THE EFFECTS OF HUNTING ON THE NUMBERS AND GROUP SIZES OF HIMALAYAN THAR (*HEMITRAGUS JEMLAHICUS*) IN CARNEYS CREEK, RANGITATA CATCHMENT

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SUMMARY: A census of the Himalayan thar *(Hemitragus jemlahicus)* in Carneys Creek, a tributary of the Havelock branch of the Rangitata River, was undertaken in 1965, when thar were at about peak density, and repeated in 1977. In the intervening 12 years, the population was hunted from the ground for recreation, and from helicopters for animal control purposes and commercially for meat. This paper describes the results of the two censuses and discusses the differences.

The 1965 census was 710 thar, the 1977 census was 48 thar. This is a decrease of 93% from 32.9 animals/km^2 (825 kg/km^2) to 2.2 animals/km^2 (56 kg/km^2). One half of the thar seen in 1965 were in groups of 31 animals or more (mean group size 15.8), whereas the largest group seen in 1977 was of 7 animals (mean group size 3.2). Female-juvenile groups comprised more than 90% of the thar seen in both censuses.

INTRODUTION

Successful liberations of Himalayan thar *(Hemitragus jemlahicus)* were made near Mt Cook in 1904 and 1909 (Donne, 1924). In subsequent years the thar population expanded and increased its range northwards and southwards along both sides of the central Southern Alps and onto most of the major lateral ranges (Caughley, 1970a). Following the colonisation of new areas, and generally in the absence of effective hunting, populations exhibited an eruptive increase in numbers (Caughley, 1970b). Throughout most of their range east of the main divide thar were subsequently hunted by government shooters to control their numbers, and by recreational and commercial hunters.

In one of these areas, Carneys Creek, a tributary of the Havelock branch of the Rangitata River, a census of thar undertaken when the population was at about peak numbers was repeated after it had been hunted for eleven years. The objective of this paper is to describe the resulting differences in thar numbers, density and social groupings as recorded by the two censuses.

The Rangitata River system is one of five major catchments draining eastwards from the central portion of the Southern Alps, and the Havelock branch is typical of much of the thar habitat along the eastern side of the Alps. Carneys Creek, which is 10-15 km from the main divide, is a deeply-dissected valley 9 km in length and approximately 2160 ha in area. At its mouth Carneys Creek joins the main Havelock Valley at an elevation of 760 m; ridgetops on either side of the valley are from 1800-2000 m and rise to 2148 m at its headwaters.

THE HUNTING HISTORY OF THAR IN CARNEYS CREEK

Thar were first reported to be in Carneys Creek in 1939, when government hunters shot 10 animals in the course of chamois *(Rupicapra. rupicapra)* control shooting operations (Davidson, 1965). Caughley (1970a) considers that these thar were probably males, and that breeding populations established in the area about 10 years later (i.e., around 1949). The numbers of thar in Carneys Creek increased rapidly during the 1950s, reaching high density around the early 1960s,* despite some government shooting operations and recreational hunting.

The catchment was not hunted for a period of two years from mid-1964 while the New Zealand Forest

* Unpublished reports by L. Boyd dated August 1962 to December 1963; File No. F.S. 90/4/6, New Zealand Forest Service, Christchurch.

Service conducted baiting and luring trials for thar. These trials were abandoned after an unsuccessful aerial poisoning operation in May 1965, and hunting resumed in early 1966. Between 1966 and 1972 about 1000 thar were shot in Carneys Creek by recreational hunters, nearly one half of this total being accounted for in a series of major "drives" immediately after the catchment was re-opened to hunting.

In September 1967 shooting from a helicopter was first used for thar control by the New Zealand Forest Service. Nearly 4 hours were spent flying over tributaries of the Havelock Valley during which 400 thar and 25 chamois were shot. Of these, 150 thar came from Carneys Creek. The success of this operation established shooting from helicopters as the primary means of thar control in Canterbury, and two further operations took place in the Havelock Valley area in 1968; the tallies obtained from Carneys Creek were not recorded separately. Reporting on the overall effects of these operations the ranger-in-charge noted that "compared to 1967 when mobs of 50 or more thar were common, this year it was seldom that more than 8-10 animals were seen together".*

An export market for thar meat was developed in 1970, and during the winter months of 1972 to 1975 large numbers were taken in helicopter hunting operations. This caused a substantial reduction in thar numbers generally. Carneys Creek was frequently hunted by helicopter during this period but no records of the numbers of thar shot are available.

Recreational hunters continued to be active in Carneys Creek, accounting for an estimated 250-300 thar between 1973-1976. During 1974 and 1975 these hunters were averaging about 2.5 days hunting per kill, although a year later, following the increase in helicopter game-meat recovery activity, their success had dropped to 3.4 days per kill.

The two censuses of thar in Carneys Creek show the effects that the combined recreational and commercial hunting had on animal numbers and density, and group size and structure. The first census was made when the population was relatively undisturbed and near to peak density, and the second census was made after a prolonged period of intensive hunting.

METHODS

Census methods involved direct counting of thar. The counts were made by two observers using 8x and l0x binoculars and 20x spotting telescopes mounted on tripods. They were undertaken in similar weather conditions during 24-28 February 1965, and 23-27 February 1977. The same procedures were used throughout, and one author (CNC) participated in both censuses. Observers operated separately, looking across-valley and onto adjacent faces and bluffs from an altitude of around 1500 m to 1800m (see Fig. 1), and often changing position during the day. Observations commenced in the mid-morning and continued until light faded in the late evening. For counting purposes the valley was divided into five blocks of about equal size (Fig. 2). Each of these blocks was scanned on more than one day and usually independently by both observers.

FIGURE 1. *Carneys Creek catchment looking into the headwaters from above the mouth.*

The number, sex, age class and position of thar seen were recorded; the observers compared notes at the end of each day to avoid duplication. Groups were classified into one of three classes which corresponded to normal social groupings. Males were classed as "mature" (4 years old) or "immature" (2 or 3 years old) from pelage characteristics;

* Unpublished report by L. Boyd dated 6 November, 1968; File No. F.S. 90/20/6, New Zealand Forest Service, Christchurch.

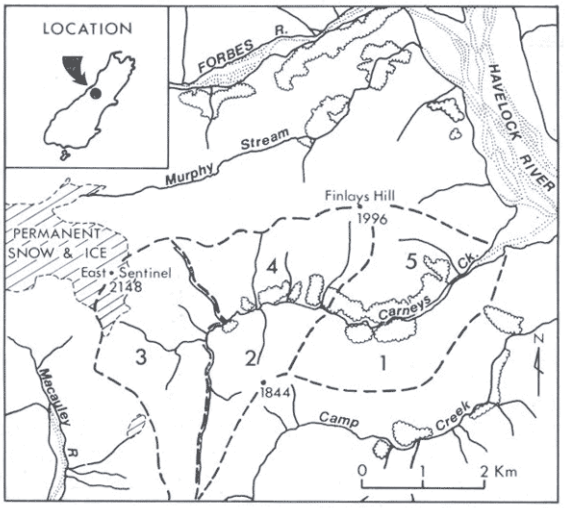

FIGURE 2. *Carneys Creek catchment showing the blocks used in the censuses.*

they were usually associated in separate groups and were classed accordingly. The other social grouping comprised aggregations of females, kids and yearlings. Yearlings of both sexes tend to form groups of their own during the early summer, following birth of kids in November-December; these are usually transitory and unstable associations and are closely linked with female-kid groups. The yearlings usually rejoin the females and kids around February, when the kids, then about three months old, are fully mobile. Also associated with female-kid-yearling groups are non-breeding females and sometimes a few immature males. No groups are completely stable and animals variously leave and rejoin an association, either singly or in sub-groups, even during the course of a day. We have called all of these groups "female-juvenile" groups.

A sample of 24 thar of mixed age and sex, shot from a helicopter on 2 September 1975, comprised the basis from which live bodyweights were derived for biomass calculations. The thar weighed comprised the results of a single foray in Carneys Creek during which all thar seen were shot and recovered.

In order to relate thar density estimates to potential forage an estimate of vegetation cover was attempted. Two hundred random points were plotted on a 20 chains-to-the-inch aerial photograph, and the points classified as "vegetated" where they fell on plant cover, however sparse, or "non-vegetated" where they fell on scree, rock, riverbed or permanent snow.

RESULTS

Changes In thar numbers and density

In February 1965, 710 thar were counted within the Carneys Creek catchment; the total count in February 1977 was 48 thar, a 93 % reduction. The numbers recorded in each block are summarised in Table 1. The greatest changes in numbers occurred

TABLE 1. *Changes in the numbers and distribution of thar.*

Block	1965	1977	% decrease
1. Downstream, true right	132	2	98.5
2. Midstream, true right	80	2	97.5
3. Headwaters	254	8	96.9
4. Midstream, true left	134	17	87.3
5. Downstream, true left	110	19	82.7
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	710	48	93.2

in the headwaters and the north-west facing slope of Carneys Creek.

The density of thar in 1965 represents 1 thar to 3.0 ha over the entire catchment or 32.9 thar / km^2; the 1977 count represents 1 thar to 45.0 ha or 2.2 thar/km^2. From an aerial photograph, 45.5% of the catchment was estimated to be devoid of plant cover. The remaining vegetated area, 1177 hectares, supported 1 thar to 1.7 ha in 1965 and 1 thar to 24.5 ha in 1977. The biomass of thar, obtained using the mean weight of 25.1 kg (derived from a shot sample) as an indication of live bodyweight, was 825 kg/km^2 in 1965 and 56 kg/km^2 in 1977, while that on vegetated areas only was calculated at 1514 kg/km^2 in 1965 and 102 kg/km^2 in 1977.

Changes in group size and composition

The 710 thar seen in 1965 were in 45 groups (a mean group size of 15.8); the 48 thar seen in 1977 were in 15 groups (a mean group size of 3.2). Figure 3 shows the distribution of group sizes for the two counts. In 1965, 50% of the thar present were in groups of 31 or more, 37 % in groups of from 11 to 30, and I3 % were in groups of 10 or fewer. The two largest groups counted in 1965 comprised 69 and 62 animals; the largest number of thar seen together in 1977 was 7.

The majority of thar were in female-juvenile groupings; they made up 94% of those seen in 1965, and 96% of those seen in 1977. Only five mature males were seen in 1965, three of these were solitary. None was seen in 1977. Six groupings of immature males were seen in 1965; these groups ranged in size

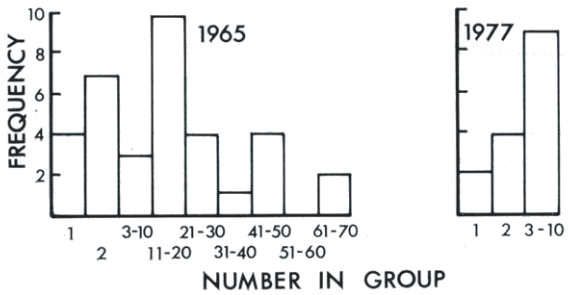

FIGURE 3. *Distribution of thar group sizes in* and 1977.

from 2 to 10 and totalled 35 animals. Only two solitary immature males were seen in 1977.

DISCUSSION

From the number of thar in Carneys Creek and the reported state of the depletion of the vegetation we consider that the population approximated peak density in 1965. This was about 15 years after the area was colonised by breeding females.

The 1965 count of 710 thar is probably conservative. Some large differences between female and kid numbers in some groups in the 1965 counts suggest that many kids may have been overlooked. Apart from their small size, subsequent studies have shown that kids tend to form sub-groups and spend much more time resting than adults, behaviour which would make them difficult to count (K. G. Tustin, unpublished data). We are also aware that single animals or small groups are more likely to be overlooked than are larger groups, and that this was more likely to have occurred in 1965 than in 1977. On the other hand, even a few thar overlooked during the 1977 counts would contribute significantly to the total count.

The disparity in the representation of sexes in particular areas was not uncommon. In January 1963, one of the authors (CNC) noted that the thar population in the North East Gorge catchment to the south-east was composed entirely of males (C. N. Challies, unpublished report). Similarly, the head of Tom's Creek, a tributary of the Macauley River immediately bordering Carneys Creek, and the north.eastem slopes of the Macauley River immediately above Tom's Creek, were occupied predominantly by males over the summer months (G. Joll, *pers. comm.).* The seasonal shift of males into regions like Carneys Creek, which are predominantly female-juvenile areas, could be expected to increase the population by at least 20-30 % over the period of the rut and during the following winter months.

The thar population in Carneys Creek was likely, therefore, to have been around 900 animals during the months May to September 1965.

Unfortunately, the magnitude of the initial eruptive increase in numbers following colonisation by ungulates on the New Zealand mainland has not previously been quantified for any species, although anecdotes of numbers seen, group sizes and hunting kill rates have been documented for some areas (e.g., Clarke, 1976). Thus, no quantitative data are available for comparing densities of animals at population peaks. Despite the limitations, it is possible to compare peak densities of thar with those of managed domestic stock. In the Canterbury high country* the density of domestic stock averaged over the 1965-67 seasons was 1990 kg/km^2 overall (considering total areas in farm leasehold runs) or 2880 kg/km^2 (considering areas used for grazing only)-a density sustainable only by modern farming practices and extensive supplementary feeding. It is interesting to note that thar in Carneys Creek at about peak population levels, although probably beyond the carrying capacity of their range, achieved densities which approached or exceeded half the domestic stock density on the mid and upper slopes of a mountainous terrain, almost all of which would be considered "ungrazable" for domestic sheep.

In considering biomass estimates it should be noted that thar are not uniformly spread throughout the area, nor is the vegetation either necessarily available or usable. Seasonal changes in snow pack and animal behaviour, thar forage preferences, canopy height differences and the avoidance of low altitude areas by thar mean that interpretation on anything but a broad scale should be regarded with caution.

High densities of thar had a profound influence on the vegetation, especially that at higher elevations. Gross modification of many plant associations occurred, particularly the subalpine scrubland and tall snowtussock communities. Following a visit in April 1965, M. H. Douglas noted **, ". . . thar are

* Biomass calculations were made using data from Hughes (1974) and Hughes *et al.* (1974) considering the "Canterbury Wet" high country land classification when an average of 252355 sheep and 9075 cattle were run on farm leasehold runs totalling 681 645 ha in area of which 469705 ha were grazed; the herd compositions were from the same publications and stock liveweights (40 kg for sheep, 380 kg for cattle) from the Lincoln College Farm Budget Manual (1977).

** Unpublished report by M. H. Douglas dated April 1965; File No. F.S. 90/4/6, New Zealand Forest Service, Wellington.

causing large areas of *Dracophyllum uniflorum* to be killed off-both by trampling and browsing. Marked depletion is occurring throughout the bluff systems-thar are feeding preferentially on *Chionochloa flavescens,* to its virtual elimination. . . severe depletion is occurring throughout Carneys Creek due to the action of thar". Although thar have had the greatest influence on the condition of the vegetation in Carneys Creek, they have shared the range with other introduced animals. Of these, the use of the habitat by chamois, domestic sheep, and European hares *(Lepus europaeus)* has most closely overlapped that of the thar, while red deer *(Cervus elaphus)* and opossums *(Trichosurus vu/-pecula)* have tended to use the taller scrublands at lower altitudes. Some burning was associated with the management of sheep, which were mostly confined to the southern faces (Block 1 on Fig. 1). Chamois colonised the area after the 1920s and were in high numbers during the late 1930s (L. Pracy, *pers. eomm.)* but were in low numbers in both 1965 and 1977.

The recent decline in thar numbers in Carneys Creek appears to have occurred in two phases: a marked reduction as a result of hunting by sports men and the control hunting from helicopters between 1966 and 1968, and a decrease after 1975, resulting from commercial hunting using helicopters. During the intervening years, 1969 to 1974, hunting by sportsmen apparently prevented any population increase but did not appear to reduce the population substantially.

It is significant that the areas in Carneys Creek where the least reduction occurred (Block 5 on Fig. 1) are those where the terrain offers the most cover for thar from ground or aerial hunting; relatively large areas of subalpine scrubland grade into steep dissected bluffs at high elevations. Conversely, the greatest number of thar were seen in the headwaters in 1965, but few survived in this area, where vegetation cover is sparse and rock bluffs offer little cover from aerial hunting.

The history and decline of the thar population in Carneys Creek are paralleled throughout their range along the eastern side of the Southern Alps, except that the influence of hunting varied in its intensity and duration and occurred at different stages of the natural increase or decline of various populations. Shooting from helicopters, especially between 1972 and 1975 by the game-recovery industry, reduced population numbers and has resulted in fairly uniform densities of thar throughout their range.

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