

FALLOW DEER CENSUS AT POINT REYES NATIONAL SEASHORE
FOR FALL 1975

Submitted by: Henry W. Elliott III

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SUMMARY

A minimum of 492 fallow deer existed at Point Reyes National Seashore in December 1975. This corresponds with the 1973 census of 479 fallow deer. The maintenance of the 1973 population level and a reduction of deer density within two subsections within the pastoral zone is an apparent effect of the two year scientific collection. A doe population increase of 12 percent per year since 1973 could have been possible if the herd reduction had not occurred. In 1976 a 3.6 percent increase of the doe population from 1975 levels is possible. This low rate of increase is attributable to the low 35 fawn per 100 doe ratio for fall 1975. A 47 buck per 100 doe ratio indicates a higher buck mortality rate than doe mortality rate. The helicopter census technique is effective in counting the total population of fallow deer.

INTRODUCTION

A study in 1973 of the fallow deer (Dama dama) at Point Reyes National Seashore established their population at approximately 500 animals (Wehausen 1973). They are the descendents of probably 28 deer introduced in the 1940s and early 1950s. Concern about their effect on the habitat and on other hoofed mammals (cattle, native black-tailed deer and exotic axis deer) within the Seashore (National Park Service 1975) prompted a two year pathological study by the California Department of Fish and Game with Park Service assistance commencing in September 1973. Field collections of the exotic deer provided specimens and at the same time served as a means of limiting population growth.

The following report establishes the current population density of the fallow deer at Point Reyes National Seashore. It quantifies the impact of the recently concluded scientific collection and monitors the effect of any other factors (range condition, disease, poaching) active within the last two years. Comparison of the current deer density with the previously known deer density in 1973 can serve as a useful tool in determining resource management action in 1976.

METHODS

Similar to the criteria of Wehausen, the fallow deer range was divided into eight subsections (see Map pg.11). They were demarcated by topography that permitted each subsection to be censused within a half day's time. To avoid counting deer twice adjacent subsections were censused sequentially. Most of the whole range was covered within a week's time as weather and logistics permitted.

An entire subsection was traversed by foot and/or automobile. When possible high hills and other panoramas were used as vantage points to overlook large areas. Deer were spotted with 7 x 35 binoculars and counted with a 15 and 25 power telescope. The date, time, location, age and sex (bucks, does, fawns) and antler size (four categories: I - spike, II to IV - in order of increasingly larger size, respectively) were noted. Four censuses of the entire deer range were made between September 23, 1975 and December 21, 1975. Several additional censuses were made within the pastoral zone (land grazed by livestock) on the Grossi, Heims and Murphy subsections because of their accessibility and large concentrations of deer.

A two passenger Enstrom helicopter was rented from Commodor Helicopters, Inc., Mill Valley, California. It was used to census most of the entire range for two hours on November 23, 1975. A 90 to 230 mm zoom lens, mounted on a 35 mm camera, was used to take High Speed Ektachrome slides of the large groups (greater than ten individuals) for later counting on a screen. Subsections not flown over, because of flight time limitations, were counted

the same or next day on foot. The helicopter flew from the southern boundary of the Seashore north to Sir Francis Drake Blvd. following topographical contours. An additional 1½ hour helicopter flight on December 14, 1975 was used to count fallow deer within the pastoral zone.

RESULTS

The number of individual deer counted on the ground was 492 between December 10 and December 21, 1975. This figure represents the minimum number of deer present on the fallow deer range. It correlates with the 490 deer tallied on the November 23, 1975 helicopter flight with supplementary ground censuses. The results of the four entire range censuses are presented in Table 1.

The distribution of fallow deer in each subsection for the December ground count is presented in Table 2. The distribution of spikes, does and fawns in both December 1973 and 1975 is in Table 3.

All censuses conducted within the pastoral zone are presented in Table 4.

The average percentage of bucks in four size categories seen in the four entire range censuses are presented in Table 5.

DISCUSSION

Population Growth: The December, 1975 minimum population of 492 fallow deer at the Seashore is similar to the 479 fallow deer tabulated by Wehausen for the fall 1973. The lack of growth

in this population that had been assumed to be continually increasing invites analysis of the population reduction effect of the scientific collection.

The scientific collection harvested approximately five fallow deer per month for two years. If the does and female fawns shot (35 does, 2 fawns in 1973-74; 34 does in 1974-75) are subtracted from a two year annual increase at twelve percent of the does present in 1973 (256), the number of does seen in December 1975 (246) is calculated. This is close to an eleven percent average annual doe increase predicted by a model developed by Wehausen. Neither the predicted growth rate nor the population limiting effect of the scientific collection is proven. But the consistent results produced by considering their effect on each other adds mutual support to their validity.

Changes in subsection density: On the Grossi subsection the density of spikes, does and fawns had stayed the same (Table 3). However, the Rodgers Ranch on the Grossi subsection had frequent sightings of fallow deer whereas none were sighted by Wehausen.

On the Heims and Murphy subsections of the pastoral zone occurred much of the scientific collection. A decrease in fallow deer density is evident on these lands that have the largest concentration of fallow deer and the greatest effect of fallow deer competition with cattle. In six censuses on the Heims, Murphy and Turney subsections from January to October 1973 Wehausen found an average of 221 ± 8 ($P \leq 0.05$) deer. In ten censuses during 1975 (eight ground and two air) of the Heims and Murphy subsections and sometimes including the Turney subsection an

average of 176 ± 26 ($P \leq 0.05$) fallow deer were present. The 45 ± 27 ($P \leq 0.05$) deer difference between years is highly significant ($P < 0.01$) by the method of "Comparison of means of two small samples (unknown variances not assumed equal)" given by Bailey (1964).

Fallow deer in the Coast Trail and Laguna Ranch subsections have increased (Table 3). The number of does multiplied in these subsections from 66 to 90 at an approximate rate of 18 percent per year. The difference between this rate of growth and the 12 percent rate for the total population may be due to immigration. Data is not available on deer movement into and out of these subsections. However, a white doe with a bobbed tail was noted in October 1975 copulating with a white buck in the Murphy subsection. A white doe with a bobbed tail was seen in December 1975 on the Laguna Ranch subsection.

The Olema subsection has had an increase in deer since the first sighting of three does and one buck in 1973 (Wehausen 1973) (Table 3). Fifteen fallow bucks were counted there in November 1975. Fallow bucks, which appear to be the vanguard of colonization, are now occasionally sighted as far south as Palomarin (Point Reyes National Seashore observation file).

Current Reproductive rate: Of the 3228 sightings that were classified on the ground throughout this study, 35 fawns per 100 does were seen. This is consistent with the average ratios for fawns found in systematic sampling of the total population and subsection censuses presented in Table 6. This fawn per doe ratio is low compared to the 72 fawn per 100 doe ratio possible

if all mature does raised a single fawn (Yearlings, classified as does, do not reproduce and twins rarely occur in mature does) and a stable age distribution is assumed.

Diseases of adults and young fawns and/or predation may be primarily responsible for the current low reproductive rate. Information on the former will be available when the findings of the two year pathological study by the Department of Fish and Game are reported. The effects of predation could be studied by collecting relatively fresh bobcat and gray fox scat during and after the fawning season in April, May and June when fawns are most vulnerable. The scat could then be analyzed for exotic deer hair.

It is possible that the total doe population on the Seashore could increase from 1975 levels by 3.6 percent in 1976. This figure is derived by taking the total doe population of the December 1975 census and adding an increase of females given by the fawn per doe ratio of 35 : 100 for fall 1975 and the sex ratio of 55 male per 45 female fawns found by Wehausen, then subtracting the 12 percent annual doe mortality predicted by Wehausen's model.

The discrepancy between the 3.6 percent doe increase predicted for 1976 and the 11 percent doe increase modeled by Wehausen is attributable to unequal fawn to doe ratios. Wehausen used a ratio of 52 fawns per 100 does that he found in summer 1973. This is much higher than the 35 fawns to 100 does found in the fall 1975. This comparison of a generalized model with data that is effected by environmental perturbations emphasizes

the importance of annual population censuses. An annual culling scheme that attempts to maintain a constant deer density must reflect annual changes in the reproductive rate.

Buck : Doe Ratios & Antler Classification: Of the 3228 sightings that were classified on the ground throughout this study 45 bucks per 100 does were seen. This is slightly higher than the averages for the systematic censuses presented in Table 6. It is similar to the 47 bucks per 100 does classified by Wehausen in his December 1973 census of the total population. The mortality rate of bucks is much higher than females. Male fawns were found to be more numerous than female fawns (55 males per 45 females) at 8 to 10 months of age by Wehausen in the winter 1973.

The correlation of antler size categories and age in fallow deer has not been satisfactorily substantiated. However, the distribution of individuals within the four antler size categories (Table 5) has a large complement of spikes (I) which are probably ^{deer} ~~are~~ in their second year of life. This is typical of animals in an increasing population (Krebs 1972). Whether the difference between I and II categories indicates a high mortality rate between the second and third year awaits determination of antler size vs. age correlations and further verification of the population growth rate.

Accuracy of the Helicopter Census Technique: The helicopter censuses, used for the first time this year, proved useful in counting the total number of deer. The accuracy of the November 23 flight over most of the deer ^{range} ~~is~~ is substantiated by the December

ground census (Table 1). The smaller number of deer seen on the December 14 flight over the pastoral zone than on the December ground counts (228 vs. 266) may be due in part to deer hidden under the forest canopy. Also, the observers on that flight were primarily concerned with finding axis deer. The helicopter census was particularly useful for counting deer in the Coast Trail and Laguna Ranch subsections. There, topography and forest cover make ground censusing difficult.

Throughout the range small groups (less than 10 deer) could be efficiently classified from the air. However, it was impossible to discriminate among individuals in large groups; and the poor resolution of the 35 mm color film, taken by a zoom telephoto lens, prohibited their classification on a slide screen.

Reccomendations For Future Censuses: I recommend that the total population of fallow deer be counted from a small helicopter in future censuses. The observer should be thoroughly familar with the topography of the deer range so that the location of groups can be noted in flight on a $7\frac{1}{2}^{\circ}$ topographical map for later analysis of population distribution. Herd classification from the air would be useful in the Coast Trail and Laguna Ranch subsections where groups are small and more difficult to find. The pilot can count bucks, while the more experienced observer can discriminate between does and fawns. Age and sex classification on the other subsections, where the deer are in larger herds, can be made by ground sampling. From the sex and age data in Table 6, the number of censuses within the pastoral zone required to determine a significant difference between years

at a 95 percent and 80 percent confidence of 5 and 10 bucks and fawns per 100 does is presented in Table 7. "Stein's two-stage sample" technique (Steel and Torrie 1960) was used to calculate the required number of censuses.

The month of December had good total counts both in 1973 and 1975. However, during all the months of winter, the deer are often in conspicuous, large herds and most easily counted. Helicopter flights were made on calm, clear mornings when the deer were less likely to be lying in protective cover. The two hour limit of the helicopter flying time was not enough to cover the entire fallow deer range. A three hour flight with a refueling landing is suggested for future censuses.

ACKNOWLEDGMENTS

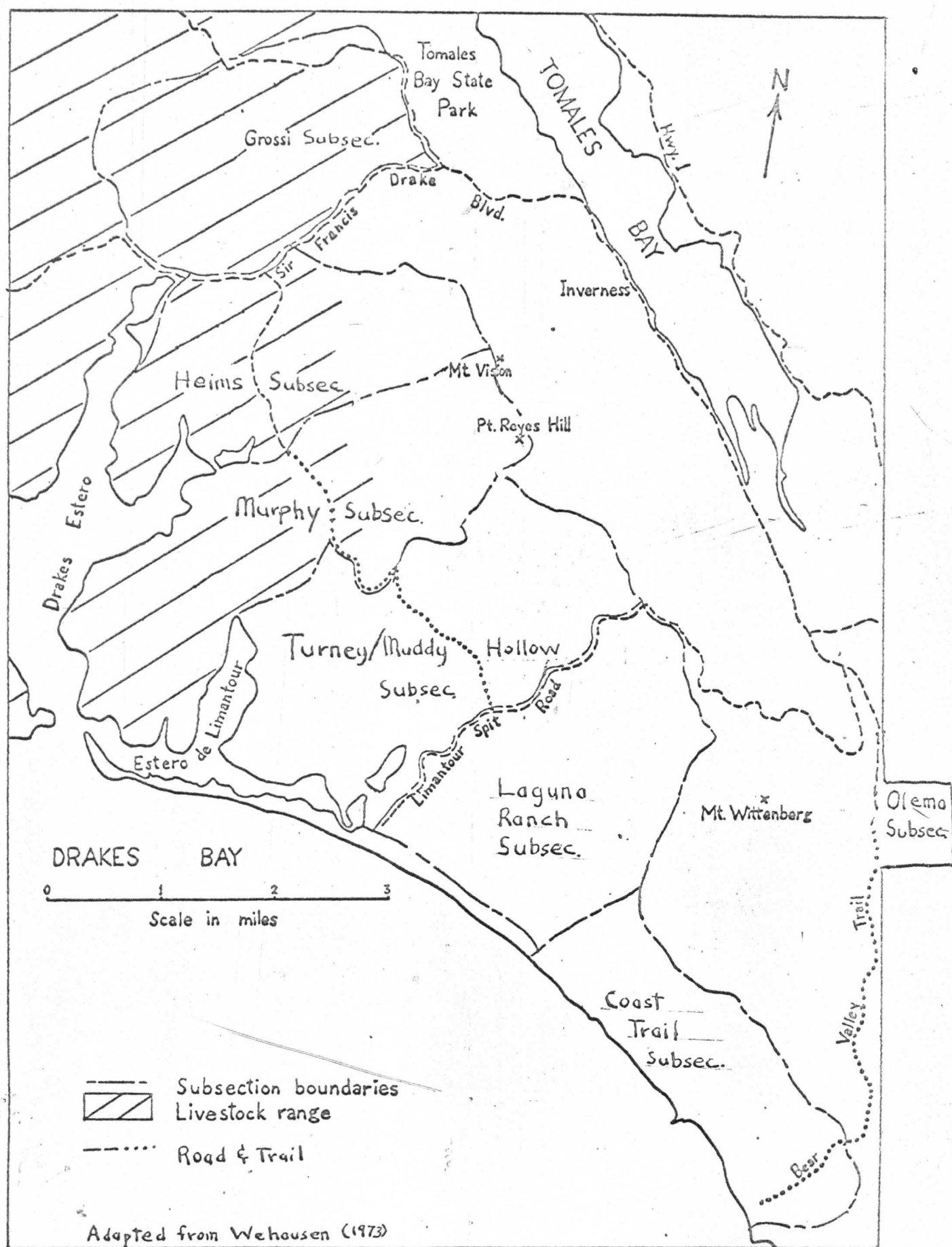
The cooperation and assistance given by the ranchers on the Lee S. Murphy Ranch and the Domingo Grossi Ranch, National Park Service personnel and Ken Hughes, Chief Pilot - Commodor Helicopters, facilitated the accuracy and enjoyment of this study.

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MAP OF FALLOW DEER RANGE

Table 1. Population totals and composition of fallow deer tallied on five censuses (four ground and one air) of the entire fallow deer range in 1975.

Date of Census	Total Counted	Number Observed Per 100 Does	
		Bucks	Fawns
Sept. 23 to Sept. 26	255	33	29
Oct. 27 to Oct. 31	347	36	36
Nov. 14 to Nov. 25	356	45	36
Nov. 23 & Nov 24 (air & ground)	490	-	-
Dec. 10 to Dec. 21	492	58	40

Table 2. The general distribution of fallow deer by subsection as determined by the December 1975 census.

Subsection	Area (mile ²)	Deer/ mile ²	Numbers Tallied				
			Total	Bucks	Does	Fawns	Uniden.
Grossi	4.2	11	47	20	18	9	-
Helms	4.1	21	86	39	35	12	-
Murphy	6.0	22	133	11	87	30	5
Turney/Muddy Hollow	6.7	3	20	6	10	4	-
Laguna Ranch	4.6	17	80	26	42	12	-
Coast Trail	2.9	39	115	31	54	30	-
Olema approx	1.0	11	11	10	0	1	-
TOTAL	29.5		492	143	246	98	5

Table 3. The density of spikes, does and fawns calculated from subsections used by Wehausen as determined from the December 1973 and 1975 censuses. Turney and Muddy Hollow subsections are subsections V and IV - III, respectively, of Wehausen.

Subsection	Area (Mile ²)	1973		1975	
		Total	Deer/ mile ²	Total	Deer/ mile ²
Grossi	4.2	37	8.8	38	9.0
Heims, Murphy Turney	12.0	227	18.9	184	15.3
Muddy Hollow	4.0	29	7.2	9	2.2
Laguna Ranch	4.6	25	5.4	70	15.2
Coast Trail	2.9	81	27.9	101	34.8
Olema	approx. 1.0	0	0.0	2	2.0

Table 4. Population totals and composition of fallow deer tallied on 14 censuses (12 ground and 2 air) within the pastoral zone.

Date of Census	Subsection (G : Grossi H : Heims M : Murphy)	Total Observed	Number Observed Per 100 Does	
			Bucks	Fawns
Sept. 23 to Sept. 25	G,H,M	143	31	31
Oct. 7	M	138	33	28
Oct. 8	M	133+	33	20
Oct. 19	H,M	116	44	24
Oct. 20	M	113	55	33
Oct. 21	M	114	28	35
Oct. 24	H,M	181	46	35
Oct. 25	H,M	143	50	29
Oct. 27 to Oct. 28	G,H,M	222	35	33
Nov. 5 to Nov. 9	G,H,M	251	40	36
Nov. 20 to Nov. 21	G,H,M	229	40	34
Nov. 23 (air)	G,H,M	270	-	-
Dec. 10 to Dec. 12	G,H,M	266	50	36
Dec. 14 (air)	G,H,M	228	-	-

Table 5. The average percentage of bucks in four antler size categories determined from the four entire range censuses. Variances are in parenthesis.

<u>I</u>	<u>II</u>	<u>III</u>	<u>IV</u>
30% (43.0)	8% (1.0)	20% (6.2)	43% (56.6)

Table 6. Average population composition ratios of fallow deer tallied within the given subsections in 1975.

Subsection	Number of Censuses	Number Observed Per 100 Does Variance in ()	
		Bucks	Fawns
Total Range	4	43 (39.2)	35 (20.9)
Grossi, Heims, Murphy	5	39 (50.7)	34 (4.5)
Heims, Murphy	9	39 (79.5)	31 (30.0)
Murphy	12	32 (72.0)	30 (53.2)

Table 7. Number of censuses required to yield a significant difference of 5 and 10 bucks and fawns per 100 does between years at the 95 percent and 80 percent confidence levels within the given subsections censused.

Subsections	confidence: difference:	Bucks				Fawns			
		95%		80%		95%		80%	
		5	10	5	10	5	10	5	10
Grossi, Heims, Murphy		16	4	5	2	2	1	1	1
Heims, Murphy		17	5	6	2	7	2	3	1