are familiar, and amounted to a vote for the status quo. None of them mentioned the possibility of basing the industry on large, long-tenure, sole-operator blocks. Their initial reaction to this suggestion was concern that it would result in a significant number of operators being excluded from their established hunting areas, and probably from WAR altogether. After discussion, most agreed reluctantly that this option was probably the best for the long-term future of the industry, but not necessarily for them personally.

Possible scenarios

The future of WAR under the current licensing regime is open to speculation. It seems inevitable that experienced operators will continue to be lost from the industry for economic and personal reasons. Whether this results in a net reduction in WAR will depend on the rate of loss and the number of potential new operators. To date, there have been more than enough suitable new applicants for C class WAR Service licences to replace those retiring; about 10 applicants were declined licences for the 1988-89 year. If this level of interest in aerial hunting is maintained, the industry could continue in its present form.

With the ongoing shift in emphasis from live capture to carcass recovery, it is probable that WAR will become commercially less attractive under the current regulatory regime, and the rate of loss of operators could increase. There are two possible outcomes, depending on how much profitability drops. A small drop is likely to result in a small loss of operators, with the industry eventually stabilising at a lower level. The productivity of the remaining operators would improve as a result of the reduced competition. A substantial drop in profitability would mean that most operators would cease hunting, at least temporarily. Those retaining an interest in the industry would return as deer numbers increased and carcass recovery rates improved.

It is unlikely that the industry would fail completely as long as there are suitable markets for wild venison; at worst it would reduce in size and its output become intermittent.

Management options

The Department of Conservation has the choice of three options for the future management of WAR:

- *Passive* – impose the minimum controls necessary to ensure that the industry is orderly and reasonably compatible with other land uses. DOC is currently using the WAR Service licence and permit scheme in this way. The possible outcomes of maintaining the status quo are described below.
- *Licence* – regulate the number and distribution of operators to limit unproductive competition and ensure that the industry remains viable. This is what the WAR Service licence was originally designed to do; the basic scheme is still applicable.

- *Contract* – establish a business relationship with the industry in which DOC is the nominal supplier of animals and the individual operators receive allocations under contract. Performance clauses would ensure that harvest levels were adequate for animal management purposes.

Before considering the suitability of these options, it is necessary to address two questions: what is the long-term aim in administering the industry; and how can that be accomplished most effectively? For DOC the objective is clearly to maximise WAR's contribution to the management of deer and other wild ungulates. The most effective way of doing this is to ensure the long-term profitability of the industry. In effect, this means reducing or eliminating direct competition for deer, and giving operators access to sufficient animals to provide them with a suitable economy of scale. A substantial reduction in the number of operators would be required.

Both the 'licence' and 'contract' options could be made to fit this prescription. The 'passive' option could not; the result of this approach is the current run-down state of the industry. The 'licence' option is essentially the WAR Service licence option. It would not be as easy to adopt as might first appear; the methods used to limit the size of the industry are not really suitable for forcibly reducing the number of established operators. This would have to be done either by ballot or competitive tender. The allocation of sole-operator blocks by tender is an important element of the 'contract' option.

Effects of reduction in hunting

Aerial hunting has reduced deer numbers to lower levels than was thought possible even as recently as the mid 1970s. The available survey data indicates that deer densities, at least in the South Island, have now been reduced about as far as they are likely to be under the current hunting regime. Whether they can be maintained at these levels is a matter of speculation.

It is possible that deer numbers will increase in some predominantly forested areas, even if the present level of hunting continues. This may be already occurring in the Urewera Ranges (Beadel 1988). Any reduction in hunting effort would obviously increase the likelihood of deer numbers increasing again. The actual effect would depend on the size of the reduction in hunting, and the extent to which recovery rates increased to compensate. There is no quantitative information on this aspect. It is likely that hunting effort could be substantially reduced without having much effect on the overall take in areas where there is strong competition between operators. A significant increase in deer numbers would result if hunting effort fell below the minimum required to recover the annual increment. Even then the rate of increase would be limited by a compensating increase in recovery rate.

It is easier to predict what would happen in the unlikely event that all hunting were to cease. Deer numbers would double within three years, and double again every three to four years thereafter until the availability of food again limited population growth. At that rate deer densities would reach 25% and 50% of their nominal peak levels in about four to seven and seven to ten years respectively. They would quickly return to their preferred habitats, including the native scrub and grasslands.

PROPOSED NEW STRUCTURE

A strong case can be made for choosing the 'contract' option and radically restructuring the wild animal recovery industry, as outlined by Challies (1988b). This option would enable the Department of Conservation to maximise the contribution of WAR to the management of deer and other wild ungulates.

The management scheme adopted should be:

- *Effective* – animal numbers should be reduced to, and/or maintained at, stable low levels by a self-sustaining industry. The best results would be obtained by enabling hunters to maximise the efficiency of their operations. This could be achieved by allocating the hunting on large blocks by tender to individual operators under a contract. This would eliminate direct competition for animals, and improve the industry's commercial basis.
- *Compatible* – hunting operations should be orderly and compatible with other uses of the land and animal populations, including recreational, safari, and commercial ground-based hunting. This could be achieved by detailing conditions in the contracts; these would be area-specific and reflect the provisions in regional wild animal management plans.
- *Enforceable* – infringements and consequent enforcement should be kept to a minimum. Poaching by WAR operators has been a long-standing problem. This could be overcome by reducing the opportunities to offend, and by discouragement. There would be little incentive for sole-operators on large blocks to poach if their blocks were all-inclusive and had logical boundaries. Those that do offend would be in breach of contract; anyone else aerial hunting would be doing so without a licence.
- *Self-financing* – funds should be generated to offset the scheme's administration, monitoring, and technical costs. This could be done by charging a market-determined resource rental. The amount would be the price tendered by the successful applicant for that block. A negative market-led rental would indicate the level of Crown 'subsidy' necessary to achieve a given sustainable low population level.

The benefits that would accrue from this restructuring are wide-ranging and would positively affect all the main interest groups. In particular it would ensure that WAR would:

- Remain a viable private enterprise industry operating in an improved commercial environment on an assured economy of scale.
- Continue to be a major force in wild ungulate management keeping populations at sustainable low densities at minimal cost to the State.
- Become a more orderly industry compatible with other uses of the land and animals, including those competing for the game resource.

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The Andean Alder *(Alnus acuminata)* in New Zealand

N. Ledgard and S. Halloy

New Zealand's environment is good for forest growing and introduced trees from many countries are performing well. At regular intervals in the past a particular species will grab the headlines as a potential new "wonder plant", with all the attributes needed to fulfil a forester's dream. Recent examples are *Paulownia* species and, to a lesser extent, *Robinia pseudoacacia* (Kriejgsman, 1989). Andean alder *(Alnus acuminata)* looks to be acquiring the credentials to become an addition to the list. A recent article on the species in "Growing Today" (Halloy, 1991) opens with an editorial statement that could be misleading. It reads: "The multiple-use Andean alder grows almost anywhere, is faster than pine, has good timber, provides stock fodder and food for bees, and improves soil". As the article goes on to explain, Andean alder has yet to be trialled properly in New Zealand.

The Success of New Plants

The list of introduced tree species which have glowing credentials from other countries and are currently growing well in New Zealand is long, but very few of them feature in our production or protection forestry estates. The reasons are several. A number of species may grow well and demonstrate good end-use qualities, but it is exceedingly difficult to obtain the financial backing to establish a commercial estate of sufficient quality and size to encourage profitable processing and marketing. In addition, the establishment and silvicultural techniques needed to grow these new species successfully are often not quite so simple as they first seem.

Thus the final success of a species depends on a mix of ecological suitability, silvicultural skills, end-use value and marketing expertise. For the Andean alder we are only at the stage of saying: "Probable good ecological suitability (for most New Zealand areas according to selections), potential product value (timber, fibre, shelter, fodder, soil protection and improvement)". More research is needed before reliable recommendations for management and use can be made.

The Species

Andean alder is the southernmost species of the genus *Alnus;* its distribution stretches along the Andes and Central American mountains from southern Mexico to 28 S in north-west Argentina. It is a fast-growing pioneering deciduous tree that reaches up to 25 m in height (averaging 10-15 m) and 40 cm in diameter. Like other alders, it has root nodules that host nitrogen-fixing bacteria and mycorrhizal fungi which assist in nutrient uptake. Unlike other alders, it will grow on drier soils and is not restricted to moist sites. In South America this allows it to cover whole mountainsides in continuous almost mono-specific woods. In north-west Argentina alone it covers an estimated 650,000 ha. The species is harvested for sawlogs (construction and packaging), pulp and firewood and is ranked amongst the 65 timber species of major importance for Argentina.

New Zealand Plantings

So far as we know, the species has been in New Zealand for less than 20 years. The Forest Research Institute acquired a provenance from a low-altitude site in north-west Argentina in 1972 and has had plants growing at its Rangiora nursery and at 850 m in the Craigieburn Range ever since (Ledgard, 1978). As with other upright alders (e.g., *A. glutinosa* and *A. rubra),* early growth at Rangiora was fast (1 m annually) but growth slowed down considerably after four to five years. After 15 years the best trees now average 9 m in height and 18 cm in diameter (maximum growth rates of 60 cm and 1.2 cm/year, respectively). They appear in reasonable health, although some of the tops have been broken by wind and the stems are covered in lichens. At Craigieburn the tallest trees are 5 m, and were regularly knocked back by frost in their early years. Small numbers of trees were planted privately at other sites in the South Island (such as on the West Coast), but their performance suffered from poor establishment practices (particu-

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