

FURTHER NOTES ON THE CHUKAR.

By G. R. Williams, Wildlife Service, Department of Internal Affairs.

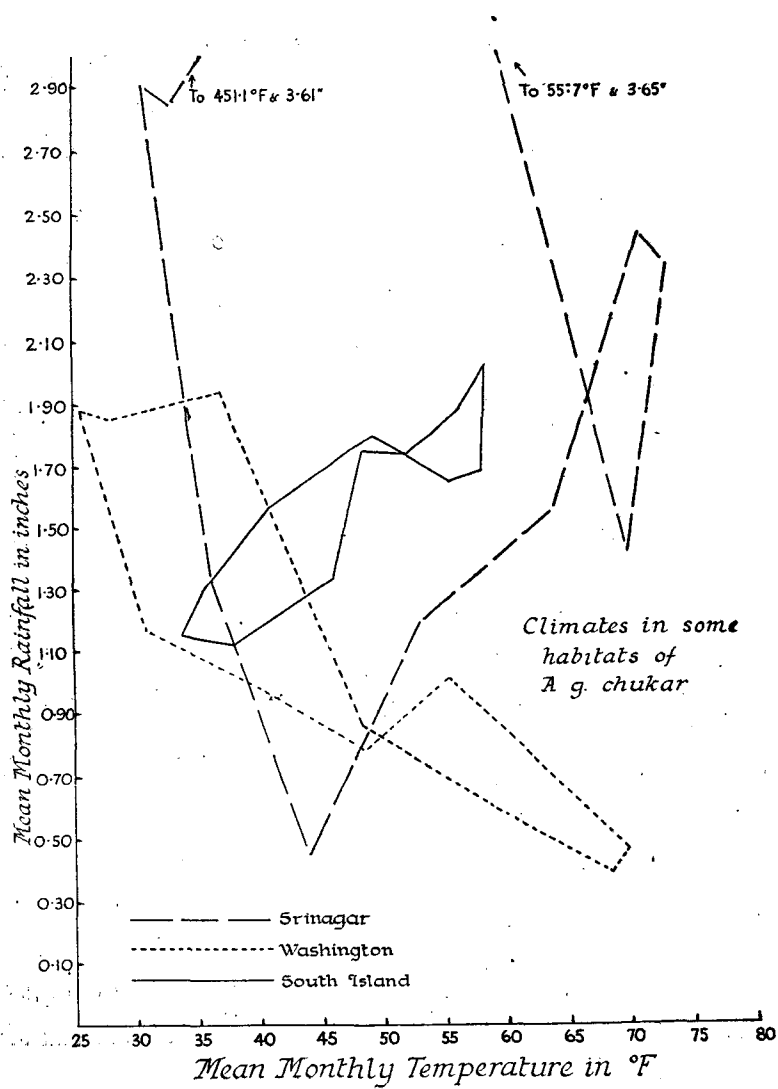
"Tradition says the apostle St. John in his old age played with a red partridge of the same species as ours, *Alectoris graeca*, which he had brought up and loved very much."—(Abbe David's Diary.)

In a previous paper (Williams 1950) an account was given of the history of the introduction and the subsequent establishment and spread of the chukar (*Alectoris graeca chukar*, and, perhaps *A. g. koroviakovi*) in New Zealand. Since then records of two more introductions have been found: In 1933, among the many liberations made by the North Canterbury Acclimatization Society in that year, was one of twenty-six birds in the Clarence River Reserve, Marlborough. This brings the total number of liberations in the South Island to eighteen. In late 1950 thirteen chukar captured in Central Otago and Marlborough were set free at Manaia, on the Coromandel Peninsula, in the North Island. This was the second liberation at Manaia and the third for the North Island.

Chukar are still extending their range in the South Island. During a recent quail survey made in Blenheim and Marlborough it was learned that the birds have been reported on a number of occasions in Nelson Province. They were first noticed there between mid-1949 and mid-1950 in the Lake Rotoiti area along the tops of the St. Arnaud Range which here stand about 5,000 feet high. One report states that a covey of about forty were seen on the summit of Mount Robert. Another account mentions that some birds were sighted on the tops of the ranges near the headwaters of the Wangapeka River—another thirty miles to the north-east. These reports are of particular interest as most of the high country in Nelson is in an area where the rainfall varies from fifty to eighty inches a year, which is higher than is usual in most of New Zealand's chukar country.

With good numbers of chukar near at hand it is to be expected that occasional flocks will be seen in Nelson. In the United States this tendency to wide dispersal has been blamed as one of the main causes of the failure to establish the species there. (Nagel 1945, Moreland 1950.)

In Marlborough chukar are now known on the Blairich Range on the southern side of the Wairau River and they apparently approach to within ten miles in a direct airline from Blenheim on this side. The range is tussock covered for the most part and bears a strong resemblance to some of the best class of hill country in Central Otago. Chukar are rare or absent on the tops of the ranges on the northern side of the Wairau—here the rainfall is generally above fifty inches a year and the lower vegetation on the mountainsides passes from either beech (*Nothofagus*) forest or second-growth to sub-alpine scrub. On the Molesworth Station block the birds are reported to be very numerous. Here, at an altitude of about 3,000 feet, is terrain that closely resembles that of some parts of Central Otago. However, the temperature is lower and the rainfall higher—being 46.1 deg. F. and 26.45 inches annually, in comparison with 50 deg. F. and about 20 inches. (Garnier 1950 and Bulletin No. 2 of the Soil Conservation and Rivers Control Council 1944.) In the State of Washington (perhaps the only large area of the U.S.A. in which chukar are satisfactorily established) the terrain seems very like that of part of Otago and Marlborough but the climate is rather more severe than any in the New Zealand habitats—in winter deep snow and temperatures as low as 30 deg. F. below zero can occur and in summer temperatures as high as 115 deg. F. are recorded; but the mean temperature is about 50 deg. F. and the rainfall is between 15 and 20 inches annually. (Moreland 1950.) Climographs have been prepared (plotting mean monthly rainfall against mean monthly temperature) which show the differences in climate between the habitats of the Himalayan subspecies (*A. g. chukar*) in part of its home range and in the new ranges of Washington State, U.S.A., and the South Island of New Zealand. Although



such graphs are always rather approximate—their accuracy increasing with the author's intimate knowledge of the areas concerned and the number of weather station records available—the general picture is probably true enough: In Washington the winters are very cold and wetter than the hot summers whereas in the South Island chukar country the winters are drier than the summers and the temperature differences throughout the year are not so extreme. When both these climates are compared with that of Srinagar in Kashmir (the only weather station within the main range of *A. g. chukar* for which full records are published; data from stations further east in northern India are complicated by the occurrence of the monsoon) it is clear that the New Zealand climate more closely than that of Washington State resembles this part of the home range of the species. A climograph prepared for the home range of *A. g. koroviakovi* but not included in the diagram for the sake of greater clarity, shows that Baluchistan more closely resembles Washington climatically than does Srinagar or the South Island. This suggests in turn that the Persian subspecies may be better suited than the Himalayan for north-west American conditions.

WEATHER RECORDS FOR BALUCHISTAN.

RAINFALL (in inches)

Jan.	Feb.	Mar.	Apl.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1.69	1.80	1.36	0.74	0.26	0.14	0.47	0.28	0.05	0.10	0.23	0.97

TEMPERATURE (in deg. F.).

Jan.	Feb.	Mar.	Apl.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
37.1	41.5	48.7	57.8	66.6	74.2	77.8	75.2	66.5	56.1	47.2	40.7

The South Island climograph has been constructed by taking the average of the records of the following six stations: Alexandra, Manorburn, Ophir, Roxburgh, Earnscliffe (all of Central Otago) and within the range of the species) and Molesworth (in Marlborough).

The Washington climograph has been constructed similarly from the records of these six stations: Moxee, Omak, Hatton, Cle Elum, Waterville and Odessa. (Marvin 1926.)

The Srinagar records were obtained from Kendrew (1942) and the Memoirs of the Indian Meteorological Department (1947) and the Baluchistan climograph was constructed from the latter and Clayton (1934 and 1951) using the records from Quetta and Kalat.

POPULATION DENSITY.—As far as is known, nowhere in New Zealand does the normal chukar density of population approach even closely to a figure of one bird per acre. In the present absence of more accurate figures an estimate of ten birds per 150 acres may be regarded as something of the right order in the best country. This estimate is based upon relative abundance of Californian quail and chukar occupying the same area. Nagel states (op. cit.) that at the end of a two-year stocking programme in Missouri the average population density of released birds on the eight active areas concerned was one per seven acres; but when liberations were discontinued this artificially-maintained density soon fell away and chukar subsequently failed in that State. Moreland (op. cit.), discussing the distribution of chukar in Washington—where the species is apparently well-established and liberations have ceased—found a population density of about one bird to twenty-three acres over a range of sixty-one square miles. Under the circumstances this is likely to be a fairly natural state of affairs.

WEIGHTS AND MEASUREMENTS.—As stated previously, there may be more than one subspecies of *Alectoris graeca* in the South Island. In order to check whether this is so it will be necessary—among other things—to obtain and compare a series of measurements taken from birds inhabiting Central Otago (where *A. g. chukar* is presumed to be the species) with a similar set obtained from Marlborough (where *A. g. koroviakovi*) is suspected to occur). Figures calculated from an at-

present small number of Marlborough birds taken in June, 1951, are quite in conformity with this supposition of two races being present in New Zealand—the means of the measurements of each of the criteria listed below are consistently smaller in both sexes than the corresponding values for the Otago specimens, and these differences are in the required direction. Confirmation must await the obtaining of a larger number of specimens from Marlborough and a careful comparison of the plumages of the two populations. In the following table figures from the Otago population are set down. In the absence of any fully reliable method for distinguishing immature from adult chukar in the field by using plumage differences alone, only sex differences have been compared. As two chukar with spurs on the tarsi have been found on dissection to be females (this possibility was suggested by the various body measurements) this method of sex determination on sight may be regarded as not being as reliable as previously thought.

	Sex	No. of Observations.	Range	Mean	Coeff. of Variation.	Standard Deviation	S.E. of Mean
WEIGHT	Male	16	0.510–0.794kg.	0.638kg.	12.03	0.073	0.017
	Female	20	0.454–0.680kg.	0.540kg.	10.44	0.056	0.013
CULMEN	Male	19	2.10–2.35cm.	2.25cm.	2.73	0.061	0.014
	Female	19	1.90–2.40cm.	2.10cm.	5.36	0.113	0.026
TARSUS	Male	19	5.00–5.80cm	5.45cm.	4.04	0.210	0.048
	Female	19	4.50–5.60cm.	5.00cm.	4.66	0.221	0.051
MID-TOE & CLAW	Male	18	4.30–5.10cm.	4.80cm.	4.46	0.205	0.048
	Female	17	4.30–4.80cm.	4.55cm.	3.94	0.186	0.043
WING	Male	19	15.6–17.6cm.	16.6cm.	3.23	5.67	1.301
	Female	19	15.3–16.6cm.	15.8cm.	2.29	2.36	0.541

Measurements were carried out as suggested in Gurr's paper (1947). The following comments are necessary: In the table "culmen" means "chord of the exposed culmen," "tarsus" means "diagonal of the tarsus," and "wing" means "chord of the closed wing."

Simple statistical analysis shows that all the differences between the sexes for each of the above characteristics are significant. In other words, male chukar are reliably and distinctly bigger than females in most external organs usually measured and, at this time of year at least, they are also heavier. (The specimens were taken in July, 1950.)

The mean weight in Central Otago for chukar in winter taking the two sexes together was 0.58 kilograms (20.6ozs.). Moreland found a mean winter weight of chukar of both sexes in the State of Washington to be 0.52 kilograms or 18.2oz. The difference between the two seems great enough to be significant. This is rather interesting because the two populations (as far as is known) belong to the same subspecies—*Alectoris g. chukar*—and occupy similar habitats so far as mean annual temperature and mean annual rainfall are concerned, so the possibility of Bergmann's Rule operating can be virtually ruled out. However, winter in 45 deg. N. on the American continent is more severe than winter in 45 deg. S. in New Zealand so that Washington birds may show the effects of a seasonal food shortage at this time of year. The very fact that chukar can become established and extend their range under these rigorous conditions suggest that neither winter food shortage nor winter climate is likely to be a limiting factor in this country.

FOOD.—The feeding behaviour of chukar is similar in its rhythm to that of the Californian quail—activity being at its minimum in the middle of the day and at its maximum near dusk. The diet throughout the year seems to be composed of almost equal amounts of seeds and shoots—a small amount of insect material is also found. Remains of the following plants have so far been identified from crop contents:—

Items present.	Systematic name.	Type of Plant.	Availability
Scarlet pimpernel—seeds	<i>Anagallis arvensis</i>	Herb	E2
Thistle—seeds	<i>Cirsium</i> sp.	Herb	A1
Common coprosma—seeds leaves	<i>Coprosma propinqua</i>	Shrub	A2
Hawkweed—flowerheads leaves	<i>Crepis capillaris</i>	Herb	A1
Matagouri—seeds leaves	<i>Discaria toumatou</i>	Shrub	A2
Milkweed—seeds	<i>Euphorbia peplus</i>	Herb	A1
Yorkshire fog—leaves	<i>Holcus lanatus</i>	Grass	A1
Hymenanthera—seeds	<i>Hymenanthera alpina</i>	Shrub	A2
Pohuehue—seeds leaves	<i>Muehlenbeckia complexa</i>	Creeper	D1
Kentucky bluegrass—leaves	<i>Poa praetensis</i>	Grass	A2
Tussock—seeds	<i>Poa caespitosa</i> (?)	Grass	A1
Sweet briar—seeds	<i>Rosa eglanteria</i>	Shrub	A1
White clover—leaves	<i>Trifolium repens</i>	Herb	A1
Nettle—leaves	<i>Urtica</i> sp.	Herb	D1
Vetch—seeds	<i>Vicia</i> sp.	Herb	E2

In addition to all these there is much grassy material and seeds still to be identified and it has been reliably reported that the birds eat chickweed (*Cerastium* sp. A1) and clover seed.

In the table above availability has been indicated according to the following scheme:—

- A—widely spread throughout the year
- B—locally throughout the year.
- E—locally six months of the year.
- 1—abundant.
- 2—not common.

Results essentially similar to these have been recorded by Nagel and Moreland but naturally the food resources are rather different in the U.S.A. The most important foods throughout the seasons studied in Washington were cheatgrass (downy chess), seeds, grass leaves and wheat; and in Missouri seeds of ragweed, Korean lespedeza, foxtail and leaves of grasses were the most common items. Downy chess (*Bromus tectorum*) is plentiful in the Mackenzie Country and Central Otago, and foxtail (*Alopecurus* sp.) is locally common in both islands (Allen 1940) but neither has been found in the crops so far examined in New Zealand.

To the question: "What damage are these birds likely to do to the plant cover?" one can say only this:—At their present population density it does not seem that chukar could noticeably modify the vegetation in those areas where they occur—the total food intake per bird each 24 hours (using Sumner's figures for quail as a basis for estimation) is probably about two ounces. Even assuming that chukar population was as high as one bird per acre (which is a very high figure indeed and perhaps at least ten times greater than that actually occurring) it is clear that each bird would be destroying a very small proportion of the total seed matter in the area it was occupying. Further, because of their characteristic scratching habits, chukar—and quail—while feeding, cover up at least as much ground as they uncover. Thus, one could say with some truth, that by removing excess seeds and covering up those that remain chukar are carrying out a useful, rather than a harmful, function. Sumner in his study of the life-history of the Californian quail (1935) found that quail confined for at least a year in an area such that the population density therein was as high as about 80 birds to the acre did not in any marked way affect the original plant association: On their removal it soon returned to its previous luxuriance.

Occasionally both quail and chukar do acquire the habit of invading newly-sown grain fields for their evening meal. This generally happens

when these fields are near to natural cover. There have been reports in the Press that chukar uproot tussock on the Otago hill country. The author has not so far seen this happen, and it would be very difficult to distinguish such damage (if, in fact, it does occur) from that caused by rabbits occupying the same area. It is hoped that as the chukar food investigation proceeds it will be possible to speak with more assurance on this controversial subject. A quantitative study of the food habits is at present in progress.

TRAPPING.—Nearly all attempts that have been made to trap chukar in New Zealand have failed conspicuously. Heretofore such lack of success has been hard to explain as the birds are apparently caught with ease in India; and Christensen (in a private communication 1950) states that “in areas of Washington where the chukar are heavily concentrated Coleman has captured as many as a thousand birds in two months, using only one man in the field. However there are occasions in less concentrated areas where the catch would not exceed 150-200 chukar partridges over the same period of time.” Even the lower figure would be considered a very satisfactory result in this country.

However, both Nagel and Moreland state clearly that chukar are intimidated by quail and Moreland remarks: “Recent trapping operations during the winter. . . were not successful until the valley quail in the trapping area had been removed. . . . The chukars appeared reluctant to approach the baited area while quail were present even though there appeared to be no conflict between the two species. In only one case were chukars enticed into the traps before all the quail were removed from that vicinity.”

As quail far outnumber chukar and are nearly always found closely associated with them in New Zealand the above statement would seem to be the explanation for the general failure to trap them here. A further difficulty in the way of trapping is that chukar—unlike quail—do not usually occupy permanent roosts in Central Otago, so the laying of bait trails in places where they are likely to be immediately perceived and followed becomes a matter of chance. From Moreland one gets the impression that in Washington chukar are more reliable in their roosting habits. This may be because the harder winter there seriously diminishes the amount of suitable roosting cover available at that time.

SEX RATIO.—Of 302 birds shot throughout Central Otago during the winter of 1950 it was found that 164 were cocks and 138 were hens. Thus for every 100 females there were 119 males (or 46:54). Although this sample is a small one it is probably fairly representative and is worth recording here as no other figures for the sex ratio in this species have yet appeared in the literature.

PREDATION.—Only feral cats, hedgehogs and mustelids (stoats and ferrets, etc.) can now be regarded as predators of this species under all normal circumstances. (See also, Wodzicki 1950.) Gurr, in a private communication, states that his study of the harrier (*Circus approximans*) has so far shown that the feeding habits of this hawk may be disregarded as having a modifying influence on game-bird populations. Other possible predators—such as rats and falcons (*Falco novaeseelandiae*)—are rare in most, if not all, chukar habitats.

In Central Otago large numbers of chukar are reported to be killed each year in places where strychnined carrots or swedes are used for rabbit poisoning. Strychnine incorporated in other baits (such as pollard) does not cause great mortality.

Although chukar kept in captivity in this country are recorded as having died of black-head disease, parasites are not very numerous in New Zealand wild-bred birds. The following have recently been described from some Marlborough specimens: *Goniocotes alatus* and *Lipeuris* sp. (lice)—another species, *Lagopoecus* sp. may have come from Californian quail shipped in the same container); *Rallietina graeca* (a tape worm), *Capillaria* sp. (a nematode) and *Eimeria kovoidi* (a coccidium).

In conclusion, it is worth noting that an attempt was made during last century to introduce chukar into Australia. In 1864 twenty-three were liberated in Victoria, followed by thirteen more in 1865 and eight in 1872. The birds soon disappeared (Ryan 1906) and no attempts have been made since.

ACKNOWLEDGMENTS.—I am indebted to Miss Ruth Mason, of the Botany Division D.S.I.R. for identifications made of crop contents; to Mr. Lloyd Whitten of the Wallaceville Animal Research Station for the information on parasites; and to Mr. Richard O'Kane and various officers of the Wildlife Service for the supply of bird specimens.

BIBLIOGRAPHY.

- Allan, H. H. (1940)—Handbook of the Naturalized Flora of New Zealand. D.S.I.R. Bulletin No. 83, Wellington, N.Z.
- Anonymous (1944)—Tackling High Country "Problem Land" at Molesworth. Bulletin No. 2, Soil Conservation and Rivers Control Council.
- Anonymous (1947).—Memoirs of the Indian Meteorological Department. 27 (v.) pp. 101-298.
- Clayton, H. H. (1934)—World Weather Records. (1947) Smithsonian Miscellaneous Collections, 90 and 105.
- Garnier, B. J. (1950)—New Zealand Weather and Climate. Wellington, N.Z.
- Gurr, L. (1947)—Measurements of Birds. N.Z. Bird Notes, 2, pp. 57-61.
- Kendrew, W. G. (1942) —The Climates of the Continents. New York.
- Moreland, R. (1950)—Success of the Chukar Partridge in the State of Washington. 15th North American Wildlife Conference, pp. 399-409.
- Nagel, W. O. (1945)—Adaptability of the Chukar to Missouri Conditions. Journal of Wildlife Management, 9, pp. 207-216.
- Ryan, C. S. (1906)—On European and Other Birds Liberated in Victoria. Emu, 5, pp. 110-119.
- Sumner, E. L. (1935)—Life History and Management of the Californian Quail. California Fish & Game, 21, pp. 167-256 and 277-342.
- Williams, G. R. (1950)—Chukar in New Zealand. N.Z. Science Review, 18, pp. 2-6.
- Wodzicki, K. A. (1950)—The Introduced Mammals of New Zealand. Bulletin No. 98, D.S.I.R., Wellington, N.Z.

GLOSSY IBIS IN NEW ZEALAND.—A glossy ibis (*Plegadis falcinellus*) was seen near Woodville from April 26 to April 30, 1951. Mr. A. Beatty, who described the bird to me, states that it was quietly feeding in his pig paddock. His description was that the head and neck were black, the body brownish, and the wings blackish with a green gloss. With long legs (c. 14in.) of a green-black colour, the bill was long (c. 5in.), heavily down-curved and of a horn colour. This description agrees closely with that given by Serventy and Whittell in "A Handbook of the Birds of Western Australia," 1948. It is the seventh recorded occurrence of the species in New Zealand.—J. F. Robinson, Woodville.

NEST RECORDS SCHEME.—The number of cards issued in the 1950-51 season was 163, and those returned totalled 67, representing twenty species, as follows:—Blackbird 6, chaffinch 2, banded dotterel 7, grey duck 1, mallard 1, fantail 2, harrier 3, pipit 1, pukeko 1, redpoll 1, robin 4, silver-eye 3, sparrow 1, pied stilt 4, grey teal 5, song thrush 15, pied tit 3, grey warbler 3, whitehead 4. The following observers have returned cards: J. C. Davenport, D. E. Crockett, E. W. Hursthouse, Miss E. C. MacDonald, H. R. McKenzie, C. H. Parkin, R. H. D. Stidolph, L. H. Munro, J. M. Cunningham, G. F. Dobbs, W. H. Davidson, H. Taylor, Mrs. I. Tily, D. E. Prickett.—J. King, Masterton.