

Final Report

In Accordance With

Contract No. USDI PX4000-1-0496

MAR-4

POPULATION CHARACTERISTICS, HABITAT
UTILIZATION, AND FEEDING HABITS OF
THE FERAL PONIES, SIKI DEER, AND
WHITE-TAILED DEER WITHIN ASSATEAGUE
ISLAND NATIONAL SEASHORE

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November 30, 1982

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ABSTRACT

This 1-year study had two primary goals, each having several objectives. The first primary goal was to continue during 1981 a long-term effort to collect data on the NPS pony population. The objectives of this goal were to determine for 1981 (1) the effects of feral pony grazing on the island's vegetation; (2) the home range and habitat utilization of individual pony bands; (3) the size, sex, and age structure of each pony band; and (4) the foaling rate for the pony population. The data were compared to similar data collected since 1975. The second primary goal was to initiate data collection efforts for the Sika and white-tailed deer population of the Maryland portion of Assateague Island. This goal's primary objectives were to determine (1) the size, sex, and age structure of the two deer populations; (2) the identity of unknown deer pellet samples through pH analysis; and (3) the late spring food habits of both deer populations.

The effects of grazing by the ponies were studied by using exclusion cages in which only pony grazing was prevented. The results suggested that the effects of pony grazing, at present population levels, are light.

The home range and habitat utilization of the major pony bands were determined through direct field observation. Bands spent the most time in the salt-marsh, but utilized five other habitats for grazing and to escape biting insects.

Six one-male harem bands were observed on the island during 1981. In addition, two multi-male bands, consisting of several young male and female ponies, were also present. The pony population as of December 31, 1981 consisted of 81 ponies. Forty-seven percent of these animals were two years of age or younger, and twenty-one percent of the population was composed of male animals.

Fifteen foals were born during the 1981 breeding season. The 1981 population foaling rate (number of foals born/number of sexually mature females) was 44.2%.

The size of the deer population on Assateague Island National Seashore was estimated, using the pellet-group count technique, at between 600 and 700 animals. Based on data obtained during the 1978-81 deer seasons, the total deer population seemed to be composed of 75% Sika and 25% white-tailed deer. For both deer species, males comprised about 37% of the population, and fawns and yearling comprised over 60% of the populations.

An attempt was made to separate unknown deer fecal pellets into Sika and white-tailed samples through pH analysis, but this method proved unsuccessful.

The late spring food habits of the deer on the National Seashore were studied by comparing plant fragments from fecal samples collected on the island in June 1981 with known plant material from a reference collection. Less than thirty different kinds of plants were found in the samples. Myrica and Rhus made up over 75% of the relative density of the fragments and were found in over 80% of the samples.

INTRODUCTION

Assateague Island is a 37-mile-long barrier island located off the Atlantic coast of Maryland and Virginia. The Virginia portion of the island consists of approximately 9,200 acres administered by the U.S. Fish and Wildlife Service as the Chincoteague National Wildlife Refuge. The Maryland portion of Assateague Island contains 8,538 acres primarily administered by the National Park Service. The National Park Service lands are designated the Assateague Island National Seashore (AINS).

The major vegetation types on The National Seashore include: American beach grass (Ammophila brevilingulata) on sand dunes along the ocean, American three-square (Scirpus americanus) and various sedges in the inner-dune zone in the middle of the island, and saltmarsh cordgrass (Spartina spp.) in the marshes along the bay on the western edge of the island. A shrub zone composed of bayberry (Myrica pennsylvanica) and marsh elder (Iva fruscens), and a narrow band of loblolly pine (Pinus taeda) are also present on the higher regions of the island.

Assateague Island supports populations of three large mammalian herbivores: the feral pony (Equus caballus), white-tailed deer (Odocoileus virginianus), and Sika deer (Cervus nippon). The Sika deer, like the pony, is an exotic species on the island. A wire fence along the Maryland/Virginia boundary of the island greatly restricts, but does not totally prevent, immigration of the NPS wild and free-roaming ponies to the Virginia portion of the island. The fence probably provides little deterrent to deer movements.

Since 1975, considerable scientific information has been collected on the behavior and ecology of the AINS feral pony population. This information includes data on home range, habitat utilization, and activity patterns (Zervanos 1978, Zervanos and Keiper 1979, Keiper 1980), on the effects of pony grazing on the

vegetation of the island (Keiper 1977, Keiper 1978, Eline and Keiper 1979, Keiper and Zervanos 1979, Keiper 1980) and on population dynamics (Keiper and Zervanos 1979, Keiper, 1980). However, little is known about the size, sex and age structure, habitat utilization, and feeding habits of either deer population on the Maryland portion of the island.

This research was designed to collect additional information on the habitat utilization, population characteristics, and feeding habits of the NPS feral ponies and to establish a data base on these parameters for the Sika and white-tailed deer population on the NPS Assateague Island National Seashore. Specifically, the project's objectives were to:

1. Determine the size, sex and age structure of each pony band through direct observation during the summer of 1981. Each individual animal was identified on the basis of sex, size, color, and markings.
2. Determine the foaling rate for the pony population. The birthdate and sex of each foal born during 1981 and the age and identity of its mother was recorded.
3. Determine the home range and habitat utilization of the individual pony bands during 1981 through direct observation and mapping of their locations.
4. Determine the effects of feral pony grazing on the island's vegetation by using exclusion cages and by comparing results from 1981 with those from previous years.
5. Determine the size, sex and age structure of the Sika and white-tailed deer population on AINS by utilizing the pellet-group count method and by using data collected on deer killed by hunters during the 1981 hunting season.
6. Determine the identity of unknown pellet samples collected on the island through pH analysis. If unknown pellets can be identified as either Sika or white-tailed deer pellets, then species-specific data on food habits and habitat utilization can be more easily gathered.

7. Determine the late spring food habits of both deer populations by collecting unknown pellet samples from a variety of habitats and analyzing these samples to identify the plant species consumed.

METHOD

Population Dynamics and Social Organization of the Ponies

Through the summer and fall of 1981, data were collected on the size, sex and age composition of each of the bands living on the Maryland portion of Assateague Island. Data were also collected on the number of foals born in 1981. Information recorded included the birth date of each foal, its sex, and the age and identity of its mother. This data was then compared with similar data collected since 1975 and was also used to provide information on the rate of population increase.

Habitat Utilization of the Ponies

The habitat utilization of the ponies was determined by visually locating a pony band and collecting the following data: size and composition of the band, band location, type of habitat being utilized, the plant being consumed, band activity, and the time. The observer then either stayed with the band for several hours, collecting the above data at one hour intervals, or moved on to another band where comparable data were collected. By recording the daily position of each band on maps of the island, the home range of each band could be determined.

Effects of Pony Grazing

The effects of pony grazing on the dune vegetation were studied using exclosures constructed in 1978. The exclosures were constructed on primary dunes, two near the northern tip of the island and eight down the island at one mile intervals starting just south of Dune Crossing One.

Each exclosure was five square meters (5m^2) surrounded by a single strand of barbed wire strung at a height of 78 centimeters above the ground.

As in previous years, the ponies were given the opportunity to graze around the cages during the summer growth period. In the later summer, ten randomly selected 30 cm^2 vegetation samples were cut from within and from outside each cage. The vegetation was cut at ground level using hedge shears and collected in plastic bags. The bags were sent immediately to the laboratory at the Mont Alto Campus of Pennsylvania State University. Each sample was oven-dried for one week at 45°C and weighed on a torsion balance.

Sizes of Deer Populations

The pellet-group count method was used to determine the size of the white-tailed and Sika deer populations (Rogers et al. 1958, Stormer et al. 1977). Ten transects were established at randomly selected locations along the island (Figure 1). The transects ran from the top of the primary dune approximately westward to the low saltmarsh. A 10m^2 sampling plot was established every 100 meters along each transect. The entire area of each plot was visually searched for pellet groups and the number of such groups was recorded. The groups were then sprayed with a waterproof paint to prevent counting the same group during subsequent sampling.

Each plot along each transect was surveyed three times during a fourteen day period between June 14 and June 28, 1981. Only new pellet-groups were counted during each survey.

pH of Deer Pellets

Before the pellet-group census method can be accurately used to estimate the size of each deer population on AINS, it is necessary to be able to distinguish between pellets of the two deer species. Because white-tailed and Sika deer cannot be accurately sorted on the basis of the size or characteristics

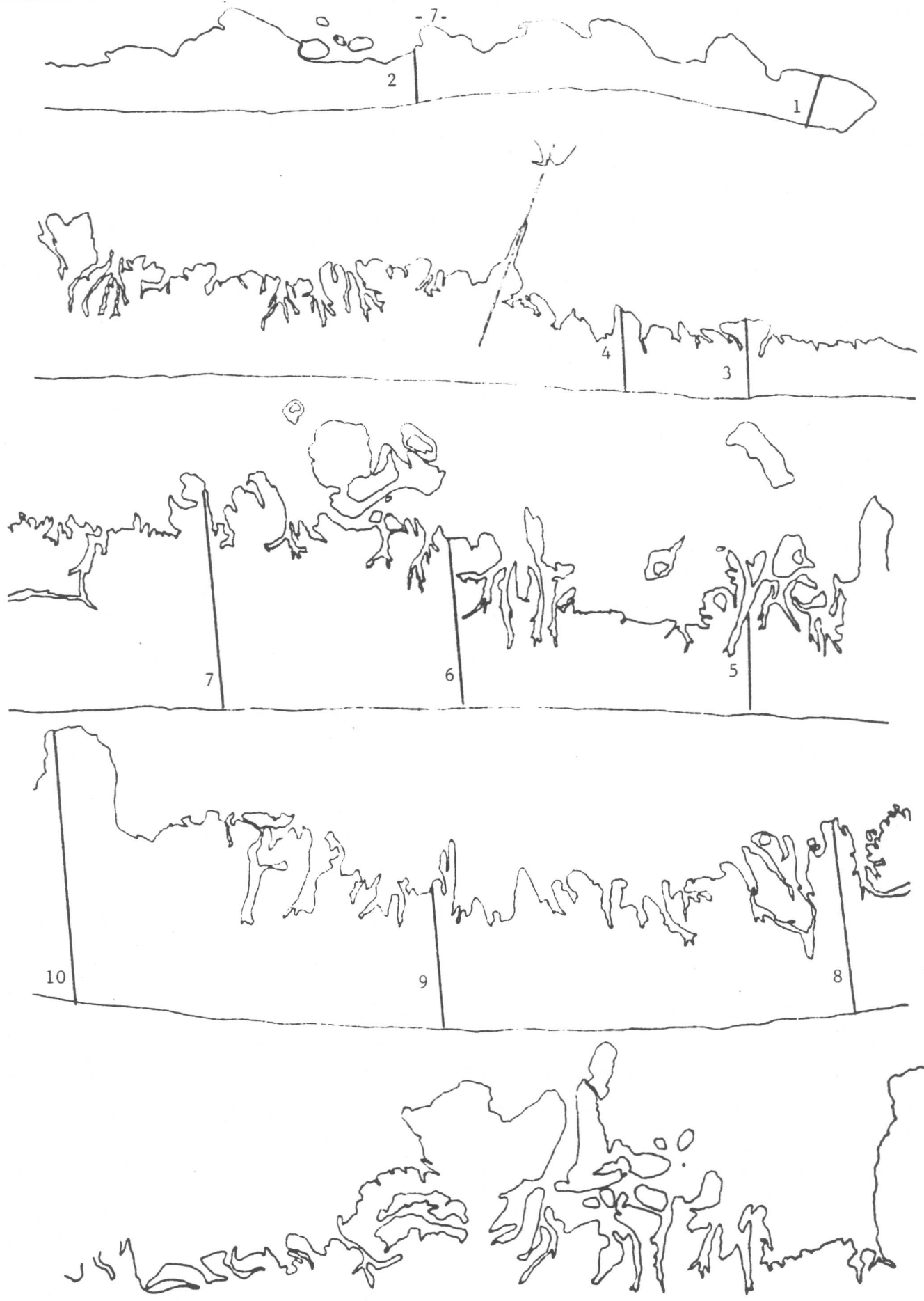


Figure 1. Location of Transects Used to Estimate Deer Populations

of their tracks, or on the basis of the size, shape, color, or texture of their pellets (Feldhamer and Chapman, 1978), an attempt was made to separate their pellets through pH analysis. Fecal pH analysis has been used to distinguish the feces of herbivores ranging from white-tailed and Sika deer (Feldhamer and Chapman, 1978) to feral horses and Gemsbok (Hansen, 1978).

The fecal samples were collected during the transect surveys and immediately frozen. The frozen samples were sent to the laboratory at Mont Alto and dried for 72 hours at 75°C. Approximately two grams of this dried fecal material were placed in 100 ml. of distilled water and mixed in a blender for five minutes. Two one ml. aliquots were removed and undissolved sediment was allowed to precipitate for several minutes. The pH of both aliquots from each sample was then measured with a Beckman pH meter to the nearest 0.1 unit.

During the 1981 deer hunting season, fecal samples were also obtained from the anuses of 13 deer of known species. These pellets were treated in the same manner as the unknown pellets described above, and their pH was determined. The rest of the hunter-killed deer had been gutted, so pellets for these were not available.

Deer Food Habits

To determine deer food habits, 29 pellet samples from unknown deer species were collected and packed with table salt. The salt dries the pellets and prevents decomposition. The salted samples were sent to the Composition Analysis Laboratory at Colorado State University for analysis. This consisted of preparing 20 microscope slides from each pellet sample and comparing the plant materials on the slides with known plant reference slides.

Deer Sex, Age and Weight

Deer sex, age and weight data were gathered from inspections of hunter-killed Sika and white-tailed deer during the November 28 - December 5, 1981 hunting season. A check station, located at the island's sole land vehicle access

point, was manned during most of the period. Harvested deer were sexed, aged (tooth replacement and wear) and weighed (dressed weight). For all deer, girth was measured and an incisor tooth (I_1) and one or both eyes removed. The lens was removed from each eye and stored in 10% formalin.

RESULTS AND DISCUSSION

Population Dynamics and Social Organization of the Ponies

The size, sex, and age composition for each of the pony bands present from June to November 1981 are shown in Table 1. Six harem bands were observed on the island. Each consisted of one dominant adult male pony, a number of sexually mature female ponies, and their offspring up to two years of age. Two other bands, each containing more than one male, were also present during the study. Both of these multi-male bands were composed of animals three years of age or younger. This marked the first time during the past seven years that two multi-male bands were present.

Another interesting situation developed in the J band where a male offspring (M17C) remained in its natal band through his third summer. This was the longest time a young male was observed to stay in his natal band.

Fifteen foals were born in 1981. Since 34 mares were sexually mature and thus capable of foaling, the foaling rate (the number of foals born/the number of sexually mature mares) was 44.2%. This foaling rate is both lower than the foaling rate for 1980 (56.7%) reported by Keiper (1981) and the average foaling rate for the past seven years (57.5%) (Table 2). The 1981 foaling rate was also the second lowest observed during the past seven years. This reduced foaling rate may be the result of inbreeding or it may have resulted from the large number of young females in the population, for young mares have a lower foaling rate than the adult mares.

Of the fifteen foals born in 1981, only twelve were still living by the end of November 1981. Two died of unknown causes within a week of birth. The third foal was killed at 3 weeks of age by a car in the State Park.

Table 1. Composition of the Pony Population on Assateague Island National Seashore During 1981.

<u>Adult (> 2 year old)</u>						
<u>Band</u>	<u>Male</u>	<u>Female</u>	<u>2 Year Old</u>	<u>Yearling</u>	<u>Foal</u>	<u>Total</u>
M	1	8	0	3 (1M, 2F)	4	16
O	2	1	2 (1M, 1F)	0	0	5
**J	2	3	0	2 (1M, 1F)	3	10
K	1	3	1 (1F)	1 (1F)	3	9
T	1	7	1 (1F)	4 (1M, 3F)	2	15
R	2	0	2 (1M, 1F)	0	0	4
N	1	6	1 (1M)	3 (1M, 2F)	2	13
L	1	3	0	2 (2F)	1	7
Other	0	1	1 (1M)	0	0	2
Total	<u>9</u>	<u>34</u>	<u>8</u>	<u>15</u>	<u>15*</u>	<u>81⁺</u>

*Includes all foals born, not surviving foals.

+Animals surviving as of December 31, 1981.

**Only one male was a fully adult male and the dominant harem master of the band. The other male was a three year old male who had not yet dispersed (he left the herd in August 1981 and became a solitary animal). Consequently J band is considered a harem band.

Table 2. Foaling Rate for Mares on Assateague Island National Seashore

	# Sexually <u>Mature Mares</u>	# Mares <u>Foaling</u>	<u>Foaling %</u>
1975 - (Keiper, 1980)	18	10	55.6%
1976 - (Keiper, 1980)	14	9	64.3%
1977 - (Keiper, 1980)	17	12	70.6%
1978 - (Keiper, 1980)	20	14	70.0%
1979 - (Keiper, 1980)	22	9	40.9%
1980 - (Keiper, 1980)	30	17	56.7%
1981	34	15	44.2%
			57.5%

The pony population on AINS, therefore, numbered around 80 animals seen during 1981, about a 12% increase over 1980. However, a number of previously identified ponies "disappeared" and it is not known if these animals are dead, have dispersed from the northern portion of the island, or are living in some remote or restricted part of the island. If the latter is true, then the population could actually number 85-90 ponies.

Habitat Utilization of the Ponies

The habitat utilization of five of the one-male harem bands was determined during 332 hours of direct field observations during the summer of 1981 (Table 3). The sixth harem band was not observed because it occupied the most southern home range and required too much travel time to reach it. The "other" habitats used by the ponies include the campgrounds for bands K, J, and T and the mudflats for bands N and M. Beach utilization by the J and K bands primarily involved the State Park Beach.

The 1981 home ranges for all eight bands are shown in Figure 2. The most important change involved the appearance of the new bands (O and R) during 1981. The range of band O spatially overlapped much of the range of M band and undoubtedly contributed to the high degree of grazing on the dunes at the northern tip. The range of band R lied between that of bands T and N and its appearance may have contributed to a decrease in the home range size of those bands. The home ranges of the J and M bands have been reduced, but in both cases it was because the bands no longer used the area across from Coffin's Point. This area had recently experienced severe overwash and was largely devoid of vegetation during the study.

Effects of Pony Grazing

The results of the exclusion cage sampling are presented in Table 4. The 1981 data were compared with data collected in 1978, the first year in which the

Table 3. Habitat Utilization by Ponies During the Summer of 1981.

<u>Band</u>	<u>Habitat (Percent Utilization)</u>						<u>Total Observation Time (Hrs.)</u>
	<u>Beach</u>	<u>Dune</u>	<u>Inner Dune</u>	<u>Saltmarsh</u>	<u>Bay</u>	<u>Other</u> *	
K	27.43	11.76	7.84	21.60	0	31.39	51
J	14.13	21.74	6.52	38.05	2.17	17.39	92
T	16.67	19.70	10.61	33.33	12.12	7.57	66
N	0	4.48	20.90	14.93	43.28	16.42	67
M	1.78	5.36	33.93	50.00	0	8.93	56
Average	12.00	12.61	15.96	31.58	11.51	16.34	332

*Other habitats included campgrounds for K, J, and T bands and mud flats for bands N and M.

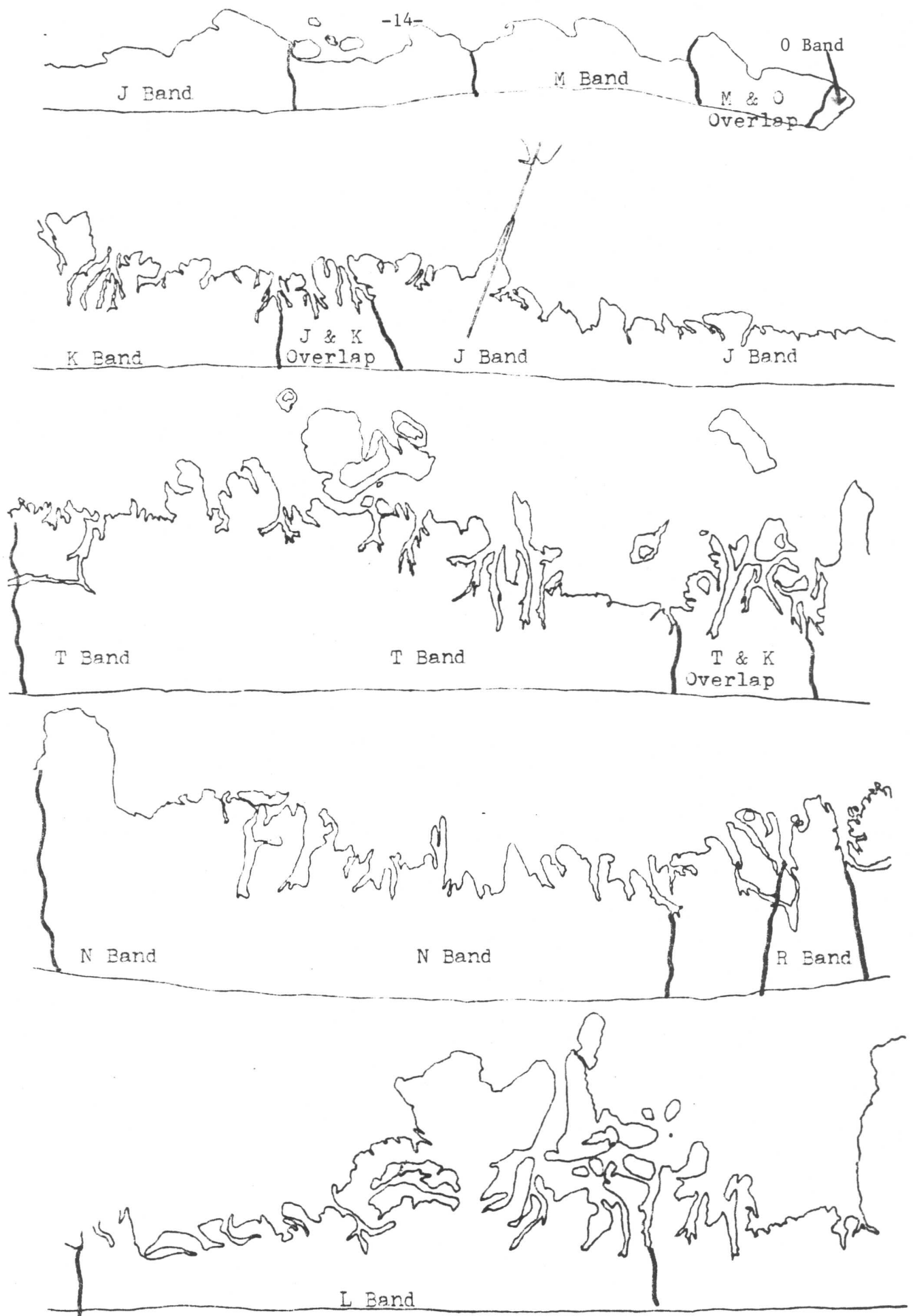


Figure 2. Home Ranges for Pony Bands on Assateague Island during 1981.

Table 4. Comparison of Vegetation Removed from 30 cm.² Samples Within and Outside of Exclusion Cages

<u>Exclusion Cage</u>	<u>Control Samples Within Cage</u>		<u>Samples Within 5m. of Cage</u>		<u>Samples 5-10m. from Cage</u>	
	(1) <u>1978</u>	(2) <u>1981</u>	(3) <u>1978</u>	(4) <u>1981</u>	(5) <u>1978</u>	(6) <u>1981</u>
1	15.35g	6.35g	16.49g	4.60g	18.86g	5.45g
2	11.72g	12.55g	14.52g	8.62g	15.78g	12.02g
3	20.90g	21.15g	19.01g	13.30g	23.90g	8.38g
4	17.50g	24.90g	15.73g	14.98g	17.73g	20.38g
5	17.80g	15.15g	17.90g	12.48g	16.46g	8.35g
6.	22.67g	16.40g	20.60g	16.60g	19.57g	28.38g
7	11.62g	13.00g	6.70g	8.32g	13.49g	6.87g
8	30.50g	13.55g	31.60g	17.65g	41.40g	12.95g
9	20.15g	17.15g	20.50g	8.25g	23.35g	8.85g
10	22.60g	25.40g	14.80g	10.78g	20.06g	9.45g
Avg.	19.08g	16.56g	17.78g	11.56g	21.05g	12.11g

exclusion cages were sampled, using a one-way analysis of variance with a randomized block design. A summary of these comparisons is presented in Table 5. For 1981, the experimental samples, taken from outside the cages, averaged less biomass than the control samples, taken from within the exclusion cages, although only the difference between the control samples and the samples taken within 5m. of the exclusion cage was significant ($P < 0.05$).

When the 1981 data were compared with those from 1978 (Eline and Keiper, 1979), no significant differences were noted between control samples ($P > 0.05$). These results suggest that the condition of the primary dunes' vegetation would not have changed greatly during the four year period if ponies had not been grazing the dunes.

Comparison between 1978 control samples and 1981 experimental samples did show significant differences in biomass ($P < 0.01$ for samples taken within 5m. of the cage, $P < 0.05$ for samples taken between 5-10m. from the cage).

A decrease in biomass was also noted when 1978 grazed samples obtained in the area 5-10m. from the cage were compared with 1981 grazed samples from within 5m. of the cage and from the area 5-10m. from the exclusion cage ($P < 0.01$ for both comparisons). These results also suggest that the condition of the dune vegetation outside of the exclusion cages has deteriorated to some extent over the period 1978-1981.

Because there was no significant difference in the biomass of control samples taken in 1978 and 1981 from within exclusion cages where grazing was prohibited, it appeared that the decrease in biomass recorded from outside of the cages, where grazing could take place, resulted from the effects of pony grazing on the dune vegetation.

It should be noted, however, that although there were no significant differences between 1978 and 1981 control samples, 1981 control samples weighed less

Table 5. Results of One Way Analysis of Variance Comparisons of 1978 and 1981 Data from Table 4.

<u>Comparison</u>	<u>F_c</u>	<u>Significance</u>
Column 1 and 2	0.95	ns.
Column 1 and 3	0.08	ns.
Column 1 and 4	11.43	P < 0.01
Column 1 and 5	0.42	ns.
Column 1 and 6	6.34	P < 0.05
Column 2 and 3	0.06	ns.
Column 2 and 4	4.79	P < 0.05
Column 2 and 5	2.11	ns.
Column 2 and 6	2.50	ns.
Column 3 and 4	1.94	ns.
Column 3 and 5	0.44	ns.
Column 3 and 6	1.42	ns.
Column 4 and 5	11.45	P < 0.01
Column 4 and 6	0.05	ns.
Column 5 and 6	7.11	P < 0.01

than 1978 control samples. Because grazing was prevented within the cages, grazing could not be responsible for the decrease. Instead the decrease could have resulted from the effects of natural erosive processes. If erosion caused the decrease in biomass between control samples, it could also have contributed to the decreased biomass outside of the cage, so that the effects of grazing may not be as great as they might appear.

Sizes of Deer Populations

The pellet-group count method was used to estimate the size of the deer populations on Assateague. This method has been used successfully by other investigators (Rogers et al. 1958, Stormer et al. 1977). However, in those studies, the researcher worked with either a large number of pellet-groups or a known number of deer in an enclosure. Because of the small number of pellet-groups counted during this study, it must be emphasized that any estimate of population size should only be considered a very rough estimate.

During three surveys of the ten transects, 62 new pellet-groups were located. Thirty-four pellet-groups were noted in inner-dune habitat. The shrub habitat contained the second highest number of new pellet-groups, with 21 pellet-groups being located there. Only six pellet-groups were recorded from the pine woods habitat while only one pellet-group was recorded from the marsh habitat.

The pellet-counts recorded for each habitat over the 14-day survey period (June 14-28, 1981) were averaged to give a daily pellet-count figure. For example, the 34 pellet-groups counted in the inner-dune habitat yielded a value of 2.43 pellet-groups per day when averaged over the 14 days of the survey. Previous research on defecation rates using tame deer found an average deer defecation rate of 15.21 pellet-groups per day (Rogers et al., 1958). Hence, 2.43 pellet-groups/day divided by 15.21 yields 0.16 deer for the inner-dune habitat sampled. The inner-dune area sampled was only 1/3 ha. (hectare) out of a total of 701 ha. covered by inner-dune

vegetation, so the number of deer located in 1/3 ha. (0.16) must be multiplied by 2124 (701 ha. divided by .33 ha.) to provide the estimated number of deer found in the inner-dune area. This figure (2124 x .16 deer) equals 340 deer. This procedure was repeated for each habitat sampled and resulted in an estimated population of between 600 and 700 deer on the Maryland portion of Assateague Island (Table 6).

This population figure is a rough estimate because it is based on a short sampling period and on a limited number of pellet-groups. In addition, the figure is for the total deer population and does not distinguish between Sika and white-tailed deer. There are no data available for daily defecation rates for Sika deer, and the figure used in our calculations (15.21 pellet-groups/day) may be too low for these smaller-sized deer. If Sika deer do have higher defecation rates, then the population figure of 600 deer might be too high.

Deer Food Habits

Microscopic examination of 29 deer fecal samples collected in June of 1981 and compared with known plant materials from a reference collection provided some information on the food habits of the deer on Assateague Island National Seashore (Table 7). Analysis revealed that although there are at least 441 different species of plants on Assateague (Higgins et al., 1971), less than 30 kinds of plants were identified in the samples and only 12 species made up more than 90% of the relative density of plant fragments in the samples. Myrica (wax myrtle and bayberry) was present in 27 of the 29 pellet samples (93.10%) and comprised 57.51% of the relative density. Dwarf sumac and poison ivy (Rhus spp.) were present in 82.75% of the 29 samples and made up 18.97% of the relative density of the identifiable plant fragments in the samples. Other important species included Rosa (wild rose), which was present in 37.93% of the fecal samples, Lonicera (honeysuckle) which was found in 44.82% of the samples, Solidago (goldenrod) which was present in 44.82% of the samples, and Vitis (grape)

Table 6. Estimation of Deer Populations

	<u>Habitat</u>			
	<u>Dune-Inner Dune</u>	<u>Pine Woodlands</u>	<u>Shrub Thicket</u>	<u>Saltmarsh</u>
# Pellet-groups counted in survey	34	6	21	1
# Pellet-groups/Day	$\frac{34}{14} = 2.43$	$\frac{6}{14} = 0.43$	$\frac{21}{14} = 1.50$	$\frac{1}{14} = .07$
$\frac{\text{\# Pellet-groups/Day}}{\text{Daily Deer Defecation Rate}}^1$	$\frac{2.43}{15.21} = 0.16$	$\frac{0.43}{15.21} = 0.28$	$\frac{1.50}{15.21} = .10$	$\frac{.07}{15.21} = .005$
Total Area Surveyed	.33 ha.	.05 ha.	.13 ha.	.05 ha.
Total Habitat Area ²	701 ha.	86 ha.	211 ha.	1446 ha.
$\frac{\text{Total Habitat Area}}{\text{Total Area Surveyed}}$	2124	1720	1623	28920
Estimated Deer/Habitat	$(0.16) (2124) = 340$	$(.028) (1720) = 48$	$(.10) (1623) = 162$	$(.005) (28920) = 145$

Total Estimated Deer Population = 695 deer

1 = Daily Deer Defecation Rate from Rogers et al. (1958)

2 = Land Area Estimates from Turner (1979)

which was found in 55.17% of all fecal samples. Trees were not utilized to any great degree during the survey period. Pinus (pine) fragments were found in only 20% of the fecal samples. Quercus (oak) fragments were recorded from 17% of the 29 samples, while Ilex (holly and inkberry) with 14%, Prunus (cherry) with 10%, and Juniperus with 10% were less common. Smilax (greenbriers) were only present in two samples. Grasses also were not utilized to any great degree by the deer during this survey, for grass fragments were found in only 37.93% of all samples and made up less than 4% of the relative density. Individual fecal sample analyses are presented in the appendix.

These results suggest that in late spring the deer fed primarily on herbaceous rather than woody vegetation. Similarly, grasses were relatively unimportant in the deer diet, meaning there was little overlap in the diet between deer and ponies and hence apparently little feeding competition at this season. Deer feeding also apparently had little impact on the dune and salt-marsh vegetation. Since diet usually changes from season to season, diet overlap and hence feeding competition may occur between deer and ponies during other times.

Initial data analysis did not seem to indicate two distinct spring diets between the deer species. If the samples did include pellets from both deer species, then there was a good deal of dietary overlap between Sika and white-tailed deer. For example, Myrica and Rhus were represented in over 93% and 82% of the samples, respectively, and over 75% of the samples (22 out of 29) contained fragments of both plant genera.

PH of Deer Pellets

The results of the pH analysis conducted on the unknown and known deer pellets indicated that this method was unable to separate the white-tailed deer pellets from the Sika deer pellets. For the unknown samples there was no clear dissection of samples based on pH which could indicate a difference between white-

tailed and Sika deer pellets. Instead the unknown samples ranged only from a pH of 5.00 to a pH of 8.00, with 51 of the 62 samples showing a pH of 6.00 to 7.50 (Table 8). All of the 13 known samples, obtained from white-tailed or Sika deer examined at the deer check station during the 1981 hunting season, also showed a pH of 6.00 to 7.50.

These results suggested that there was a complete overlap of pH between Sika and white-tailed deer pellets so that pH analysis therefore could not be used as a way of separating out deer pellets and then studying the specific food habits of the two species.

Data from Deer Hunting

During the 1981 hunting season on Assateague, 63 deer were collected from AINS. These included 52 Sika and 11 white-tailed deer. Only 56 deer (45 Sika and 11 white-tailed deer) were processed at the deer check station and only data from these animals were included in the discussion below. All data collected on each harvested deer processed at the deer check station are included in the Appendix of this report.

Sex

Of 45 Sika deer harvested in 1981, 18 deer (40%) were male, 17 deer (37.8%) were female, and 10 deer were fawns (Table 9). Because all Sika deer were dressed the sex was determined by the presence of antlers in males and the absence of antlers in females. Since male fawns lack antlers, the male fawns could not be distinguished from the female fawns so the sex of fawns was not recorded (male fawns could be sexed by the presence of male reproductive structures, but these are destroyed by dressing). Of 11 white-tailed deer harvested, 4 deer were males (36.4%), 5 deer were females (45.4%), and 2 deer were fawns whose sex could not be determined. In 1981 for both deer species the

Table 8. pH of Unknown and Known Deer Pellets.

<u>pH</u>	<u># of Samples of Unknown Pellets</u>	<u># of Samples of Sika Deer Pellets</u>	<u># of Samples of White-tailed Deer Pellets</u>
5.00 - 5.50	2	0	0
5.51 - 6.00	4	0	0
6.01 - 6.50	18	1	0
6.51 - 7.00	19	1	7
7.01 - 7.50	14	1	3
7.51 - 8.00	5	0	0
	62	3	10

Table 9. Species and Sex of Deer Killed in Assateague Island National Seashore in 1981.

<u>Sika Deer</u>				<u>White-tailed Deer</u>			
<u>Male</u>	<u>Female</u>	<u>Fawn*</u>	<u>Total</u>	<u>Male</u>	<u>Female</u>	<u>Fawn*</u>	<u>Total</u>
18	17	10	45	4	5	2	11
40.0%	37.8%	22.2%		36.4%	45.4%	18.2%	
Male:Female Sex Ratio		1.06		0.80			

*The sex of fawns could not accurately be determined.

male:female sex ratio approached 1.0 (1.06 for Sika, 0.8 for white-tailed deer). Since the number of males and females are about equal at birth (Schemnitz, 1980) these data suggest that mortality was not sex-specific; hunters do not apparently selectively harvest male deer of either species.

Age

The ages of 44 of the 45 Sika deer inspected were tallied. The age of one female Sika deer was not obtained because the lower jaw was shot off. These data are presented in Table 10. Twenty-seven (61.4%) of the forty-four harvested Sika deer that were aged were fawns and yearlings. The average age of the Sika deer tallied was 2.02 years ($\pm$ SE .20 yrs.). Females were more prevalent in the older age classes but their average age ($x = 2.75$ yrs., SE $\pm .37$ yrs.) did not differ significantly ($P < .05$) from that of males ($x = 2.22$ yrs., SE $\pm .21$ yrs.). The fawn:adult female ratio, an indicator of reproductive success, was relatively high at 62.5%. The ten fawns comprised over 22% of the Sika deer harvested. These results suggest that the Sika deer harvest was fairly heavy, with younger animals making up the principal kill. The harvest, in turn, appeared to be balanced by good reproductive success and rate of increase.

The white-tailed deer harvest revealed an age structure similar to that of Sika deer. Five (45%) white-tails were fawns or yearlings and the remaining six deer were three year olds. The small sample size precluded a more detailed analysis.

Since no age data were available for Sika and white-tailed harvested during the period 1978-1980, the age data collected in 1981 could not be compared with data from previous years.

Table 10. Age Distribution of 44 Sika Deer and 11 White-tailed Deer
Harvested in 1981

<u>Sika Deer</u>			
<u>Age (Yrs.)</u>	<u>Male</u>	<u>Female</u>	<u>Fawn</u>
$\frac{1}{2}$	0	0	10
$1\frac{1}{2}$	10	7	0
$2\frac{1}{2}$	3	4	0
$3\frac{1}{2}$	5	1	0
$4\frac{1}{2}$	0	2	0
$5\frac{1}{2}$	0	2	0
Total	18	16	10

<u>White-tailed Deer</u>			
<u>Age (Yrs.)</u>	<u>Male</u>	<u>Female</u>	<u>Fawn</u>
$\frac{1}{2}$	0	0	2
$1\frac{1}{2}$	3	0	0
$2\frac{1}{2}$	0	0	0
$3\frac{1}{2}$	1	5	0
Total	4	5	2

Eye-Lens-Age Relationship

A weak linear relationship was found between eye lens weight and age of Sika deer ($r^2 = .55$; $P < .01$ Figure 3). Additional data and analysis using curvilinear models would likely show a higher correlation (Feldhamer and Chapman, 1980).

Weight

The dressed weights of 45 Sika deer are presented in Table 11. The mean weight of ten Sika fawns was 23.90 pounds. Eighteen adult male deer (animals $1\frac{1}{2}$ years of age or older) averaged 48.94 pounds. while seventeen adult female Sika deer averaged 42.65 pounds. The two white-tailed deer fawns averaged 32.5 pounds, although one animal was not field dressed when weighed. Three male white-tailed deer averaged 86.3 pounds (the fourth male was not field dressed) while five female white-tails averaged 54.4 pounds. The small sample size precludes any additional analysis. Sexual dimorphism in weight is characteristic of members of the deer family.

Girth-Weight Relationship

A fairly good linear correlation existed between the weight and girth of field-dressed Sika deer ($r^2 = .61$; $P < .01$ Figure 4). The small size of the white-tailed deer harvest prevented an analysis of the weight-girth relationship in this species.

During the 1981 hunting season, the deer kill (63 animals harvested) was higher than in any of the years in the period 1978-1980 (Table 12). Sika deer made up 82% of the 1981 harvest compared to an average of 72% of the harvest for the three previous years (Table 12). These results may suggest that the number of Sika deer, relative to the number of white-tailed deer, are increasing.

Fig. 3. Relationship of Age and Eye Lens Weight for 34 Sika Deer

Age is a "best estimate" obtained from tooth replacement/wear and/or annuli count methods.

When both eye lenses were collected, the average weight was used.

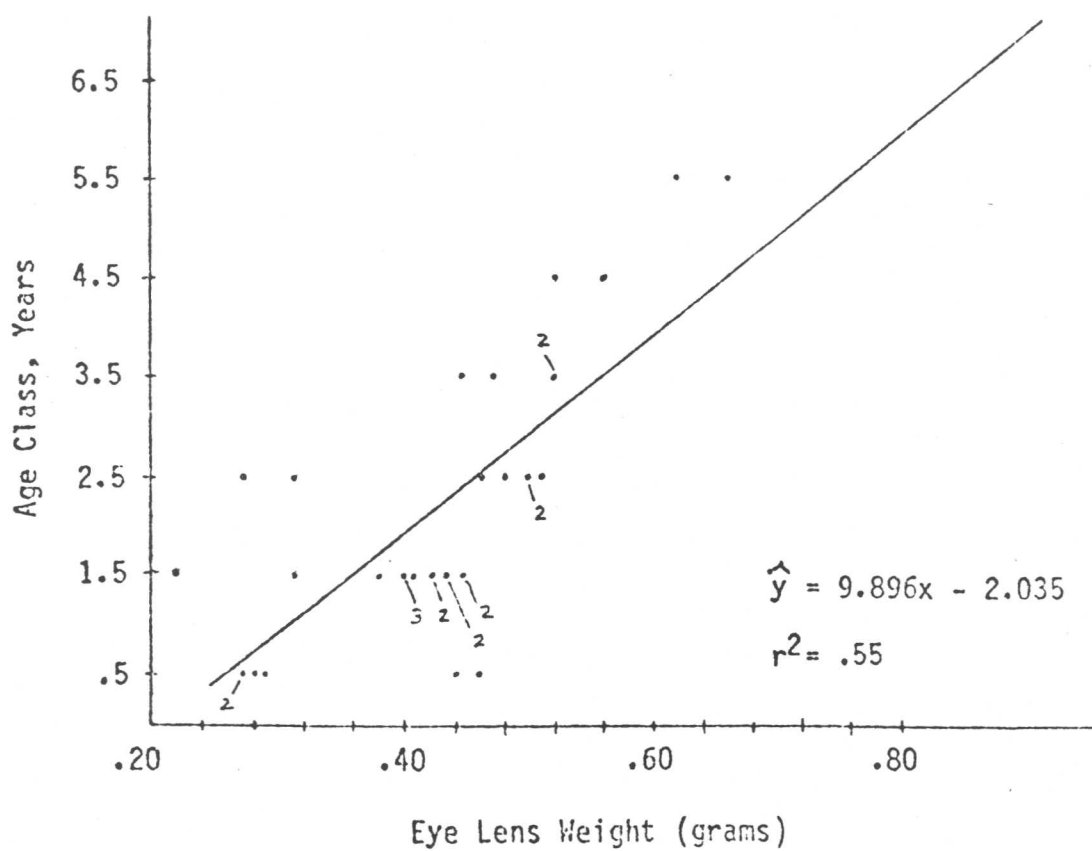


Table 11. Dressed Weights (pounds) for Sika and White-tailed Deer Killed on Assateague Island National Seashore in 1981.

<u>Sika Deer</u>			
<u>Age Class</u>	<u>Mean Wt.</u>	<u>Standard Error</u>	<u>Sample Size</u>
Fawn (less than 1 yr.)	23.90	1.40	10
Adult Male (over 1 yr. of age)	48.94	1.86	18
Adult Female (over 1 yr. of age)	42.65	2.46	17

<u>White-tailed Deer</u>		
<u>Fawn</u>	<u>Adult Male</u>	<u>Adult Female</u>
30	87	60
35 (not dressed)	97	67
	68 (not dressed)	37
	75	63
		45

Fig. 4. Relationship of Weight and Girth for 44 Field Dressed Sika Deer

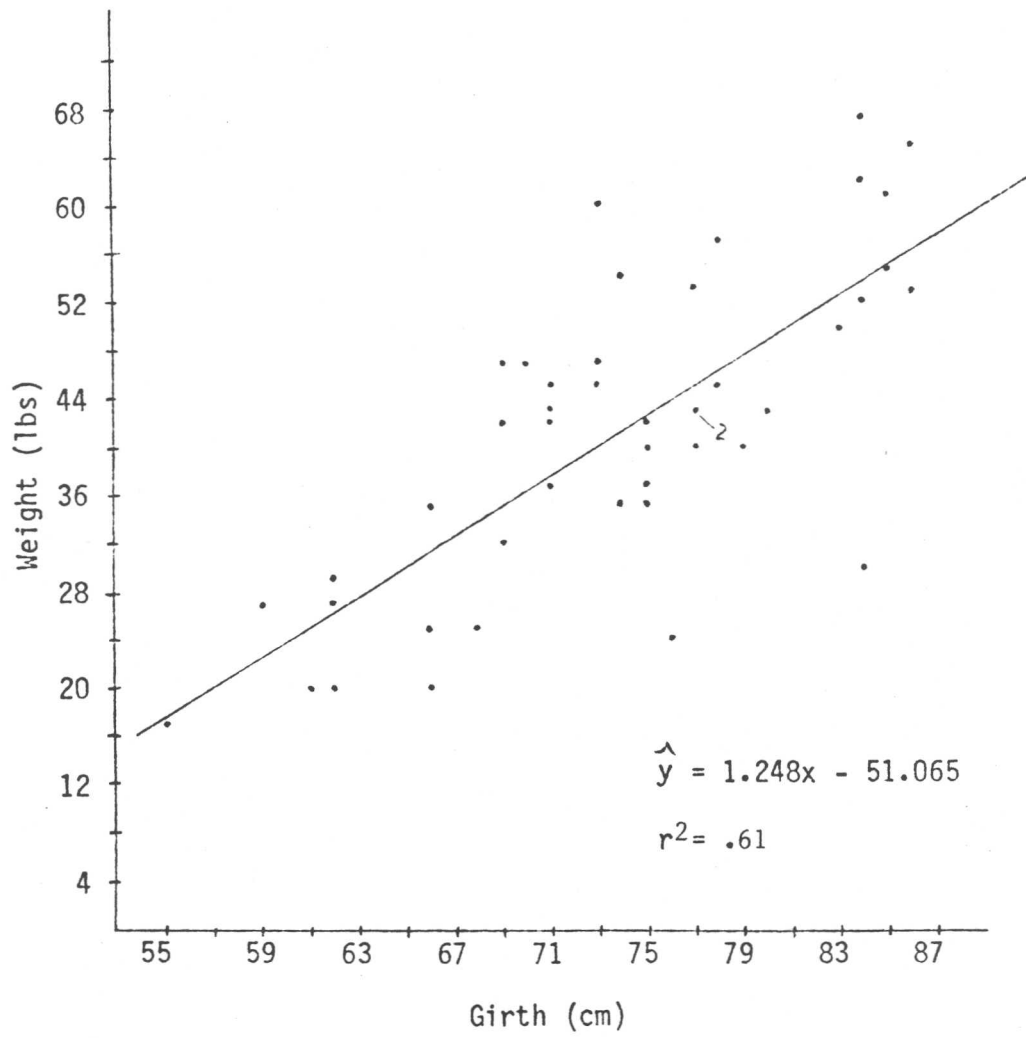


Table 12. Species Composition of Deer Harvested in Assateague Island National Seashore, 1978-1981.

<u>Year</u>	<u>Sika Deer</u>	<u>White-tailed Deer</u>	<u>Total Deer</u>	<u>% Sika Deer</u>
1978	26	10	36	72.2%
1979	38	13	51	74.5%
1980	37	16	53	69.8%
1981	52	11	63	82.5%

Other comparisons between the data collected in 1981 and the data recorded during the period 1978-1980 cannot be made because the deer harvested during the years 1978-1980 were not properly sexed or aged. Deer were classified as male and female apparently on the basis of the presence or absence of antlers. Male fawns would not show antlers, but could not be identified as male deer because the reproductive structures needed for proper sexual identification were destroyed by field dressing. Male fawns, therefore, were probably classified as female deer, effecting the validity of male:female sex ratios and preventing valid comparison with 1981 sex data.

Similarly because the data collected for the years 1978-80 did not distinguish between fawns and older animals and did not determine the ages of older deer, accurate information on the age structure of the population could not be gathered. The data on dressed weights for those years also did not differentiate between weights of fawns and weights of adult animals so that the data cannot validly be compared with the weight data for known aged deer collected in 1981.

CONCLUSIONS

1. The pony foaling rate dropped significantly in 1981 to one of the lowest rates since 1975. The number of foals born was less than the previous year despite the fact the population contained more sexually mature mares than ever before. The reduced foaling rate may have been caused by inbreeding within the population or it may have resulted from the age structure of the population (i.e., the increase of young sexually mature mares less than five years of age). Younger mares showed a lower foaling rate than mares five to ten years of age (about 30% versus 60-70%).

Because of the reduced foaling rate, the pony population does not appear to be growing as fast as predicted in earlier investigations. The estimated carrying

capacity of 150 animals (Keiper and Zervanos, 1979) may not be reached until at least the end of the 1980s. Selective management actions may be necessary for certain bands before that time.

2. Because of the continued, almost constant utilization by K band on the state and federal campgrounds, there is an increased opportunity for the ponies to cause personal injury to visitors and damage to their property. This band could be studied in more detail to determine the factors that trigger personal pony attacks or "raids" on campsites. If the specific factors which contribute to or initiate negative pony behavior can be identified, then mitigation measures could be instituted through visitor education or changes in park regulations.

3. Pony grazing seemed to have a significant effect on the dune vegetation, for biomass samples taken within 5m. of the exclusion cages in 1981 weighed significantly less than the control samples yet this was not the case in 1978. However, since control biomass samples taken from within exclusion cages in 1981 weighed less than control samples from 1978, some of the decrease in biomass may be due to deterioration of the dunes and the covering vegetation as the result of natural erosion.

4. A more accurate determination of the population sizes for Sika and white-tailed deer would require either long-term data collection from hunter kills or shorter-term, but more costly, use of trapping - recapture or radio-telemetry techniques. Continued use of pellet-group counts are not advised unless additional funding can be devoted to surveying additional transects over a longer period of time. Other techniques for estimating population sizes, such as "driving" or spot-lighting, are considered impractical on Assateague Island due to the paucity of roads and the thickness of the vegetation.

5. The limited deer food data collected during this study suggests that there was minimal spring diet overlap and feeding competition between the ponies and the deer and that the deer had little effect on the dune and saltmarsh vegetation. On the other hand, both deer species seemed to have similar dietary preferences, suggesting late spring feeding competition between the species; they both fed largely on Rhus and Myrica. The information was not species-specific, because we were unable to distinguish whether the analyzed pellets came from white-tailed or Sika deer.

If trapping and/or the use of radio-telemetry of deer is initiated on the island, known pellet samples and visual observations of feeding could be used to accurately assess the diet of each species.

Additional information on deer diet could be obtained by examining rumen samples. Preliminary attempts to get hunters to collect a rumen sample while gutting their deer proved successful; this suggests that more rumen samples could be obtained in the future if a deer check station was operated for that purpose.

6. The preponderance of young in the Sika deer harvest indicated high rates of death and recruitment, apparently due to hunting pressures. Studies of other members of the deer family in North America show this age structure to be typical of hunted populations. In a heavily hunted population of white-tailed deer in New York, 66% of the harvest was fawns and yearlings; 80% was 2-1/2 years old or less (Taylor, 1956). In elk harvest records from the Jackson Hole - Yellowstone National Park region, calves comprised 9-21% of the total elk kill (average about 17%) and cow and calf ratios of 38-41% were observed in free-ranging herds during the same time period (Murie, 1951). In a population in which hunting is both a primary source of mortality and a management tool, the net

impact of hunting on population size is of primary interest. Allen (1961) stated that deer populations can sustain annual harvests of at least 25%. Taylor (1956) found that mule deer herds can remain stable with as much as 40% of an annual harvest made up of young deer taken before their first breeding season. The preliminary findings of this study indicate that the Sika deer harvest is within these rough guidelines.

7. Definite correlations existed between (a) eye lens weight and age, and (b) girth and weight. With some refinements, these relations can aid in the collection of field data from hunter-killed animals and provide management information that might otherwise be unattainable.

8. The continued collection of data from hunter-killed deer is vital to the scientific management of deer on Assateague Island. The small sample size and the lack of repeated sampling over a period of several years preclude definitive statements about the Sika deer herd and rule out virtually any conclusions on the white-tailed deer herd at this time. Population estimates can be obtained from the age and sex data but only after two or more successive years of data collection (preferably several for deer). Likewise, weights of field-dressed deer can provide a reliable index of animal condition and carrying capacity levels only when compared from one year to the next.

RECOMMENDATIONS

1. The population dynamics and the social organization of the ponies should be monitored by recording the size and sex and age composition of each of the bands and the birth date, sex, and parentage of each foal born in 1982. The reproductive information can be used to calculate the foaling rate which can be compared to previous data to determine reproductive patterns.

2. The home ranges of the pony bands should be plotted in the future in order to aid in the recognition of potential overgrazing areas before damage is done to the vegetation. Sufficient data on habitat utilization, however, is available and it does not seem necessary to collect additional data in the future, except in the case of a new band.

3. The effects of pony grazing on the dune vegetation should be monitored by comparing the biomass of ungrazed vegetation samples collected from within barbed wire exclosures and samples randomly collected outside of the exclosures at the end of the 1982 summer vegetation growing season.

4. The year-round diet of the deer on Assateague should be studied by identifying the plant fragments observed in pellet samples collected from known deer at all seasons of the year. Pellets collected from known hunter-killed deer or from deer under visual observation should be utilized.

5. The home ranges and habitat utilization of Sika and white-tailed deer should be studied by following the movements of animals of each species that are fitted with radio-telemetry collars.

6. Additional data on the sex, species, age, weight, and girth of hunter-killed deer should be obtained by operating a deer check station during the 1982 deer hunting season. This data would provide a more accurate estimate of the size, sex and age composition of each deer population on Assateague Island National Seashore.

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APPENDIX

Percent relative density of discerned fragments from deer fecal samples collected by
 Ron Kelper from Assateague Island during 1981. Based on 20 fields per sample.
 (Table completed February 12, 1981)

	#1	#2	#3	#4	#5	#6	#7	#8	#9	#10	#11	#12	#13	#14	#15
	6/19	6/18	6/15	6/15	6/22	6/22	6/17	6/18	6/18	6/17	6/16	6/16	6/18	6/15	6/18
TENTATIVE IDENTIFICATION															
<u>Anemophila</u>							2.22								
<u>Distichlis</u>							2.22	8.26			9.59	8.95			
<u>Eleocharis</u>												8.15			
<u>Leptochloa (type)</u>							12.17					2.82			
<u>Panicum (type)</u>							2.22					8.95			
<u>Phragmites</u>								2.61							
<u>Spartina</u>											3.03				
Unknown grass					1.85									2.76	
Fern												2.82			
<u>Hudsonia</u>					1.85			2.61							
<u>Ilex</u>										6.03				6.07	
<u>Juniperus</u>										20.59					
<u>Lonicera</u>		1.91				3.08	2.22	2.61			3.03			6.07	2.00
<u>Myrica</u>	85.95	95.03	74.33	61.77	1.85	87.57		2.61	91.50	15.66	54.05	2.82	3.77	67.55	87.67
Mushroom															
<u>Pinus</u>		1.63		2.77						12.76				1.81	
<u>Prunus</u>					1.85										
<u>Quercus</u>					5.86		2.22								
<u>Rhus</u>		6.07		4.87	32.26	83.01	1.75	67.77	70.13	2.01	7.30	21.05	50.43	15.41	2.96
<u>Rosa</u>			7.51				2.22	8.26			3.03	5.80	57.57	2.96	
<u>Smilax</u>					1.85										
<u>Solidago</u>			13.21				2.22		6.16		6.22	2.82			2.00
Seed															
<u>Vaccinium</u>										2.93					
<u>Vitis</u>		6.07	3.34		1.85	3.08		2.61					21.39	9.39	
Unknown forb						1.50				2.13		2.82			
Unknown forb I							2.22					2.82			

Assateague Island 1981 Continued

	#16	#17	#18	#19	#20	#21	#22	#23	#24	#25	#26	#27	#28	#29
	6/19	6/17	6/31	6/28	6/17	6/15	6/17	6/17	6/18	6/22	6/15	7/17	6/22	
TENTATIVE IDENTIFICATION														
<u>Ammophila</u>														
<u>Distichlis</u>		2.69	3.20											
<u>Eleocharis</u>			3.20											
<u>Leptochloa (type)</u>														
<u>Panicum (type)</u>									2.17	4.54				
<u>Phragmites</u>			3.20											
<u>Spartina</u>			3.20											
Unknown grass								2.74						
Fern								10.66					2.59	
<u>Hudsonia</u>														
<u>Ilex</u>						2.74				2.21				
<u>Juniperus</u>			10.13										8.21	
<u>Lonicera</u>		2.69	6.57					6.91	20.46	2.47		2.04		
<u>Myrica</u>		2.69	37.25	87.87	86.00	66.13	86.25	6.11		77.49	81.82	95.74	91.72	95.62
Mushroom			7.70											
<u>Pinus</u>								3.36		2.21				
<u>Prunus</u>								3.36			2.13			
<u>Quercus</u>						2.75		6.05	2.47					
<u>Rhus</u>		55.05	26.65		28.45	2.75	33.46	6.05	5.08	7.01	2.13		4.38	
<u>Rosa</u>		5.53					10.66	6.05				2.04		
<u>Smilax</u>									2.47					
<u>Solidago</u>				5.63	2.46	2.75	3.26		2.17		4.20		2.59	
Seed		3.20						2.74						
<u>Vaccinium</u>														
<u>Vitis</u>		31.35	3.20	2.13	5.63	2.46	2.75		52.57	5.08	2.21			
Unknown forb						2.75	10.66	2.74					5.32	
Unknown forb I								10.66						