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ECOLOGICAL STUDIES OF THE
PERSIAN-IBEX (*Capra hircus aegagrus*)
IN MOHAMMAD REZA SHAH
NATIONAL PARK, IRAN

Thesis for the Degree of M. S.
MICHIGAN STATE UNIVERSITY
BAHRAM HASANZADEH-KIABI
1975

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ABSTRACT

ECOLOGICAL STUDIES OF THE PERSIAN-IBEX

(Capra hircus aegagrus) IN MOHAMMAD

REZA SHAH NATIONAL PARK, IRAN

By

Bahram Hasanzadeh-Kiabi

A study to determine the summer food preference and population status of the Persian-ibex (Capra hircus aegagrus) was conducted in Mohammad Reza Shah National Park, Iran, during July and August, 1974. The steep rocky area of Chund-e-Abbas, where there was no overlapping of the habitat of the urial or wild sheep (ovis ammon), was selected for the research. The Soulegerd area was also surveyed from the standpoint of population composition. The highest number of animals seen was 292, comprising 53 per cent adults, 24 per cent yearlings, and 23 per cent kids. Adults, and presumably also the younger categories, were nearly equally divided by sex.

Grasses made up 61.2 per cent, shrubs 30.1 per cent, and forbs 8.7 per cent of the Persian-ibex diet in summer. The percentages of availability for these forage classes were: grasses 56.4, shrubs 33.2, and forbs 10.4.

Highly-preferred summer food species were: Acer monspessulanum, Festuca ovina, Galium tricornis, Prunus divaricata, Haplophyllum perforatum, and Astragalus sp. These six preferred species were 55 to 94 per cent utilized. In contrast, Cousinia sp., Berberis vulgaris, Cressa cretica and Centaurea bahen were widely distributed over the range but were totally avoided. Some other species were eaten occasionally, but with less frequency than their availability might indicate. Overall, the vegetation consisted of 28 per cent preferred species, 42 per cent somewhat-neglected, and 30 per cent totally-avoided food plants.

Unless the high rate at which the preferred species were being cropped is only temporary, which seems most unlikely, it may be concluded that the avoided plant species are replacing the preferred forages. At the site studied, it is concluded that the range is deteriorating from the related standpoints of ibex-habitat maintenance and plant community preservation. National park values will tend to be diminished if present trends continue.

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A THESIS

Submitted to
Michigan State University
in partial fulfillment of the requirements
for the degree of

MASTER OF SCIENCE

Department of Fisheries and Wildlife

1975

ACKNOWLEDGMENTS

The author wishes to express his sincere appreciation to Ing. Eskander Firouz, Director of the Department of Environmental Conservation of Iran, for his generous logistics and financial assistance. Among helpful members of the Department of Environmental Conservation staff, Mr. J. Fazel was a constant source of encouragement. Dr. Mohammadi, Mr. Ali Sassani, Miss Ghanbarzadeh, and Mr. Naseer Sadeghi aided in the field work. I am especially grateful for the kind help of Ing. Termeh in Evin Institute of Iran. To all these people, I wish to express my sincere appreciation and thanks.

At Michigan State University special appreciation is extended to Dr. George A. Petrides, my advisor, who offered many helpful suggestions and carefully edited the manuscript. I would also like to thank my other committee members, Dr. Leslie W. Gysel, and Dr. Rollin H. Baker for their enthusiasm and advice.

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CHAPTER I

A. INTRODUCTION

1. Objectives of Study

Although not a true ibex (see beyond), the wild goat of Iran (Capra hircus aegagrus) is a spectacular animal. Though the most widely used common name is wild goat, this is not the case in Iran (formerly Persia) where the species is normally referred to as the Persian-ibex. Because the name ibex is properly applied to another species of the genus, however, the hyphenated term of the common name has been adopted here.

Excepting only the urial sheep, the Persian-ibex is the most important game animal in Iran. As a contribution toward a sound management program and a more complete knowledge of the animal's ecology and behavior, this study was undertaken to study Persian-ibex summer food preferences in northeastern Iran. It was conducted during July and August, 1974.

2. The Study Areas

The Mohammad Reza Shah National Park was the first area in Iran to be designated as a national park, located

in the province of Khorasan from 37° 36' to 37° 16' north latitude and 56° 17' to 55° 44' east longitude (Figures 1 and 2). The terrain is mountainous with the altitude varying between 380 and 2,410 meters. The entire park is about 91,890 hectares (Firouz, 1974).

This study of the Persian-ibex was carried on at Chund-e-Abbas, a steep rocky peak. This site is the only goat range in the park which the urial has not yet occupied. Soulegerd area was also used for population observations.

Chund-e-Abbas supports basically a Festuca-Artemisia plant community, with other vegetation present in degraded form. 18 shrub, 11 forb, and 5 grass species were identified.

The area tends to have a Mediterranean climate except that winters are colder and there is much snowfall (Pabot, 1967). Snow depth often exceeds one meter at higher elevations.

Soils in the area are shallow and stony. They are sandy with minor components of silt and clay, and calcareous with about 24 per cent limestone. They have a poor moisture-holding capacity. They have a basic chemical reaction with Ph ranging between 9.65 and 8.26.

In addition to the Persian-ibex and urial, other large mammals also present in the park (Figure 2) are the

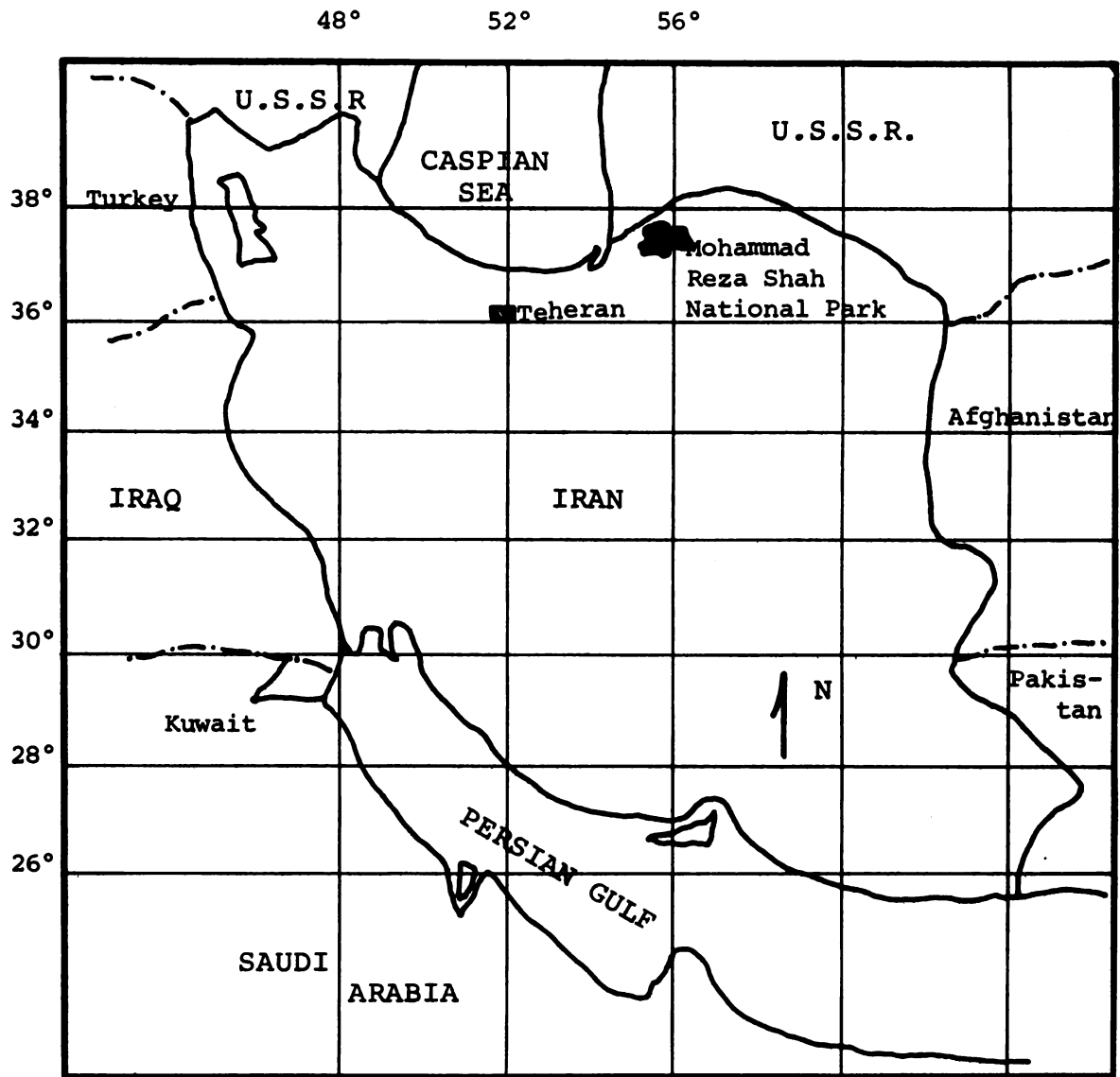


Figure 1. Map of Iran showing the relative location of the Mohammad Reza Shah National Park.

Source: From diverse sources.

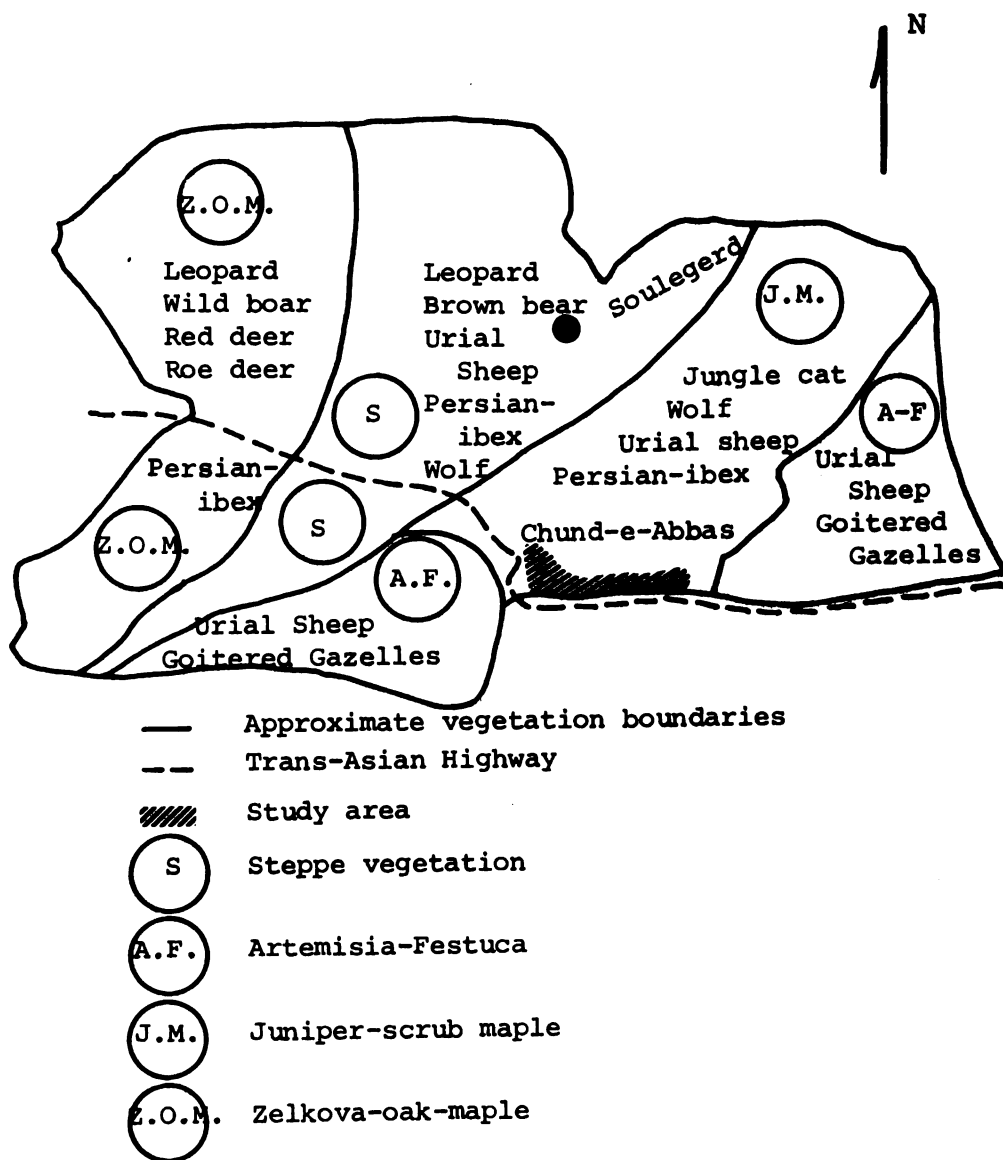


Figure 2. Distribution of vegetation types and large mammals in the Mohammad Reza Shah National Park, Iran.

hare (Lepus capensis), wild pig (Sus scrofa), goitered gazelle (Gazella subgutturosa), red deer (Cervus elaphus), brown bear (Ursus arctos), red fox (Vulpes vulpes), jackal (Canis aureus), wolf (Canis lupus), African wild-cat (Felis lybica) and leopard (Felis pardus).

3. History of Study Area

A complete history of the park seems to be lacking. It is known, however, that the park has maintained relatively undisturbed conditions for several decades. There has been no grazing or woodcutting as a result of careful government control over the area. In 1962, H.I.H. the Shah assigned park control to the Game Council of Iran, a government body. In 1964, the park gained its present boundaries.

4. Taxonomy of the Genus Capra

Ellerman and Morrison-Scott (1966) have divided the genus Capra into five species as follows:

<u>Species</u>	<u>Sub-generic Name</u>	<u>Common Name</u>
<u>Capra caucasica</u>	Turus	Caucasian tur
<u>Capra falconeri</u>	Orthaegoceros	Markhor
<u>Capra hircus</u>	Capra	Wild goat
<u>Capra ibex</u>	Ibex	Ibex
<u>Capra pyrenaica</u>	Turocapra	Spanish-ibex

Within the species C . hircus, Lydekker (1913) recognized the four subspecies: aegagrus, blythi, picta, and cretensis. The Persian-ibex, he referred to the scientific name of Capra hircus aegagrus and termed it a true wild goat, or pasang.

The distribution of C . hircus extends from the Caucasus through the mountains of Asia Minor and Iran to Pakistan (Lydekker, 1913). The male has huge scimitar-shaped horns with the anterior surface laterally compressed so as to form a rather sharp anterior keel. Though the horns of the male Capra ibex are similar in length and curvature, the forward edge of the horns in the true ibex is quite broad with many prominent transverse knobs. The two horn types, thus, are quite distinctive (Lydekker, 1913).

In both species, the horns of the females are much smaller. The largest male horns are considerably longer than the height of the animal that carries them (Osmond, 1967) and large males stand about 90 cm at the shoulder.

The Persian-ibex is somewhat smaller than the true ibex, ranging in height from 60 to 85 cm at the shoulder. Male Persian-ibexes weigh from 60 to 100 kg. Females are considerably smaller, ranging in weight between 40 and 50 kg (Firouz et al., 1971). The reddish-brown summer coat turns grayish-brown in winter.

CHAPTER II

B. METHODS

1. Population Composition

Capra species are convenient ungulates to study since growth rings on the horns are laid down every winter after the first. In the Persian-ibex, at least, the ages of adult males thus can be easily ascertained in the field using a 20-power spotting scope and 8X binoculars.

Sightings were made in the Chund-e-Abbas area every day. The lowest number of animals seen was 80 and the highest 292 specimens. Another series of 112 sightings was made in the Soulegerd area during September. The extent to which repeat observations were made is unknown.

Though they would have been the preferred sex for life table analysis, age data could not be determined for females because their much-smaller horn size and less-distinct growth rings made study at field distances infeasible. Neither could kids be sexed with certainty.

2. Vegetation Surveys

A wooden frame, 1 meter square, was used to sample systematically the vegetative community over an area of 120 hectares.

Both Cain (1938) and Braun-Blanquet (1932) have stated that the number of plots needed to sample vegetative composition is adequate when, after increasing the numbers of plots, the slope of the species-area curve becomes approximately horizontal. By this criterion, it was determined (Figure 3) that in Chund-e-Abbas, only 42 plots were necessary. To be certain of adequacy, it was decided to employ 50 plots spaced at 250-meter intervals along north-south lines which were 100 meters apart. Distances between plots were measured by tape. Lines were kept parallel using a hand-held prismatic compass.

To determine density and composition, the numbers of forbs and grasses rooted within the plot, and the number of annual twigs per rooted shrub were tallied by species. Along lines determined by the western borders of each plot, all overhanging vegetation also was measured by species to determine the percentage of protective cover on the area (Canfield, 1941).

Shafer's (1963) twig count method and a modified procedure of Beruldsen and Morgan (1934) were employed to determine the availability and ungulate use of woody browse and of grasses and forbs, respectively. The latter practice is based on the dry weight differences of herbaceous forages before and after the grazing period.

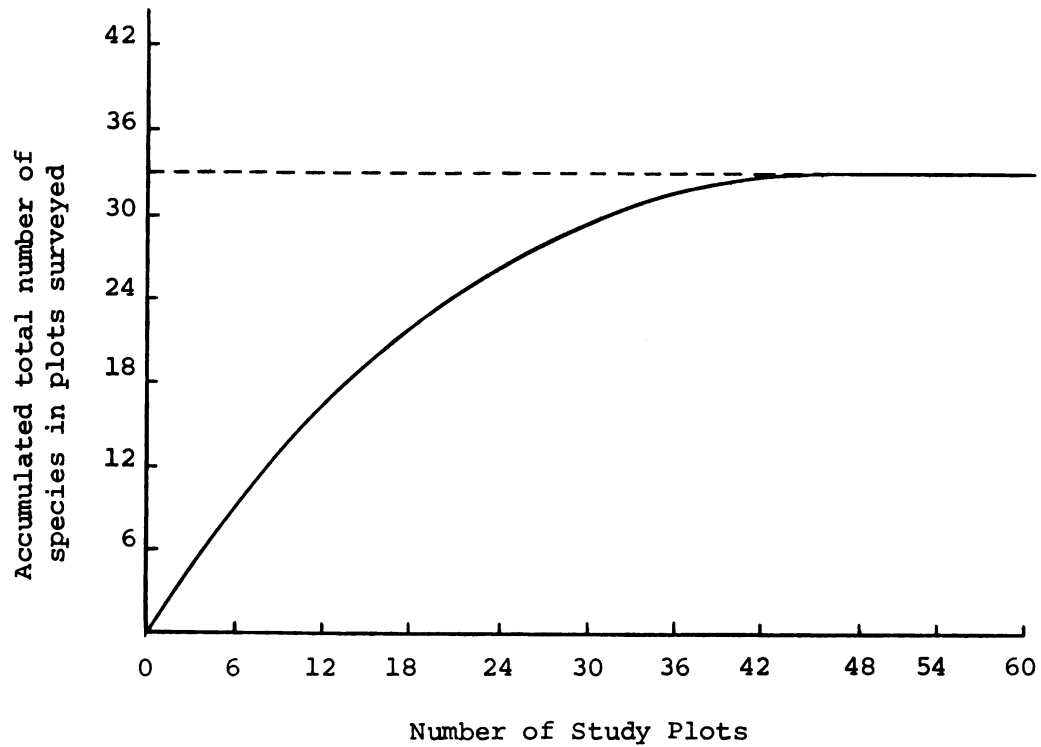


Figure 3. Species-area curve for the vegetation in Chund-e-Abbas, Mohammad Reza Shah National Park, Iran. July, 1974.

After collecting inventory data on the 50 one-square-meter plots, uneaten herbs were clipped at the mean grazing height and twigs at the usual diameters of browsing. Specimens of unbrowsed twigs were randomly selected from different plants to determine mean dry weights for twigs of each species. All plants were dried in a standard laboratory oven at 105° C for 24 hours before weighing. The missing weights of consumed plant parts were estimated by comparing the weights of uneaten plants with those of grazed plant stubble and browsed twigs found on nearby areas.

3. Food Preference Calculations

There are several ways to express food preference values but it seemed suitable to use the equation which divides the percentages of forage eaten by its percentage availability (Petrides, 1975). Though the percentage of the plant utilized (See results) also indicates comparative forage preferences, the ratio $\frac{\text{percentage in diet}}{\text{percentage available}}$ yields a figure (Table 4, Column G) which, if over 1.00, indicates relative degrees of preference and if under 1.00, reveals degrees of unattractiveness.

Since moisture conditions, chemical composition of the soil, and other factors could result in seasonal preference ratings, it is recommended that food preference

ratings be determined seasonally. In this study, however, only summer preference ratings were obtained. Field data were obtained after the vegetative growing season had ended.

The tally of foods eaten by the Persian-ibex (Table 4, Column C) could have been distorted if the low hare and possibly also rat (Rattus sp.) population present left browse or graze marks which were similar to those of the Persian-ibex. Since hares and rats cut twigs and herbs sharply while ungulates, lacking upper front teeth, break them, it is not thought that this was a confusing factor.

4. Range Condition

The current status and apparent trend in range condition were determined through analysis of the degree to which the various forage species in the plant community were utilized by Persian-ibex. Such use was compared with the generally-accepted standard (Stoddart and Smith, 1943) of 50 per cent annual non-damaging cropping of vigorous forage.

CHAPTER III

C. RESULTS

1. Population Densities and Life Table

The counts at Chund-e-Abbas showed 26.7 per cent adult males, 25.7 per cent adult females, 24.3 per cent yearlings, and 23.3 per cent kids (Table 1). The counts at Soulegerd (Table 1) were not significantly different. The sex ratio among the 214 identified adults was nearly even. The yearlings and kids, because they did not exhibit clear sexual dimorphism, were not sexed. As Papageorgiou (1974) found true for Capra hircus aegagrus on Crete, it seems almost certain that Persian-ibex are likely at all ages to have essentially-even sex ratios.

Maximum longevity was 9 years based on field observation. The average life expectancy beyond age 1.5 was calculated to be $ex = 2.7$ years (Table 2).

Logarithms of the numbers of Persian-ibex alive at each age (lx), when plotted against the associated time intervals, yield a survivorship curve (Figure 4) which implies a rather regular percentage mortality up to 4 (4.5) years old when animals mature. From 4 to 7 (7.5) years

Table 1. Sex and Age Composition of Persian-ibex Sightings, Summer, 1974, Mohammad Reza Shah National Park, Iran.

Month	Place	Totals	Adults		Yearlings	Kids	Kids per 100	
			Males	Females			Adults	Adult Females
July	Chund-e-Abbas*	292	78	75	71	68	44.4	90.7
September	Soulegerd**	112	32	29	26	25	41.0	86.2

* - the highest number recorded.

** - from one day's observation.

Table 2. Life Table for the Persian-ibex (Capra hircus aegagrus), Chund-e-Abbas, Mohammad Reza Shah National Park, Iran, 1974. Based on Males Only. July and August, 1974.

X	Number of Observed Animals	(1) lx	(2) dx	(3) qx	(4) Lx	(5) Tx	(6) ex
1*	35.5	1,000	380	.380	810	2,697.0	2.70
2	22	620	198	.319	521	1,887.0	3.04
3	15	422	84	.199	380	1,366.0	3.24
4	12	338	56	.166	310	986.0	2.92
5	10	282	57	.202	253.5	676.0	2.40
6	8	225	28	.124	211	422.5	1.88
7	7	197	84	.426	155	211.5	1.07
8	4	113	113	1.000	56.5	56.5	0.50
TOTALS		2,297	1,000		2,697.0		

* - The youngest individuals tabulated were yearlings at about 1.5 years of age. The kids seen (Table 1) were not included because they were fewer than the number of yearlings counted (see text).

another regular mortality pattern seems to be prevailing. This may as well implies for a regular reproductive rate for these years. After 7 years old, mortality increases sharply.

Although the procedures used to estimate population composition could be refined, one can still gain some insights into the population characteristics of the Persian-ibex from this study. Kids were very few and life expectancy was 2.7 years. The term "turnover" is used to indicate the period of time required for a given year class to shrink to a specified level approaching zero. In a stable population, turnover rate would be equivalent to mean annual replacement rate as well as mean annual adult mortality rate (Buechner, 1960). This will lead us to conclude that the shorter life expectancy would be accompanied by a higher turnover rate.

The low number of kids can be affected by different factors. Nievergelt (1966) found an inverse relationship between the amount of rainfall during the gestation period and the numbers of kids born for his Capra ibex in Switzerland.

2. Vegetative Composition and Food Preferences

Thirty-four plant species were found to occur on the Chund-e-Abbas area. Only 16, however, were eaten by Persian-ibex. The 9 shrub, 4 grass and 3 forb species comprised 30.1 per cent shrubs, 61.2 per cent grasses and

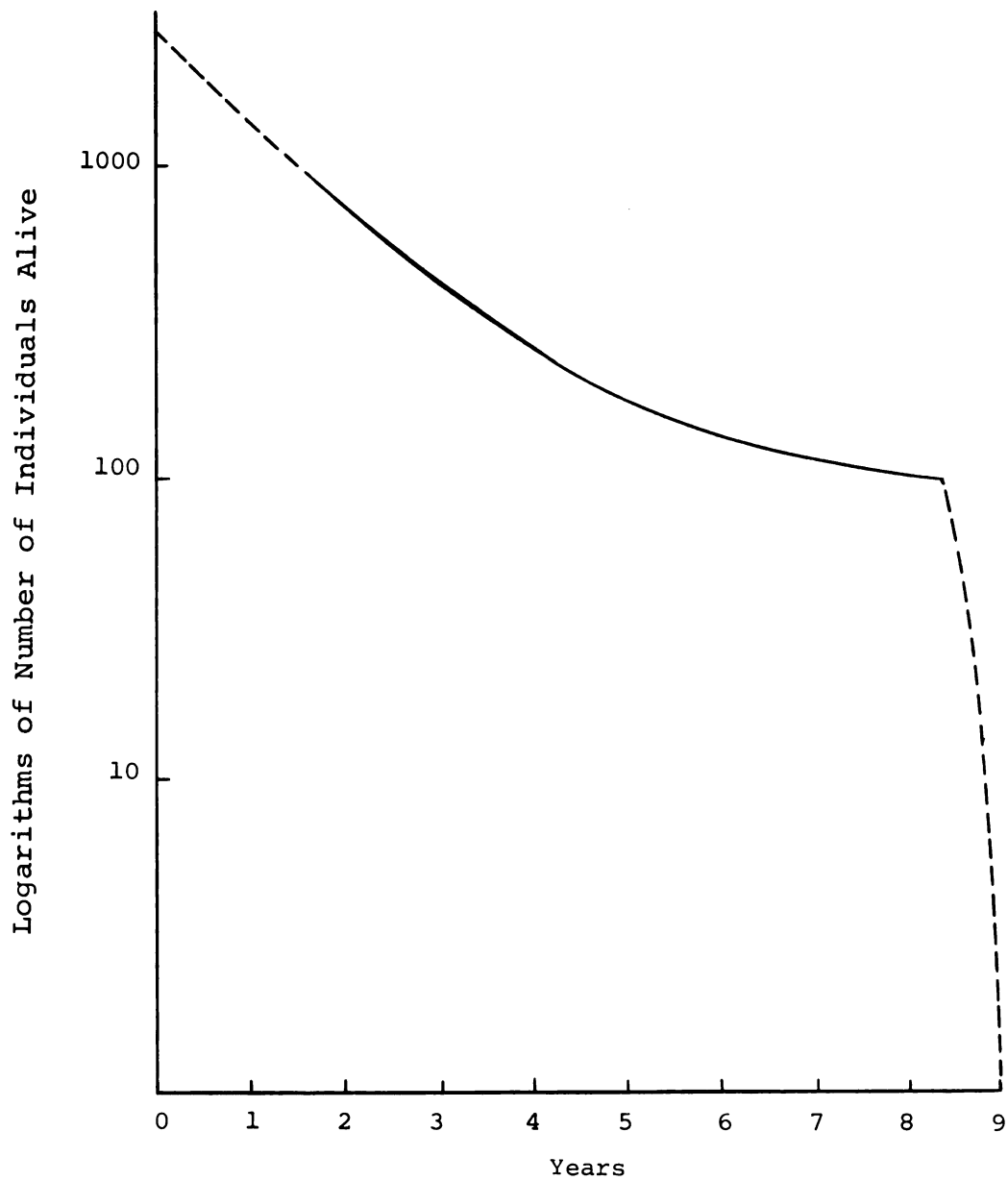


Figure 4. Survivorship curve for the male Persian-ibex population in Chund-e-Abbas, Mohammad Reza Shah National Park, Iran.

8.7 per cent forbs. These categories were available as foods in the proportions 33.2, 56.4, and 10.4 per cent, respectively (Table 3).

During the summer, the Persian-ibex is mainly a grazer, preferring grasses over woody forages (Table 3). Of the 16 plants eaten by Persian-ibex (Table 4, Column G), six species were preferred: Acer monspessulanum, Festuca ovina, Galium tricornis, Prunus divaricata, Haplophyllum perforatum, and Astragalus sp. Eleven other plant species were eaten, but only to a degree that was less than would be expected by random choice (Table 4). These were: Achillea micrantha, Teucrium polium, Ephedra sp., Artemisia absinthium, Dactylis glomerata, Poa bulbosa, Dianthus orientalis, Polygonum lapatifolium, Agropyron cristatum, and Acantholimon sp. Though abundant (Table 4) the following species were avoided entirely: Cousinia sp., Berberis vulgaris, Centaurea bahen, Salvia sp., Cressa cretica, and Colutea arborescens.

In terms of bulk contribution to the Persian-ibex's diet (Table 4, Column E), the most important forage species were Festuca ovina, Prunus divaricata, Galium tricornis, Dactylis glomerata, and Ephedra sp. These comprised 84.12 per cent of the total diet and 69.66 per cent of the available forage. The first three of these were preferred species, comprising 72.97 per cent of the total food eaten. On the range, however, they totalled only 48.91 per cent of the available forage.

Table 3. Percentages of Vegetation Available and Eaten by the Persian-ibex Population by Forage Classes. Chund-e-Abbas, Mohammad Reza Shah National Park, Iran, 1974.

Plant Type	Forage Available (Per Cent)	Forage Eaten (Per cent)	Preference Rating
Grasses	56.4	61.2	1.08
Shrubs	33.2	30.1	0.91
Forbs	10.4	8.7	0.84

Table 4. Summer Food Preference Ratings for Forage Plants Eaten by the Persian-ibex, Chund-e-Abbas, Mohammad Reza Shah National Park, Iran, July, 1974.

Forage Species	Average Dry Weights		
	A	B	C
	Per Twig or Plant (gr)	Originally Available/ hectare (kg)	Consumed Per hectare (kg)
<i>Acer monspessulanum</i>	0.230	6.12	5.75
<i>Festuca ovina</i>	0.600	174.00	159.60
<i>Galium tricornis</i>	0.152	29.01	20.56
<i>Prunus divaricata</i>	0.620	85.81	51.46
<i>Haplophyllum perforatum</i>	0.333	1.20	0.67
<i>Astragalus</i> sp.	0.650	1.83	1.01
<i>Achillea micrantha</i>	0.400	12.01	6.39
<i>Teucrium polium</i>	0.137	7.02	2.89
<i>Ephedra</i> sp.	0.132	43.82	16.16
<i>Artemisia absinthium</i>	0.272	43.03	14.91
<i>Dactylis glomerata</i>	1.325	78.70	19.23
<i>Poa bulbosa</i>	0.525	47.22	10.33
<i>Dianthus orientalis</i>	0.466	12.77	2.70
<i>Polygonum lapatifolium</i>	0.113	1.54	0.29
<i>Agropyron cristatum</i>	0.825	31.49	4.89
<i>Acantholimon</i> sp.	0.575	4.09	0.58
Total Avoided Forage Species	--	<u>10.79</u>	<u>0.0</u>
SUMS		590.45	317.42

Percentages			Preferences
$D = \frac{B}{\sum B} \times 100$	$E = \frac{C}{\sum C} \times 100$	$F = \frac{C}{B} \times 100$	$G = \frac{E}{D}$
Available Forage	Dietary Consumption	Plant Removal	Forage Ratings
1.04	1.81	93.95	1.74
29.47	50.28	91.72	1.71
4.91	6.48	70.87	1.32
14.53	16.21	59.97	1.11
0.20	0.21	55.83	1.05
0.31	0.32	55.19	1.03
2.03	2.01	53.20	0.99
1.19	0.91	41.17	0.76
7.42	5.09	36.88	0.68
7.29	4.70	34.65	0.64
13.33	6.06	24.43	0.45
8.00	3.25	21.88	0.41
2.16	0.85	21.14	0.39
0.26	0.09	18.83	0.35
5.33	1.54	15.53	0.29
0.69	0.18	14.18	0.26
<u>1.84</u>	<u>0.0</u>	<u>0.0</u>	0.0
100.00	100.00	53.76	

Festuca ovina comprised 29.47 per cent of the available forage and was the most abundant forage plant on the range. Since at the same time it made up 50.28 per cent of the animals' diet in the summer, it appears to be the most important summer food species for the Persian-ibex on this range.

The animals' preference for Acer monspessulanum was slightly higher than for Festuca but the shrub was so uncommon, comprising only 1.04 per cent of the available forage, that it had little dietary significance. It seems probable, however, that the status of these species and of several other preferred forages can serve to indicate habitat condition on Persian-ibex ranges with a similar vegetation type.

3. Range Status and Trend

As has been determined for other ungulate species on other ranges (Stoddart and Smith, 1955), it can be expected that the preferred forage species of Persian-ibex also will tend to decrease under heavy feeding pressure while forage species of low preference and those avoided as foods are likely to increase. The six highly preferred species on the study area were 55 to 94 per cent utilized during summer (Table 4, Column F). Thus, at Chund-e-Abbas, the degree of utilization for preferred species was far in excess of the general 50 per cent (Stoddart and Smith, 1943) rule for proper use of grazing lands.

The heavy utilization of preferred forage species on the study area indicated that they were in serious danger of depletion, possibly even eventual extermination. Furthermore, these species tend to be replaced by less palatable plants. In consequence, changes in plant composition can be foreseen on the study areas.

4. Park Status

National parks are planned to preserve natural environments on a permanent basis. Both the park's own wildlife and its tourist visitors may have impacts upon the natural conditions.

The park areas visited appear to be free from encroachment except, possibly, along the Trans-Asian highway which passes through the park. There are several recreation sites there built by the Department of Conservation of Iran for automobile passengers. As yet, there is only limited evidence of wood-cutting and campfire burning. Since game and park guards patrol the entire park thoroughly and faithfully, it is hoped that the natural conditions which the park is dedicated to preserve will be protected from tourist impact.

CHAPTER IV

D. CONCLUSIONS

As compared with Dall mountain sheep (Murie, 1944), Himalayan thar (Caughley, 1966), and the agrimi (Papageorgion, 1974), this population of the Persian-ibex lived shorter lives. They also had an even sex ratio, and mortality was more spread out among old and young.

Range species with preferred food ratings Acer monspessulanum, Festuca ovina, Galium tricornis, Prunus divaricata, Haplophyllum perforatum, and Astragalus sp. tend to be replaced by Centaurea bahen, Berberis vulgaris, Salvia sp., Cousinia sp., Colutea arborescens, Rosa canina, Hordeum bulbosa, Cressa cretica, Hultemia persica, and Alhaji camelorum.

Park habitats must be watched to insure that their natural composition is not disrupted.

CHAPTER V

E. RECOMMENDATIONS FOR MANAGEMENT

In considering a program to insure maintenance of the park ecosystems, it is suggested that:

1. Assessments of animal populations, range interactions and dynamics should be conducted annually in all important areas of the park and for all major animal species. Basic information is essential for the maintenance of both the park's animal inhabitants and its habitats.

2. Particular efforts should be made to identify areas where range use conflicts may occur between the urial and/or the Persian-ibex. Any ungulate range interactions which seem likely to endanger the quality or quantity of habitat conditions should be managed in favor of the restoration of natural conditions.

3. Study of the effects on the range of rats and hares and perhaps other small mammals is desirable in order to determine their importance as influents of environmental conditions. Regular surveys to appraise the

occurrence of erosion, depletion and pollution should be made with respect to park preservation.

4. In any case, where management is undertaken in order to preserve wilderness values, periodic assessments should be made of the effects of that management in order to modify procedures as required.

CHAPTER VI

F. SUMMARY

In July and August, 1974, a study was conducted on Chund-e-Abbas peak in Mohammad Reza Shah National Park, Iran, to determine the population characteristics and summer food preferences of the Persian-ibex (Capra hircus aegagrus) population there. The highest number of Persian-ibex seen on one day was 292 individuals and consisted of 53 per cent adults, 24 per cent yearlings and 23 per cent kids. The adults were equally divided by sex. Based on the age distribution of males, the further average life expectancy from 1.5 years of age was 2.70 years. Life table and survivorship curve data indicated a gradual increase in mortality up to 4.5 years of age and a higher rate thereafter.

Summer preferred food species were found to be Acer monspessulanum, Festuca ovina, Galium tricornis, Prunus divaricata, Haplophyllum perforatum, and Astragalus sp., Berberis vulgaris, Cressa cretica and Centaurea bahen were widely distributed over the range but totally avoided as foods. In terms of bulk intake, Festuca ovina was the most

important forage plant. Based on field signs, it comprised 50.28 per cent of the Persian-ibex's summer diet. Only 28 per cent of the vegetation consisted of preferred food species and the six highly preferred species were 55 to 94 per cent utilized during the summer. In view of the high rate at which preferred species were being cropped, it seems likely that avoided species are replacing the preferred forages and that the range is deteriorating in quality. In order to have a functioning management program, it is recommended that more detailed studies be undertaken. Close study of population densities and trends; range condition and trend; and of erosion, pollution, and depletion must be conducted and related to park preservation.

LITERATURE CITED

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