

## MARKHOR, POPULATION DYNAMICS AND FOOD AVAILABILITY, IN CHITRAL GOL WILDLIFE SANCTUARY

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**Summary.** 520 markhor were estimated to be occupying Chitral gol Wildlife Sanctuary during the first fortnight of January 1979, an increase of 123 animals from the previous year. 159 young ones were recruited to the population, and 36 animals lost to the population, major casualties (32) amongst the young ones. Kid/female was 1.03. Medium sized groups (5 to 20) contained most of the population. During August 1978 habitat characteristics were determined for the summer season. Cover conditions were favourable and the food was plentiful for the number of animals occupying the area.

**Introduction.** From January 8 to January 14, 1979 markhor (*Capra falconeri falconeri*) were counted in Chitral Gol Wildlife Sanctuary (declared as such in 1971) to compare the population and its structure with that recorded in February-March 1975, January 1977, and December 1977 (Aleem, 1976, 1977, 1978).

The rut was not yet over and a few pairs were still courting. Most of the herds had, however, started disintegrating. The areas occupied by the herds were identified during the reconnaissance survey and later the estimates were made by localities. The survey was attempted using binocular (7×50) and the spotting scope (20×60 mm). Snowfall was exceptionally late this year and snow did not stay except on very high peaks. This made spotting difficult as the animals stayed along higher elevations and a larger area had to be covered to spot the animals. The weather remained clear most of the time and spotting was possible only in the mornings and evenings from 7.00 to 10.00 a.m. and from 3.00 to 5.30 p.m.

**Population.** A total of 610 animals were spotted and categorised. The population was, however, estimated to be 520 after discounting possible double counts. They were categorised as follows:

Category	Number	Percentage in population	Number per female
Male	129	24.8	0.83
Female	155	29.8	
Yearling	77	14.8	0.50
Young	159	30.6	1.03
Total:	520		

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The young ones were the maximum in the population followed by the females.

The estimate is compared below with the estimates of December, 1977, January 1977 and February-March 1975 (Aleem 1978, 1977, 1976).

Category	Feb March 1975	January 1977	December 1977	January 1979
Total	240	299	397	520
Male	61	107	118	129
Female	94	124	139	155
Yearling	32	37	31	77
Young	53	31	109	159
Yearling/female	0.33	0.30	0.22	0.50
Young/female	0.56	0.25	0.79	1.03

While comparing December 1977 and January 1979 populations, an increase of 11 males and 16 females was observed out of 31 yearlings, thus about 87% of yearlings had grown into adults. About 29% young failed to grow into the yearling stage. In January 1977—about 90% young and yearling of 1975 (two growth years) had grown into adults, whereas in December 1977, 70% of yearlings and almost all the young of January 1977 had grown into the next higher category.

Percentage of males and females (24.5 and 29.7 respectively) in the estimate, however, is less as compared to previous year's (December 1977) percentages of 29.5 and 35.1 for the same categories mainly because of increased number of young ones in the population.

The population was categorised according to mature sexes (Table 1):

Male female ratio: The male/female ratio 129/155 (0.83 : 1) remained almost the same as in January 1977 (107/124 : 0.86 : 1) and December 1977 counts (118/139 : 0.89 : 1) whereas there was a distinct increase in the number of males from that recorded in 1975 (61/94 : 0.65 : 1). Male/female ratio was almost equal except in those localities from where the older males had left. The localities from where older males had left, females were present in high proportions.

Male categorisation: The males were categorised into 2 types: A — males with a greater horn spread i.e., more than 7-1/2 years old, and B — the younger or less than 7-1/2 years of age. Their distribution is given in table 2.



Table 1 : Markhor population distribution (Mature Sexes) in Chitral gol

Locality	Number in the locality	Male	Female	Male/female ratio
Ishper Juh	9	2	3	1 : 2
Meran	7	2	2	1 : 1
Nogh	24	3	9	1 : 1
Chutak	12	3	4	1 : 1
Shosh Mologh	32	12	7	1 : 0.6
Sardawais gol (Khush Bakhtan Shal)	39	6	13	1 : 2
Mardeen gol	47	11	13	1 : 1
Tongogh	93	22	26	1 : 1
Banjho Nakh	12	2	5	1 : 2
Tajammal Nakh	53	16	16	1 : 1
Ashghotar	21	5	6	1 : 1
Kasaver	30	9	8	1 : 1
Kasaver lasht	9	3	3	1 : 1
Ishpe dher	60	12	10	1 : 1
Bakhtan Shal	28	12	8	1 : 0.7
Krui dheri	36	5	12	1 : 2
Birson shal	8	4	2	1 : 0.5
Total:	520	129	155	1 : 1.2

Table 2 : Distribution markhor of male categories in Chitral gol

Locality	Total males	Male category A	Male category B
Ishper Juh	2	—	2
Meran	2	1	1
Nogh	3	2	1
Chutak	3	1	2
Shosh Mologh	12	10	2
Sardawais gol (Khush Bakhtan Shal)	6	3	3
Mardeen gol	11	7	4
Tongogh	22	10	12
Banjho Nakh	2	—	2
Tajammal Nakh	16	4	12
Ashghotar	5	1	4
Kasaver	9	5	4
Kasaver lasht	3	1	2
Ishpe dher	12	7	5
Bakhtan Shal	12	3	9
Krui dheri	5	1	4
Birson shal	4	2	2
Total:	129	58	71

Compared with the previous year's count (Aleem, 1978) there was an increase of 25 males in category A i.e., from 32 to 57 whereas the number of category B males was 71 as compared to 86 of the previous year, showing thereby a shift of more animals in the older age gradation rather than from the yearling stage to the adult male class.

Females in relation to yearlings and the young: The number of yearlings and the young in the population was as follows:

Locality	Female	Yearling	Yearling/female ratio	Young	Young/female ratio
Ishper Juh	3	2	0.67	2	0.67
Meran	2	1	0.50	2	1.00
Nogh	9	3	0.33	9	1.00
Chutak	4	2	0.50	3	0.75
Shosh Mologh	7	5	0.70	8	1.11
Sardawais gol (Khush Bakhtan Shal)	13	8	0.62	12	0.92
Mardeen gol	13	9	0.69	14	1.08
Tongogh	26	14	0.54	31	1.19
Banjho Nakh	5	—	—	5	1.00
Tajammal Nakh	16	6	0.38	15	0.94
Ashghotar	6	4	0.67	6	1.00
Kasaver	8	4	0.50	9	1.13
Kasaver lasht	3	—	—	3	1.00
Ishpe dher	18	11	0.61	19	1.06
Bakhtan Shal	8	1	0.13	7	0.88
Krui dheri	12	7	0.58	12	1.00
Biron shal	2	—	—	2	1.00
Total:	155	77	0.50	159	1.03

Yearling/female and young/female ratio (0.50 and 1.03) increased from the previous year's count—0.22 and 0.79 for yearling and young/female in December 1977 and 0.30 and 0.25 in January 1977.

**Social organisation.** Group size: Over-all mean group size was 9.5 (range, 1-58 amongst 55 groups). Group size tended to increase during the rut and decreased after the rut. During the study period almost half the groups (28 out of 55) contained 5 or less markhor. The percentage of all markhor found in groups of various sizes, however, was greater in medium sized groups (5 to 10 and 11-20) with 46.2% of the total population. Small sized groups contained only 11.7% of animals, whereas groups more than 20 animals contained 36.9% of the population.



**Group composition:** The male markhor accompany the females only during the rut and with the close of the rut the males abandon the groups; older males are the first to leave. The larger males contribute the most towards the rut and keep the herd in tact. The group after abandonment by the older males disperses into smaller units. During the study period, large males (male only groups)—category A, were seen on four occasions—two solitary and two groups of 3 and 7 each. The largest herds of 58 and 50 contained larger males—7 and 6 respectively who served to keep the groups in tact.

In the estimates made during April, July and October 1978, no males were observed to be accompanying the females. Even the larger males tended to keep in separate herds of their own and would even shun the smaller males.

Seventeen herds were observed to contain more than 10 animals. Following is the composition:

Herd No.	Total	Males	Females	Yearling	Young
1	12	3 (1+2)*	4	2	3
2	20	2 (1+1)	8	2	8
3	58	13 (7+6)	15	10	20
4	19	4 (0+4)	6	3	6
5	14	2 (0+2)	5	2	5
6	12	3 (1+2)	5	—	4
7	17	6 (3+3)	4	3	4
8	17	4 (1+3)	5	3	5
9	33	4 (1+3)	11	7	11
10	15	3 (1+2)	4	3	5
11	11	1 (0+1)	3	3	4
12	17	7 (5+2)	3	3	4
13	12	— (— --)	4	3	5
14	10	2 (0+2)	3	2	3
15	27	4 (2+2)	9	5	9
16	25	5 (1+4)	8	4	8
17	50	10 (6+4)	15	10	15

**Predators.** One snow leopard (*Panthera uncia*) was reported to be seen on two occasions in October 1978 at Gokhshal where the livestock graze during summer. The snow leopard was encountered by the farmers but it did not harm them. No damage to the livestock or wild animals was reported. At least 10 wolves (*Canis lupus*) were reported to be present in the area in two packs. During the period of study, tracks of 2 wolves at one spot and 3 at the other were seen on the snow at higher elevations along the peaks.

**The habitat.** The vegetation of the area has been described by Beg (1974), Aleem (1976) and Khan (1978). Winter habitat characteristics were determined by Aleem (1978).

\* (Male category A + Male category B)

To study the summer habitat characteristics, the area was surveyed in August 1978. Cover conditions and forage production were determined. Seventeen, 30 m long transects were laid out in the summer habitats of markhor covering all the vegetation types. Equidistant quadrats of one m<sup>2</sup> each (spaced at 1.5 m) were read along the transect lines to determine cover percent (foliage as well as base cover, litter, rock pavement and bare soil); results:

Species	Cover percent					
	Chhat		Gokh shal		Kasaver	
	Cooler aspects	Hotter aspects	Cooler aspects	Hotter aspects	Cooler aspects	Hotter aspects
Grasses and forbs	4.3	12.6	14.0	10.8	5.3	6.9
Shrubs	38.8	20.1	17.2	24.0	18.2	17.1
Trees	17.0	15.0	38.0	17.0	33.0	18.1
	60.1	47.7	69.2	51.8	56.5	42.1

The data above show that the grasses are more on the hotter aspects (southern and western) whereas trees and shrubs are more frequent on the cooler aspects (northern and eastern).

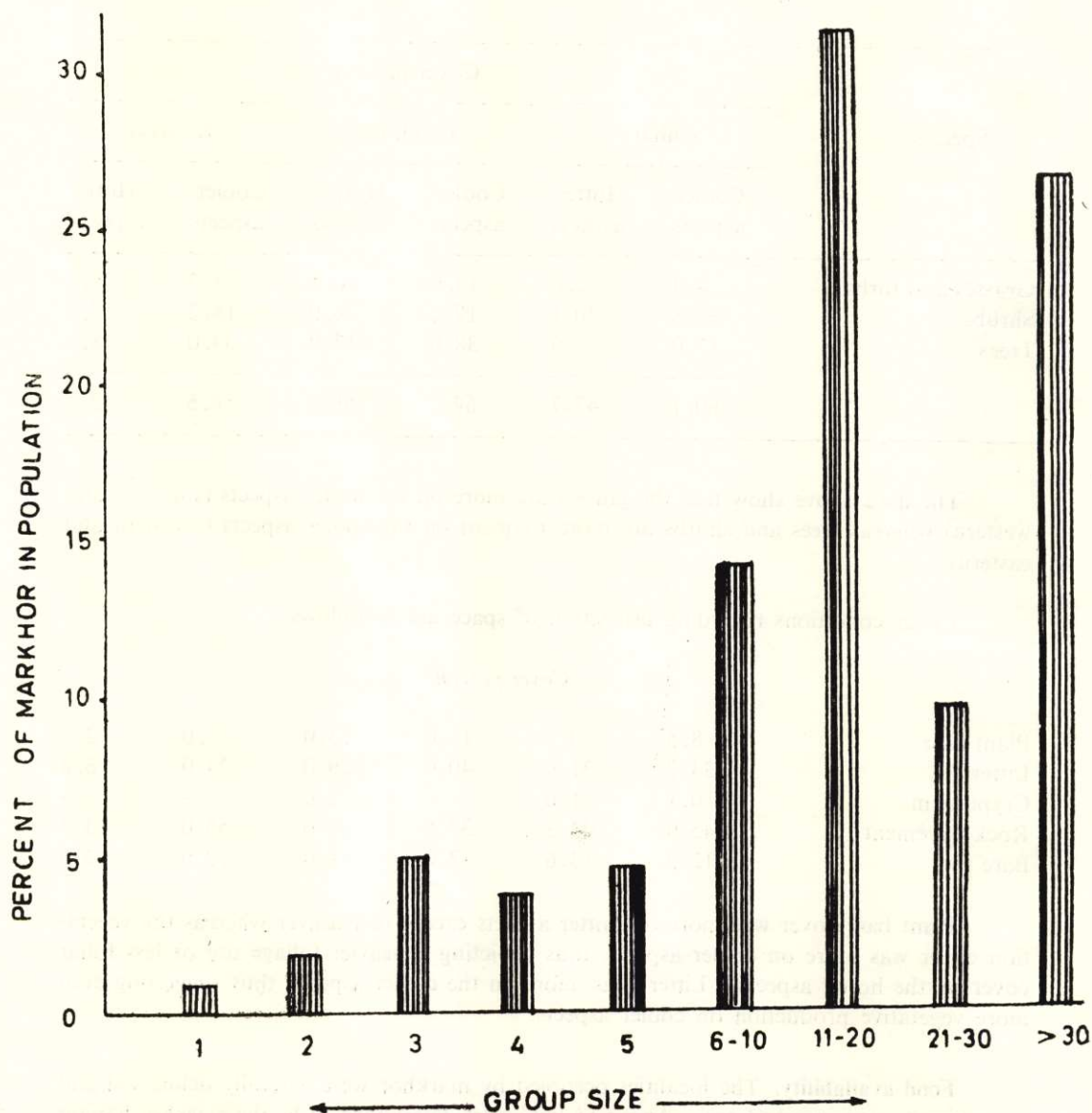
Cover conditions regarding utilization of space are as follows:

	Cover percent					
Plant base	8.5	10.5	11.0	13.0	9.0	2.2
Litter	34.2	31.6	40.0	29.0	24.0	6.0
Cryptogam	0.1	1.0	—	2.0	—	—
Rock pavement	45.0	43.3	37.0	45.0	55.0	13.7
Bare soil	12.2	13.6	12.0	11.0	12.0	3.0

Plant base cover was more on hotter aspects except in Kasaver whereas the vegetation cover was more on cooler aspects, thus depicting a heavier foliage use or less foliar cover on the hotter aspects. Litter was more on the cooler aspects, thus suggesting even more vegetative production on cooler aspects.

**Food availability.** The localities occupied by markhor were carefully delineated and approximate areas worked out. About 15 km<sup>2</sup> were determined to be the markhor habitat during summer. Rest of the areas in the sanctuary (65 km<sup>2</sup>) are either occupied by the livestock or abandoned in favour of high altitude grazing grounds. Forage production was determined by clipping the vegetation by one m<sup>2</sup> equidistant quadrats (spaced at 3 m) on

### FREQUENCY DISTRIBUTION OF MARKHOR BY GROUP SIZE





17 transect lines. Vegetation was weighed green and after air drying. Air dried weight in grams was multiplied by 10 to determine forage production in kg/ha. Yield was determined separately in different areas of markhor occurrence: Chhat, Gokhshal and Kasaver for grasses, forbs, and shrubs, as follows:

Locality	Area (hectares)	Forage Production kg/ha			Production in the area (kg)	
		Shrubs	Grasses	Forbs	Total	
Chhat/Duni	800	668	196	33	897	717,600
Gokhshal area	200	1,449	601	136	2,186	437,200
Kasaver and areas upto Meran	500	932	136	3	1,071	535,500
Total:	1,500	3,049	933	172	4,154	1,690,300

The utilization factor for summer vegetation would be about 0.4 as against 0.6 for the winter forage which mainly consisted of tree vegetation. Available forage thus would be: 676,120 kg.

Based on the animal weights reported by Prater (1973) and Roberts (1977) (for the male markhor) and the animal equivalents by Khan (1971, 1973) the categories of population were transformed into animal units\* as follows:

Category	Number in population	Animal units equivalent	Animal units
Male category I	58	0.4	23
Male category II	71	0.3	21
Female	155	0.25	39
Yearling and young	236	0.15	36
		Total:	119

The forage requirement for one animal unit is about 10 kg (Khan 1973) thus for seven summer months, April through October, passed in the habitat 2100 kg forage would be needed. The total forage requirement for the population can thus be worked out as:  $2100 \times 119 = 249,900$  kg. It would thus appear that food is adequate for the markhor in the summer habitat of Chitral Gol Wildlife Sanctuary. Total capacity (wild grazing animals) was however, estimated to be 320 animal units.

\*One animal unit equivalent to a mature cow with a calf or weighing about 500 kg.



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## Appendix I

Markhor in different localities of Chitral Gol Wildlife Sanctuary  
(observed Jan, 8 to Jan. 11, 1977)

Locality	Total	Males			Females	Yearling	Young
		Category A	Category B	Total			
Ishpar Juh	9	—	2	2	3	2	2
Meran	7	1	1	2	2	1	2
Nogh	24	2	1	3	9	3	9
Chutak	12	1	2	3	4	2	3
Shosh Mologh	32	10	2	12	7	5	8
Sardawais gol (Khush Bakhta Shal)	39	3	3	6	13	8	12
Mardeen gol	47	7	4	11	13	9	14
Tongogh	93	10	12	22	26	14	31
Banijoh Nakh	12	—	2	2	5	—	5
Tajammal Nakh	53	4	12	16	16	6	15
Ashoghtar	21	1	4	5	6	4	6
Kasa ver	30	5	4	9	8	4	9
Kasaver lasht	9	1	2	3	3	—	3
Ishpe dher	60	7	5	12	18	11	19
Bakhtan Shal	28	3	9	12	8	1	7
Krui Dheri	36	1	4	5	12	7	12
Biron shal	8	2	2	4	2	—	2
Total:	520	58	71	130	155	77	159



## Appendix II

Herd composition in various localities in the Sanctuary

	Male A	Male B	Female	Yearling	Young	Total	Total in Locality
Ishper Juh	—	2	3	2	2	9	9
Meran	1	1	2	1	2	7	7
Nogh	2	—	8	2	8	20	24
	—	1	1	1	1	4	
Chutak	1	2	4	2	3	12	12
Shosh Mologh	3	—	—	—	—	3	32
	7	—	—	—	—	7	
	—	—	4	3	5	12	
	—	2	3	2	3	10	
Sardawais gol (Khush Bakhlan Shal)	1	2	4	3	5	15	39
	—	—	3	1	2	5	
	—	1	3	3	4	11	
	—	—	1	1	1	3	
	2	—	3	—	—	5	
Mardeen gol	—	—	1	1	1	3	47
	5	2	3	3	4	17	
	2	2	9	5	9	27	
Tongogh	7	6	15	10	20	58	93
	1	1	—	—	—	2	
	1	—	—	—	—	1	
	—	1	3	—	3	7	
	1	4	8	4	8	25	
Banjho Nakh	—	1	2	—	2	5	12
	—	1	1	—	—	2	
	—	—	2	—	3	5	
Tajmmal Nakh	—	4	6	3	6	19	53
	—	1	—	—	—	1	
	—	1	—	—	—	1	
	1	2	5	—	4	12	
	3	3	4	3	4	17	
	—	1	1	—	1	3	

—Continued

## Appendix II (Contd.)

	Male A	Male B	Female	Yearling	Young	Total	Total in Locality
Ashoghtar	1	3	5	3	5	17	21
	—	1	1	1	1	4	
Kasaver	—	1	—	—	—	2	30
	—	—	2	1	2	5	
	—	2	5	2	5	14	
	1	1	—	—	—	2	
	—	—	—	—	—	4	
	—	—	1	1	1	3	
Kasaver Lasht	—	1	1	—	1	3	9
	1	1	2	—	2	6	
Ishpe dher	1	—	2	—	3	6	60
	—	1	1	1	1	4	
	6	4	15	10	15	50	
Bakhtan Shal	—	2	—	—	—	2	28
	1	—	2	—	3	6	
	—	1	1	1	1	4	
	—	2	—	—	—	2	
	—	2	2	—	—	4	
	1	1	2	—	2	6	
	—	1	1	—	1	3	
	1	—	—	—	—	1	
Krui Dheri	—	1	1	—	1	3	36
	1	3	11	7	11	33	
Biron Shal	2	2	2	—	2	8	8
Total:	58	71	155	77	159	520	520



## Appendix III

Daily observation records of Markhor in Chitral gol (January 7-11, 1979)

	Locality	Total	Male A	Male B	Total males	Female	Yearling	Young
7-1-79	Chutak	12	1	2	3	4	2	3
	Meran	7	1	—	1	2	1	2
	Nogh	20	2	—	2	8	2	8
9-1-79	Tongogh	58	7	6	13	15	10	20
	Tajammal Nakh	19	—	4	4	6	3	6
		1	—	1	1	—	—	—
		1	—	1	1	—	—	—
	Nagh	4	—	1	1	1	1	1
9-1-79	Banjoh Nakh	5	—	1	1	2	—	2
		2	—	1	1	1	—	—
	Tongogh	2	1	1	2	—	—	—
		—	—	—	1	—	—	—
	Kasaver	2	—	1	1	—	—	1
		5	—	—	—	2	—	2
		14	—	2	2	5	2	5
	Kasaver Lasht	3	—	1	1	1	—	1
	Kasaver	2	1	1	2	—	—	—
		4	4	—	4	—	—	—
		3	—	—	—	1	1	1
	Ishpe dher	6	1	—	1	2	—	3
		4	—	1	1	1	1	1
	Bakhtanshal	2	—	2	2	—	—	—
		6	1	—	1	2	—	3
	Bakhtanshal	4	—	1	1	1	1	1
		2	—	2	2	—	—	—
		4	—	2	2	2	—	—
		6	1	1	2	2	—	2
		3	—	1	1	1	—	1
		1	1	—	1	—	—	—
	Krui dheri	3	—	1	1	1	—	1
	Tongogh	7	—	1	1	3	—	3
	Tajammel Nakh	12	1	2	3	5	—	4
	Banjo Nakh	5	—	—	—	2	—	3

—Continued

## Appendix III (Contd.)

	Locality	Total	Male A	Male B	Total males	Female	Yearling	Young
10-1-79	Tajammal Nakh	17	3	3	6	4	3	4
		3	—	1	1	1	—	1
	Ashoghtar	17	1	3	4	5	3	5
		4	—	1	1	1	1	1
	Krui Dheri	33	1	3	4	11	7	11
	Biron shal	8	2	2	4	2	—	2
	Mardeen gol	3	—	—	—	1	1	1
11-1-79	Shosh Mologh	3	3	—	3	—	—	—
	Sardawais gol (Khush- bakhtan gol)	15	1	2	3	4	3	5
		5	—	—	—	2	1	2
		11	—	1	1	3	3	4
	Khush Bakhtan gol	3	—	—	—	1	1	1
	Tongogh	25	1	4	5	8	4	8
	Kasaver Lasht	6	1	1	2	2	—	2
	Ishper Juh	9	—	2	2	3	2	2
	Shosh Mologh	7	7	—	7	—	—	—
		10	—	2	2	3	2	3
	Mardeen gol	17	5	2	7	3	3	4
	Sardwais gol	5	2	—	2	3	—	—
	Ishpedher	50	6	4	10	15	10	15
	Shosh Mologh	12	—	—	—	4	3	5
	Mardeen gol	27	2	2	4	9	5	9
	Total:	520	58	71	129	155	77	159



## Appendix IV

Cover % in Summer habitat of Markhor (August 1978)

Species	Chnat		Gokh shal		Kasaver	
	Cooler aspects	Hotter aspects	Cooler aspects	Hotter aspects	Cooler aspects	Hotter aspects
<i>Rosa ecae</i>	4.2	2.2	3.0	5.0	—	1.7
<i>Astragalus</i> sp.	2.5	2.4	4.0	2.0	—	3.5
<i>Polygonum mucronatum</i>	—	—	—	1.0	0.2	0.5
<i>Nepeta podostachys</i>	1.3	—	—	1.0	—	—
<i>Vicia soongaricum</i>	3.0	—	—	—	—	—
<i>Rumex</i> sp.	—	—	—	1.0	—	—
<i>Polygonum</i> sp.	11.5	2.1	—	1.0	—	2.0
<i>Medicago</i> sp.	—	1.6	—	2.0	—	—
<i>Nepeta fruticans</i>	1.2	1.3	—	2.0	—	—
<i>Prangos pabularia</i>	5.3	6.3	3.0	4.0	—	—
<i>Verbascum thapsus</i>	.0	0.2	0.8	—	—	0.5
<i>Lonicera griffithii</i>	—	0.3	—	—	—	—
<i>Ferula narthax</i>	—	1.8	—	1.0	—	1.2
<i>Cotoneaster lindleyi</i>	0.2	1.5	3.0	3.0	—	1.7
<i>Sorbaria aucuparia</i>	0.1	—	3.0	1.0	—	—
<i>Lactuca</i> sp.	0.3	0.3	0.4	—	—	—
<i>Sassuria lappa</i>	0.2	—	—	—	7.0	3.5
<i>Cousinia</i> sp.	0.2	0.1	—	—	—	—
<i>Viburnum cotinifolium</i>	5.7	—	—	—	—	—
<i>Artemisia</i> spp.	1.8	—	—	—	—	1.5
<i>Prunus</i> sp.	1.3	—	—	—	—	1.0
Total:	38.8	20.1	17.2	24.0	18.2	17.1
<i>Agrostis canina</i>	0.6	3.3	0.9	5.0	—	0.6
<i>Oryzopsis munroi</i>	0.4	0.5	0.5	0.8	0.6	1.4
<i>Bromus japonicus</i>	0.1	0.3	0.7	0.4	0.2	0.1
<i>Eragrostis</i> sp.	0.2	0.1	0.3	0.4	—	0.1
<i>Rotobella</i> sp.	1.5	6.6	10.0	4.0	4.0	4.0
<i>Agropyron striatum</i>	0.1	0.6	1.0	—	—	0.6
<i>Carex</i> spp.	—	—	—	0.2	—	—
<i>Galium</i> sp.	1.4	1.2	0.6	—	0.5	—
Total:	4.3	12.6	14.0	10.8	5.3	6.9

—Continued

