The Japanese Sika Deer *(Cervus nippon nippon)* of Lundy with notes on the now extinct red and fallow populations

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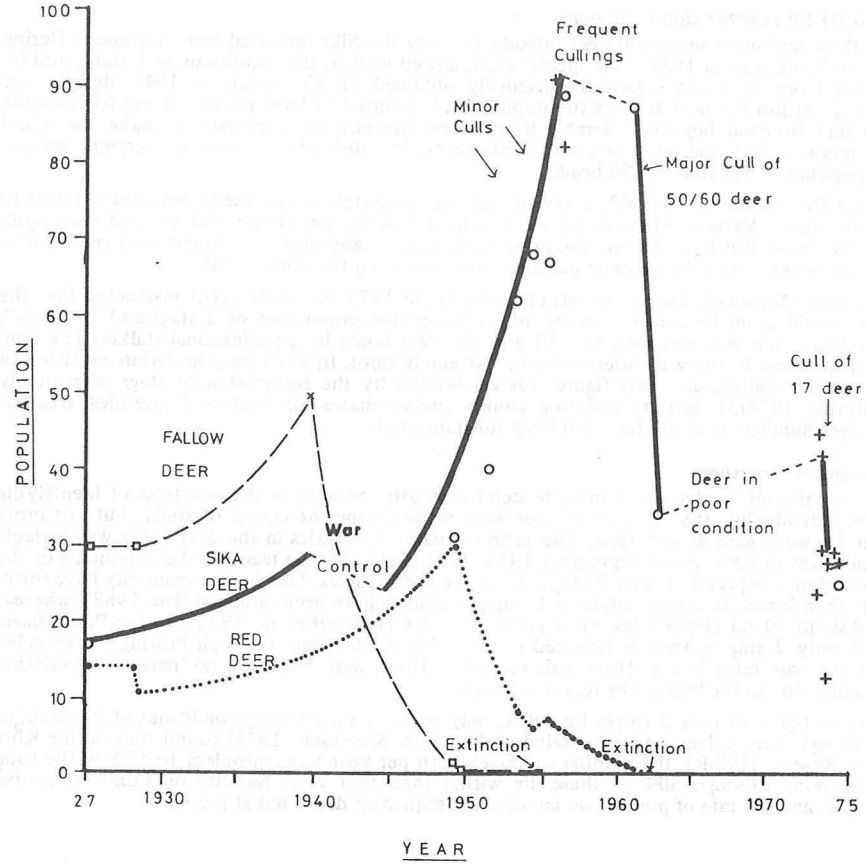
INTRODUCTION

The Sika Deer, *Cervus nippon,* is a native of the broad-leaved woodlands of East Asia, occuring in an area from Vladivostock to South China, and also on Japan and Taiwan. Sika were first introduced into Britain in 1860, when the Zoological Society released a small collection in Regent's Park. The deer, which fared well in the British climate, were subsequently sent to further parks, from which small groups escaped and established local feral herds. The Lundy Sika, which are of the Japanese race, *Cervus nippon* nippon, were introduced on the instructions of Martin Coles Harman in 1927, to enhance the fauna of the island.

A HISTORY OF THE LUNDY DEER



FALLOW DEER *(Cervus dama)*

The first record of Fallow Deer on Lundy comes from a manuscript dated 1752, which states that 16 deer were present on the island. It is believed that these had been introduced during Benson's tenancy, perhaps from Earl Fortescue's Estate at South Molton. They were last mentioned in 1882, when there were 12 present, one of which proved ". . .very thin meat". Fallow were re-introduced in 1927, when 30 animals were released. They did not compete well with the Red Deer and Sika brought over at the same time, but had increased to approximately 50 individuals by 1939. During the war, the lessee of the island was granted permission to take island animals for food. Fallow were the most approachable species and were shot frequently. Once the population had been reduced to a low level, even with removal of hunting pressure, the herd was unable to make a successful recovery, pehaps due to inbreeding. The last individual was seen in 1954.

RED DEER *(Cervus elaphus)*

Introduced also in 1927. The imported animals (15 in all), included three hand-reared deer from a Red X Wapiti cross. These were very aggressive beasts with no fear of man, and after several attacks on visitors, Mr. Harman ordered the disposal of the two most dangerous stags. By 1949, the population had reached 33 animals, all in fine condition, but the next record of numbers, just 4 years later records only 11 individuals. It is known that at least 13 animals were killed by island guests, and it is likely that further animals were destroyed because of continued aggressive tendancies. Again, possibly through inbreeding in the survivors, the species dwindled towards final extinction in 1962.

SIKA DEER *(Cervus nippon nippon)*

The third and most successful deer introduced were the Sika imported from Surrenden-Dering Park in Kent, also in 1927. This species acclimatised well to the conditions of Lundy, and increased from the seven individuals originally obtained, to 33 animals by 1949, despite war control. Within the next 6 years the population is reputed to have trebled. It was felt that the deer had boomed beyond 'tolerable limits', and concern was expressed to make the island ". . .less of a zoo, and more of a farm." However, by 1961, after 5 years of frequent culling, the population was still over 90 head.

During the winter of 1961/62, a severe cull was undertaken, and the population reduced to 30–40 beasts. Various estimates for 1972 suggest that the population had still not risen significantly above this level. During the intervening years many deer were found dead and emaciated, and severe attack by *Fasciola* parasites may have been the cause of this.

Following continued damage to island property, in 1973 the island agent instructed that the deer should again be culled, "ideally to an acceptable population of 2 stags and 10 hinds", (this figure was not reached), and 17 animals were taken by a professional stalker. The condition of these beasts was observed to be extremely poor. In 1975 the population consisted of approx. 30 individuals. This figure was established by the recognition of stags individually (9 during 1974/5), and by collating counts and estimates for hinds and juveniles. Reports of larger numbers than this have not been substanciated.

Population Structure

This is difficult to determine in such secretive beasts, because of the problems of identifying hinds individually. 358 sightings of deer were made during the course of study, but not more than 11 were seen at one time. The ratio of males to females in the deer herds was variable at all times of year. From September 1974 till March 1975, the recognised components of the population comprised at least 9 stags, 15 hinds and 3 calves. Sika herds commonly have fewer stags than hinds. In Japan, ratios of 1 stag per 2 hinds have been obtained (Ito, 1968), whereas on Askold Island (USSR) the ratio given is 1: 3.6 (Prisyazhnyuk, 1972). In the Poole Basin (UK) only 2 stag sighting is reported per 7 of hinds, although thorough beating has revealed that the true ratio is 1:1 (Horwood, unpubl.). The Lundy Sika have no 'natural' population structure due to the bias of the recent cullings.

The low figure of only 3 calves for 1974, may reflect poor breeding conditions of the herd, or conversely some calves may have deluded detection. Kasnvskii (1972) found that on the Khopersk Reserve (USSR), the number of calves born per year was equivalent to 56% of the total population, although 50% of these die within their first year. Natality on Lundy is probably low, and the rate of population increase consequently depressed at present.

Behaviour

The Lundy Sika are alert secretive animals. During daylight hours they retire to the dense thickets of *Rhododendron ponticum* which partially clothe the East Sidelands. The lairs are mostly situated between Millcombe Valley and Quarter Wall, although some deer are also present in the smaller clumps of Tibbett's Hill and Brazen Ward to the north. Thus, during the day the deer have excellent cover but no food, whilst at night they can feed, but have no cover. They may frequently be seen venturing out to feed at dusk, and returning to the thickets at early light, although it cannot be readily determined whether they remain out *all* night.

When disturbed Sika emit a piercing whistle-like bark, and the hairs of the caudal patch of all but youngest animals becomes erect and brilliant white. This alerts other animals of danger. Aroused deer will bound off towards cover, springing on all four legs simultaneously. Subsequently, this gait may be changed to a running stride. Uncertain animals may face the potential danger for a considerable time, run back and forth hesitantly, or stamp the ground with a hoof as if in challenge. In winter, animals are less wary and more frequently encountered during hours of light. This increased daylight activity may be because of food shortages necessitating longer feeding periods, and because of less disturbance from island visitors. The deer appear to avoid other island animals, although deer and sheep will graze on the same hillside, but not close to each other. Only one encounter was observed with a feral goat; on that occasion an old Billy repeatedly approached a hind, which screamed and ran into cover.

Signs of sexual activity first appear in autumn, with the formation by the stags of rutting scrapes or platforms. The rutting call, heard mostly in October and November, consists of 2 to 4 drawn out nasal screams, each of which comprises a crescendo and low fading roar, audible from over one mile away. When giving a call a stag stands with a hunched attitude, thick neck bulging and head held upwards. Stags may also thrash the ground with their antlers. Whether Sika stags maintain harems as well as territories in Britain is uncertain. On Lundy the stags appear to feed during the rutting season, although this apparently does not occur in the Poole Basin. (Horwood, unpubl.).

FEEDING ECOLOGY

The quality and quantity of food supply are known to influence the body weight, condition, skeletal size, growth rate, reproductive potential, antler size, and winter mortality of deer (Whitehead, 1950). If controlled management of deer populations is to be undertaken, it is crucial that the inter-relationships between population size and food resources are investigated; consequently it was decided that an attempt should be made to determine the dietary intake of the Lundy Sika.

Procedure

Of four methods commonly employed in the study of mammalian herbivore diets, – i) observation of feeding animals, ii) observation of grazed plants, iii) rumen analysis of dead animals, and iv) analysis of faecal pellets, the latter was chosen because it allows unlimited quantitative sampling, with minimal disturbance to the population. This procedure involves microscopic examination of deer faeces (fewmets) for the identifiable remain of plant structures. Most plant species have distinct microscopic characters, particularly trichomes (hairs) or epidermal cell outlines, which resist digestion. These are recognisable in the faeces by comparison with a reference collection of simulated plant digests. Reference samples of 22 common plants were taken from the island and stored in 100% alcohol. Macerations of plant material were prepared using Jeffrey's Method, – immersing fragments of vegetation in a mixture of 10% Chromic and 10% Nitric acids, and incubating at 35C for 24 hours. Digests were stored in distrilled water and formalin, and then mounted in Gurr's water mountant stained with methylene blue. Photographs of characteristic structure were taken using Leitz Standard 35mm Photomicrograph equipment.

Fresh fewmets were collected from various parts of Lundy during 5 visits to the island spanning one year, – June, September and October 1974, January and March 1975. Sika fewmets are so variable in shape that they have been described as resembling those of Red, Fallow and Roe Deer, as well as those of sheep. Consequently great care was necessary in distinguishing Sika fewmets from those of other island animals. Identification was always confirmed by comparison with fewmets collected from Park herds, and by examining droppings from Lundy deer which had been observed defecating. Individual pellets of the Lundy Sika are 1.5 to 2 cm long, 1 to 1.5 cm in diameter, and ovoid or slightly cylindrical in shape. They are ridged and glossy, black or dark green-black in colour, and pointed at one end. They are frequently strung together by a mucous membrane.

wmets were stored deep frozen, and then thawed for analysis. From the samples collected at each visit to the island, 15 were taken, and 2 examined per sample. Thus, 30 pellets were investigated for each of 5 periods through the year. From each pellet a small pinch was removed with watchmaker's forceps and placed in a drop of water on a microscope slide. It was teased apart under a binocular microscope and then scanned under low and high powers for identifiable plant remains. Species were recorded on a presence/absence basis, and to quantify results, an estimate was made of the percentage of the total area each species constituted, using network-graticule eyepieces. Values were calculated for each species of Mean % Area and Frequency of Occurrence.

These two sets of results provide indicators of feeding habits which are of different units. To make use of all data obtained it was necessary to combine the figures. The results were treated in two distinct ways, although the conclusions reached by both these treatments were very similar.

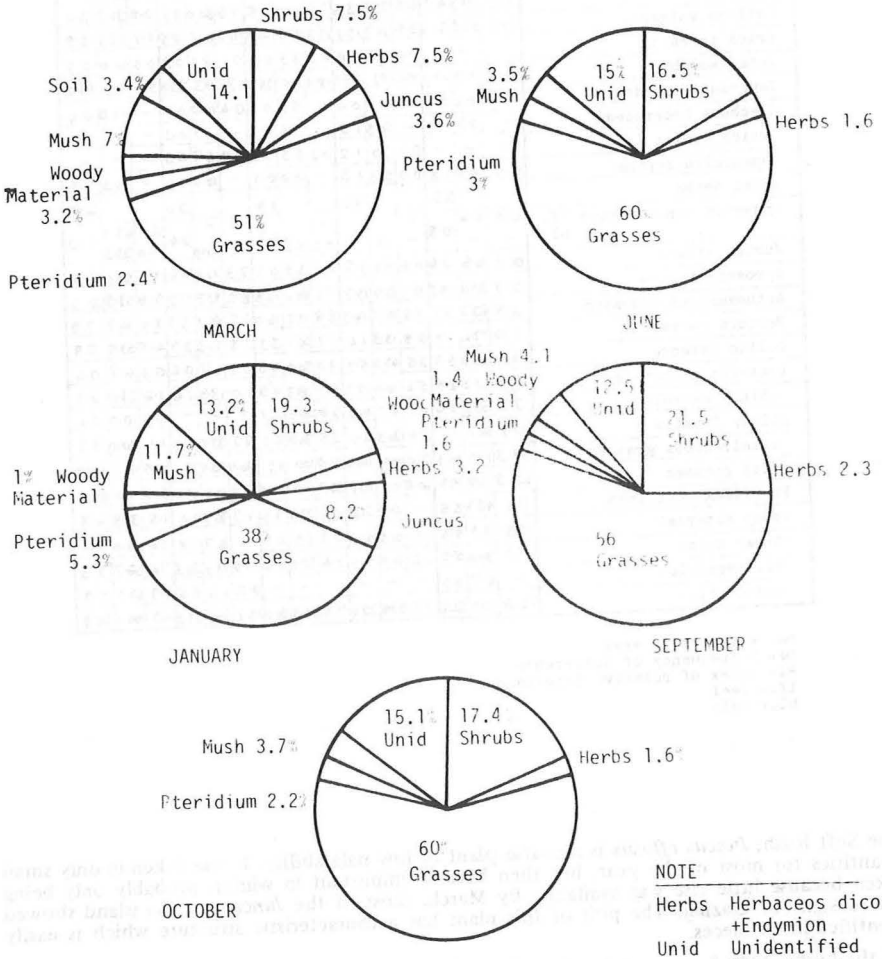
Treatment 1/. involved splitting % Area figures in to classes to give a scale of values 1 – 4. These were then multiplied by % Frequency of Occurrence to give a 'Utilization Index'. This treatment can lead to over-emphasis of small differences in % Area, and equilibration of larger ones. **Treatment 2/.** involved changing figures of % Frequency to units comparable with % Area using a graphical representation of results. These parameters formed the axes, and a point made for values of each species for each month. (Species with negligible % Area were not plotted). A clear correlation was obtained and values read directly from the regression. Since % Area was the only measure of actual quantity, % Occurrence figures were altered to units comparable with these. Then the two values were summed to give the 'Index of Importance' seen in Fig. 4, where they are expressed as a percentage. The advantages of this method are that it does not rely on subjective classes, and gives emphasis to values of species identified by structures of low % Area but frequent occurrence (e.g. trichomes) which might ohterwise be underestimated.

Certain problems are inevitable when using faecal analysis as an indicator of diet. First, the proportion of identifiable/non-identifiable matter varies for different plant species, therefore giving higher figures for species with easily recognised diagnostic characters. Secondly, the plant tissues of different species may be differentially digested by the deer, or by different deer, or at different times of year. Thirdly, the faecal analysis studied the *area* of plant remains, and not volume. Finally, the presence of a species in the faeces does not invariably indicate voluntary feeding. For example, hairs of the Pygmy Shrew *Sorex minutus* were occasionally found in the fewmets, and these had presumably been accidentally ingested.

In order to discuss the results, it must be assumed that the relative proportions of species found in the faeces *is* the same as that ingested. Anthony and Smith (1974), comparing the results obtained by volumetric rumen analysis and faecal analysis (using % Area & % Occurrence techniques) on two species of US ungulates, concluded that faecal analysis could give a reliable indication of ingested food, and this therefore has direct implications on the relevance of data obtained in this study [illegible]

Discussion

From the results presented the following conclusions can be drawn. Grasses constitute the principal component of the diet, forming from 40 to 65% of remains in the faeces throughout the year, and the relative proportions of many of these species remained similar at all times. Only 50% of all the fragments observed as being Graminaceous in the faeces were identified to species level. Furthermore, only the seven most common species (determined from observation) were collected from the island for slide reference, and the possibility of deer grazing other species cannot be eliminated. Of the grasses identified, *Agrostis tenuis* (Common Bent) was the most important, occuring in nearly every sample, and forming a significant part of each one. A slight decrease in intake was observed over winter. *Anthoxanthum odoratum* (Sweet Vernal Grass) occurred in slightly smaller quantities. This species showed peak results for late autumn, when other species were in lesser quantity, and is probably important in that it has early spring growth. *Festuca rubra* (Red Fescue) was seen to be of moderate importance in spring, and taken in smaller quantities for the rest of the year. Both *Dactylis glomerata* (Cocksfoot) and *Lolium perenne* (Perennial Rye) were taken in significant quantities throughout the summer, but their importance fell markedly in winter; this may be partly due to the removal of cultivated grass from the fields in late autumn. *Holcus lanatus* (Yorkshire Fog), a common species in the cultivated fields, appeared to be consumed in only small quantities for most of the year, but showed a slight increase in winter. The coarse Purple Moor Grass *Molinia caerulia,* which is of little nutritional value and palatability, was recorded in small amounts from June to October. This species dies back in winter, leaving only dead leaves above ground.



NOTE

Herbs	Herbaceos dicots +Endymion
Unid	Unidentified
Mush	Amorphous brown material.

Seasonal Changes in the Diet of Sika Deer on Lundy,

as Determined by Faeces Analysis, June 1974-March 1975.

SPECIES	JUNE			SEPT			OCT			JAN			MARCH		
	%A	%F	RI	%A	%F	RI	%A	%F	RI	%A	%F	RI	%A	%F	RI
Ulex europaeus	0·8	16·6	1·7	3·1	36·7	5·6	0·1	3·3	0·2	2·1	30·0	4·0	2·3	40·0	5·1
Rubus fruticosis	2·5	33·3	4·7	6·5	73·3	13·6	2·9	40·0	2·8	4·6	60·0	9·8	0·8	36·7	3·3
Calluna vulgaris	10·6	93·3	21·6	9·6	86·7	19·1	15·3	86·7	24·8	10·3	86·7	19·8	1·7	33·3	3·9
Erica tetralix	–	–	–	0·4	10·0	0·8	0·2	3·3	0·3	0·1	3·3	0·2	0·5	10·0	0·9
Total shrubs	13·9	100	29·0	19·6	97	39·1	18·5	100	28·1	17·1	93	33·8	5·3	80	13·2
Teucrium scorodonia	–	10·0	0·4	–	10·0	0·4	–	13·3	0·6	0·4	10·0	0·8	–	10·0	0·4
Glechoma hederacea	–	3·3	0·1	–	20·3	1·3	–	3·3	0·1	–	6·7	0·3	–	–	–
Urtica dioica	–	–	–	0·1	20	1·2	0·2	3·3	0·3	0·2	6·7	0·5	–	–	–
Ranunculus repens	0·2	26·6	1·8	0·3	26·3	1·3	–	10·0	0·4	–	10·0	0·4	–	23·3	1·3
Total herbs			2·3			4·2			1·4			2·0			2·2
Endymion non-scriptus lf.	0·5	6·6	0·8	–	–	–	–	–	1·2	–	–	3·4	5·5	43·3	11·0
bl.	–	–		–	–		0·2	3·3		2·3	20·0		1·0	23·3	
Juncus effusus	0·3	6·6	0·6	0·6	13·6	1·2	0·1	3·3	0·2	7·3	73·3	14·4	2·5	50·0	6·4
Agrostis tenuis	12·5	93·3	23·5	10·1	86·7	19·7	7·6	80·0	15·9	8·2	83·3	17·2	9·8	93·3	20·9
Anthoxanthum odoratum	6·5	63·3	12·1	8·2	76·7	14·3	8·8	73·3	16·0	4·5	55·7	9·0	3·4	46·7	7·9
Festuca rubra	1·0	17·6	1·9	0·8	13·3	1·4	1·7	26·7	3·3	1·8	20·3	2·9	4·5	53·3	8·8
Lolium perenne	4·1	60·0	9·3	2·5	43·3	5·7	3·0	50·0	6·9	0·3	6·7	0·6	0·3	6·7	0·6
Dactylis glomerata	4·7	53·3	8·9	5·6	70·0	12·2	2·7	33·3	4·9	1·0	13·3	1·6	1·6	23·3	2·9
Molinia caerulea	2·8	33·3	5·0	0·5	6·7	0·8	2·4	23·3	3·7	–	–	–	0·2	10·0	0·6
Holcus lanatus	0·7	16·7	1·5	1·4	20·3	2·5	2·3	30·0	4·1	2·2	33·3	4·4	1·4	30·0	3·3
Miscellaneous grasses	33·3	100	46·3	31·0	100	44·0	29·0	100	42	20·0	93·4	31·1	32·9	96·7	44·9
Total grasses	65·2	100	108	60·8	100	101	59·9	100	96·8	41·4	100	66·8	54·5	100	89·9
Pteridium aquilinum	1·2	43·3	5·5	–	40·0	2·8	1·5	23·3	3·6	4·3	36·7	9·4	1·5	33·3	4·3
Woody material	0·3	3·3	0·4	1·5	20·3	2·6	0·2	3·3	0·3	1·0	16·7	1·8	2·6	40·0	5·4
"Brown mush"	4·0	30·0	5·9	4·6	40·0	7·4	3·4	33·3	5·6	13·4	73·3	20·5	7·6	56·7	12·3
Soil particles	–	6·7	0·3	–	–	–	–	–	–	0·2	6·6	0·5	0·3	63·3	5·9
Unidentified	13·6	100	26·6	11·3	93·4	22·4	15·4	83·3	24·4	13·7	86·7	23·2	14·5	90·0	24·8

%A= estimated % area
%F= % frequency of occurrence
RI= index of relative importance
lf.= leaf
bl.= bulb

The Soft Rush, *Juncus effusus* is a coarse plant of low palatability. It was taken in only small quantities for most of the year, but then became important in winter, probably only being taken because little else was available. By March, most of the *Juncus* on the island showed severe signs of grazing. The pith of this plant has a characteristic structure which is easily identified in the faeces.

Of the herbs studied, none of the dicotyledonous species appeared to be taken in large quantities. However, the monocotyledon *Endymion non-scriptus* (Bluebell) became an important food during the spring, and few of the leaves were left on plants to die naturally. The deer were seen rooting up the *bulbs* of Bluebells in winter, and this part of the plant is probably a major winter food. Quite considerable erosion is caused by the deer at this time. The faecal analysis showed a corresponding peak for *Endymion* bulbs for the winter, although the soft nature and easy digestion of this species probably causes under estimation of its significance. The incidence of a brown acellular material (described as 'mush' in the pie-charts), which increased markedly in winter, may also reflect the ingestion of bulbs.

Primula vulgaris (Primrose) was not recorded from the faeces at all, and this may be because no collections were taken between March and June when the species is most plentiful. The absence of early primroses on Lundy has been attributed, by islanders, to the activities, although domestic stock may also play a part in this. Other herbs which were recorded include *Teucrium scorodonia* (Wood Sage), *Glechoma hederacea* (Ground Ivy), *Ranunculus repens* (Creeping Buttercup), and *Urtica dioica* (Stinging Nettle), although apart from an increased intake in early spring, they appear to be of only minor importance in the diet despite their common occurrence.

Shrubs, including dwarf heaths, make up a consistently important proportion of the diet. Both *Ulex europaeus* (Gorse) and *Rubus fruicosus* (Bramble) were taken in significant amounts throughout the year. *Ulex* showed a slight increase during winter whilst *Rubus* showed marked fluctuations in importance during this time. Calluna vulgaris (Ling Heather) formed an important proportion of the diet for most of the year, with a marked decrease in March, at which time the plant had turned brown and was in very poor condition. *Calluna,* which is a plant of poor nutritional value and palatability for most Ungulates, may be taken mainly for roughage or ballast, aiding in the movement of material through the gut. *Erica tetralix* (Cross-leaved Heath) which is not so abundant on Lundy, was only found in small and irregular quantities.

The rhizomes of Bracken *Pteridium aquilinum* were recorded in the faeces from October to June, when chewed remains could also be seen in 'scrapes' along the East Sidelands. All parts of this species contain the potentially lethal toxin hydrocyanin, producing symptoms of severe poisoning in domestic stock. The plant also contains thiaminase and is carcinogenic, and the fact that the deer are taking this species at all may reflect the winter food shortage. This is believed to be the first documented record of deer eating *Pteridium* in Britain. It is significant that in winter when the deer were rooting for both *Endymion* bulbs and *Pteridium* rhizomes, the incidence of soil particles found in the faeces also increased. The trichomes of the above-ground parts of *Pteridium* were also found in the faeces throughout the year, although because no cellular parts of the frond were discovered, and because of the abundance of this species on the island, it is assumed that these trichomes were from discarded parts and only ingested coincidentally.

MANAGEMENT

That the introduction of deer onto Lundy might be a mistake leading to intolerable damage, was stressed by Sir Park Goff in 1926. Mr. Harman remained adamant in his determination to improve the wildlife resource of the island, although in an attempt to keep the deer north of Quarter Wall, a fence was constructed across the island. This was not successful, and the deer began to cause great harm to the crops in Tillageand Brick Fields. Attempts to make these fields deer-proof, using barbed wire and electric fencing, failed because of persistent flaws through which the deer regained access.

Now that crops are no longer grown on Lundy, the deer do less damage. However, they do compete with domestic farmstock for forage, and crop grass intended for hay or strip-grazing. Some plants on which the deer feed are probably not taken to such an extent by domestic stock, – *Calluna, Endymion* bulbs and *Pteridium* rhizomes. A major proportion of the grass in Tillage Field is of the species *Holcus lanatus*, which was rarely recorded in the faecal analysis and appears to be avoided by the deer. In addition, sheep can crop grass much shorter than deer, and can therefore feed on plants which deer have partly eaten. However, other grasses cropped from the fields still constitute an important part of the diet, and the animals remain something of a 'pest'.

Whitehead (1950) states that a well built 6ft fence will keep out Fallow Deer (a larger species) and these are guaranteed deer-proof by the manufacturers. Fencing along the eastern edge of Tillage would probably complete the proofing of this field. Mechanical, Chemical or Mechano-biological deterrants have been usefully employed on other estates. Wind power could be utilized to scare deer with rattling or flapping objects – foil sheets, fertilizer bags etc., (although these might be considered visually obtrusive), or a battery powered audio device could be used. Often, a most effective and economical method of deterring deer is to allow a trained dog to run in susceptible fields. After a short time just the scent of the dog keeps the deer well clear.

The Lundy Sika form an interesting part of the wild-life of the island. They provide interest for visitors and residents alike, as well as being one of the few sites of this local species in the British Isles. If it is recognised that the Japanese Sika are a resource of Lundy which should be conserved, the major problem lies in determining the number of deer which:

a) will be tolerated by farming interests; and
b) will maintain the deer population in good condition, as influenced by:
   i) effects of density on food availability
   ii) parasites and disease
   iii) genetic viability

Land carrying-capacities have not been calculated for Sika deer in Britain. On Askold Island (USSR) Prisyazhnuk, (1972) claims that more than 5 hectares are necessary per beast, whereas on Kinkazan Island (Japan), Ito (1967/1968) states that the figure is nearer 12.5 hectares. A figure of one animal per 0.4 hectares, reached by an isolated population on James Island (USA) in 1955, induced a 60% die-off within one winter (Christian, Flyger & Davies, 1960). The carrying capacity is related to the conditions present in the habitat. Lundy comprises approximately 440 hectares, most of which is not good grazing pasture. Although the island has held over 100 deer in the past, this was when there were fewer domestic animals. The poor condition of deer in previous years may be a reflection of food shortage, disease and inbreeding. All animals observed during the period of this study were in good condition (i.e. fine build and stature, good antler growth).

Any further culling of the present population to approximately 30 animals would reduce the gene pool of what must already be a severely inbred herd. Whitehead (1950) has stated that over an extended period of years without importing new animals, even in a well kept deer park, a herd of 100 animals or less is bound to deteriorate when inbreeding is confined to such a narrow community. Lundy is far from a well kept park, and has held less than half of this figure of 100 for most of the 50 years since deer were first introduced. It is crucial that genetic variety is kept to an optimum. Inbreedin may have been important in the extinction of Red and Fallow Deer on the island.

The 'ideal' population cull to 2 stags and 12 hinds, proposed and attempted in 1973, was never reached, due to an under estimation of the numbers present at the time. This was indeed fortunate, because since 1973, two further stags have been shot, and another found dead. This would have rendered the death of all male animals and inevitable extinction for the species. Furthermore, there is no advantage in such discriminant culling of stags rather than hinds, as they do little more damage. One stag can mate a large number of hinds, and consequently population trends are solely correlated to the number of females. For maintaining a small, slow growing, but *healthy and genetically viable* population, it is advisable to have several stags, preferably with a large turnover (i.e. with regular and informed culling).

The conclusion reached is that the population should be managed at its present level of 30 animals. This would involve culling the older animals in excess of this figure, which could be ascertained by counts (say) every five years. Greater culling than this might render the population liable to extinction from inbreeding, but a larger number would probably not be compatible with farming interests. Further investigation of proofing and deterrent techniques might also be useful in reducing the damage caused.

Most of the species of deer found in Britain have been *introduced by the hand of man,* within historical times. This does not render their conservation any the less worthy or desirable. The Japanese Sika are one of the most striking and beautiful of these animals, and Lundy is one of the few areas in Britain where they live in a truly wild state. Any effort taken towards ensuring the survival of this species must surely be a commendable step.

ACKNOWLEDGEMENTS

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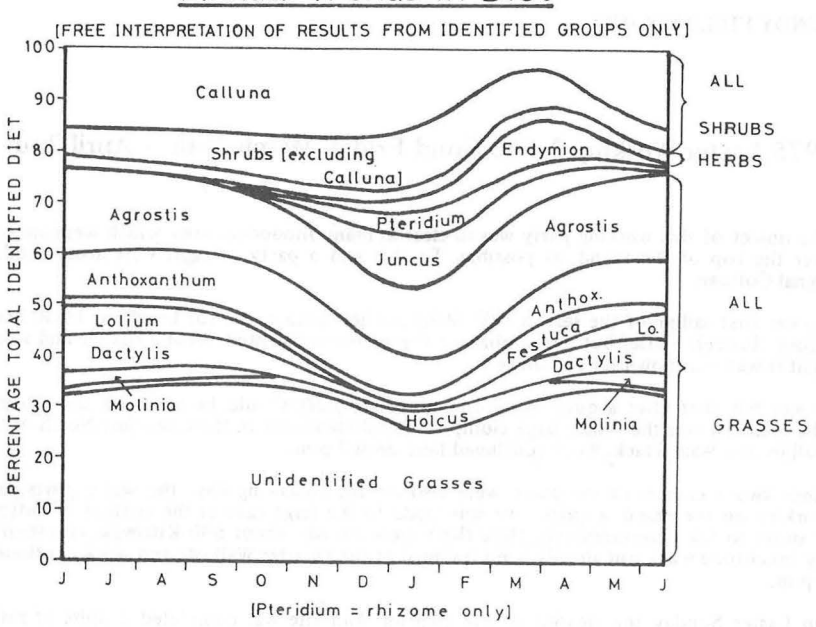

REFERENCES

ANTHONY R.G. & SMITH N.S., 1974, Comparison of rumen and fecal analysis to describe deer diets. J. Wildl. Mgmt *35.*

BROMLEY G.F., X 1964, Ecology of the wild spotted deer in the maritime territory, in'Studies of Mammals in Government Preserves', ed. Yurgenson P.B., Min. Agr. USSR, translated for National Science Foundation, Washington.

CHRISTIAN J.J., VAGN FLYGER, & DAVIS D.E., 1960, Factors in the mass mortality of a herd of Sika Deer, *Cervus nippon.* Chesapeake Science, *1,* Pt 2.

HORWOOD M.T., 1966, 1969, Sika Deer Studies in the Poole Basin, Progress Reports, unpubl.

HORWOOD M.T. & MASTERS E.H., 1970, Sika Deer, *(Cervus nippon),* British Deer Soc. No. 3.

ITO, TAKEO, 1967, 1968, Ecological studies of the Japanese Deer, Cervus nippon, on Kinkazan Island:I, Distribution and Population Size; II, Census and herd size. Bull. Mar. Biol. Sta. Asamushi Tohoku Univ. *13* (1) & (2).

KAZNEVSKII P.F., 1974, Sika Deer mortality in the Khopersk Reserve. Byull Mosk O-Va Ispyt Prir Otd Biol X *79* (4).

MITCHELL W.R., & ROBINSON J., 1972, The Bowland Sika, their history, status and distribution. Deer *2.*

MUIRA, S., 1974, The seasonal movements of Sika Deer populations in Mount Hinokiboramaru. J. Mammal Soc. Jpn. *6,* (2).

PRISYAZHNYUK V.E., & PRISYAZHNYUK N.P., 1974, Pyatistye oleni *(Cervus nippon)* na o Askol'd. Byull Mosk 0-Va Ispyt Prir Otd Biol *79* (3).

WHITEHEAD G.K., 1950, Deer and their management. Country Life.

WHITEHEAD G.K., 1964, The deer of Great Britain and Ireland. Routledge and Kegan