

ery); and bait resistance was a recognized variable to be avoided, especially among species of *Arion*. Curiously, in groups of mixed species, the numbers of a species poisoned with metaldehyde baits depended upon the other species present. As an associated species, *Agriolimax reticulatus* (Müller) particularly tended to significantly increase the numbers poisoned.

It remains to be demonstrated whether

or not the presence of slugs and/or other snail species can influence the response of BGS to metaldehyde. Another question relates to the approximately 20 species of slugs, including 10 of foreign origin, in California. Are they less susceptible to metaldehyde than in earlier years? Will they, too, evidence differential susceptibility of potential economic significance as we now have reason to think occurs in BGS?

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DEER PRODUCTION

Hunters and research workers took 2,267 deer from the 5,000-acre Hopland Field Station in southeastern Mendocino County from 1951 through 1974. About half of the deer were bucks taken by hunters and the remainder were antlerless deer shot or trapped for various scientific studies. Compared with this harvest of 12 deer per square mile of range per year, the average hunting kill for Mendocino County during the same period was only two deer per square mile per year. The heavier removal from the Hopland Field Station had no discernible effect on deer numbers, but fawn production and survival on the station were higher than elsewhere in the county. These records show that California deer populations can produce many more deer than are currently being taken with bucks-only hunting and very limited antlerless hunting.

at Hopland Field Station

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DEER MANAGEMENT has been a controversial political issue in California for many years. Biologists generally feel that the full productive capacity of deer populations can be utilized only by taking does as well as bucks, and this concept has been endorsed as Fish and Game Commission policy since 1950. However, few antlerless deer have been hunted in California because of political constraints. The University and the Agricultural Experiment Station have tried to help resolve this controversy by developing the biological facts needed for intelligent deer management. The Hopland Field Station in Mendocino County has been a primary site of the University's deer studies since 1951. In connection with these studies, complete records have been kept of the number of deer removed from the station. These records are summarized here to illustrate the potential for increased deer hunting elsewhere in California.

Hopland Field Station

The Hopland Field Station consists of 5,300 acres of oak woodland and chaparral range lands in the Russian River drainage east of Hopland. Numerous fenced exclosures reduce the range area actually supporting the wild deer popula-

tion to approximately 5,000 acres. Domestic sheep also graze most of the station. Censuses indicate that deer population varies seasonally between 600 and 900 animals—these figures are average minimum (before fawning) and maximum (after fawning) estimates. The station is bounded by conventional livestock fences which deer cross readily. Even though there is continual movement of deer back and forth across the station boundaries, long-term studies of marked animals on the station and adjoining areas show that the deer are quite resident and most spend their lives in areas $\frac{1}{2}$ to $\frac{3}{4}$ miles in diameter. Therefore, we believe we are dealing with a well-defined population, and that immigration onto the station has been negligible, even though deer on the station have been removed at a higher rate than from surrounding areas.

Buck hunting

Prior to 1951 the land was privately owned and was operated as a commercial sheep ranch. Deer hunting was restricted and only the owner's family, employees, and a few friends were allowed to hunt. As a rule only a few bucks were taken and the kill was less than 20 per year. In the early years of the Hopland Field Station (1951-53), hunting was restricted to university employees; public hunting was initiated in 1954 and has continued to the present time (1975). The public hunting is limited to 20 hunters per day,

Saturdays and Sundays only. Only bucks with forked antlers or larger are legal game in this part of the state. Since 1967 a daily fee of \$5 per hunter has been assessed to defray the cost of managing the deer hunt. The deer hunting season in this area is normally open for six to seven weeks during August and September.

Bucks taken

As shown in the table, 959 bucks were taken by deer hunters from 1951 through 1974. During the 21 years of public hunting (1954-1974) the average recorded kill was 42 bucks per year. Additional bucks were crippled and lost, and occasional spike bucks or does were killed illegally. These losses, recorded since 1957, averaged 8 deer per year or about 20 percent of the recorded buck kill. The estimated cripple loss and illegal kill is based on voluntary reports from hunters and carcasses discovered in the field. Most of these carcasses were reported by hunters or found by research workers investigating sites of turkey vulture activity. Additional cripple losses undoubtedly occurred, so the figures shown here are only minimum estimates of deer mortality resulting from sport hunting. Approximately 45 percent of the legal bucks present at the start of the hunting season were killed by hunters each year. Hunter success over the years has averaged one buck taken for every 12 hunter days of effort (ranging between 6 and 26 hunter days per buck taken in various years).

MAN-CAUSED DEER MORTALITY AT THE HOPLAND FIELD STATION, 1951-1974

Year	Bucks taken by deer hunters	Hunting cripple loss and illegal kill	Deer collected for research purposes	Deer removed by trapping	Total
1951 ¹	19	—	2	0	21
1952	16	—	71	0	87
1953	32	—	33	0	65
1954	74	—	17	12	103
1955	59	—	11	26	96
1956	44	—	29	19	92
1957	52	7	134	24	217
1958	51	11	10	12	84
1959	24	4	19	9	56
1960	51	17	16	2	86
1961	46	13	17	6	82
1962	30	6	25	7	68
1963	47	8	46	11	112
1964	31	3	18	35	87
1965	36	5	44	56	141
1966	33	7	71	8	119
1967	17	4	41	5	67
1968	37	9	39	19	104
1969	61	14	26	36	137
1970	31	0	31	26	88
1971	45	10	23	24	102
1972	43	14	35	0	92
1973	44	12	30	0	86
1974	36	6	27	6	75
TOTALS	959	150	815	343	2,267
Yearly average	42 ²	8 ³	35 ⁴	16 ⁵	98 ⁴
Deer per square mile per year	5.4	1.1	4.5	2.1	12

¹ Starting July 1.

² From 1954 when public hunting and trapping started.

³ From 1957.

⁴ Excluding 1951.

⁵ Based on range area of 5,000 acres.

Scientific collections

In studies of food habits, parasites, diseases, reproduction, radiobiology, digestive physiology, and other facets of deer biology, wildlife technicians at the station have taken 815 deer under collecting permits issued annually by the Fish and Game Commission. These collections consisted largely of does, but fawns and spike bucks were sometimes taken for special studies. A few sick or abnormal adult bucks were taken, but bucks generally were avoided because more information (particularly on reproduction) could be obtained from the does.

Wildlife studies at the Hopland Field Station began in November, 1951. For this reason the yearly average figure given in the table for scientific deer collections excludes 1951.

Trapping

Beginning in 1954 various numbers of deer were live trapped each summer. Most of the deer caught were marked, released, and subsequently observed to determine their home ranges and seasonal movements. Others were moved to deer-fenced pastures or holding pens for certain studies; these are included in the table because they were removed from the wild population as effectively as if they had been shot. The majority of these deer were held in captivity for the remainder of their lives. Deer held for a short time and then released were subtracted from the totals shown.

Since the beginning of trapping operations in 1954 an average of 16 deer per year, mostly does, was removed from the range at Hopland by trapping. A few spike bucks were retained as well. Fawns were often caught but few were held in captivity. Adult bucks were captured only rarely.

Considering trapping, scientific collections, and sport hunting together, 2,267 deer were removed from the Hopland Field Station from 1951 through 1974. From the first full year of research operations (1952), the number removed in various years ranged from 56 to 217 with an average of 98 deer per year. These consisted of nearly equal numbers of bucks and antlerless deer. (Antlerless deer, as defined in the Fish and Game Code, include does, fawns, and bucks with spike antlers less than three inches long.)

Management implications

The average annual harvest of 98 deer per year from the Hopland Field Station amounts to 12 deer removed per square mile of range per year. In comparison, the reported deer kill for Mendocino County as a whole for the same period of years (1952-1974) averaged 4,040 deer per year. Correcting this figure for estimated unreported kills and cripple losses, the average take for Mendocino County may have been 7,000 to 8,000 deer per year, or about two deer per year per square mile of occupied deer range.



These records show that, on a unit area basis, the deer harvest from the Hopland Field Station over the last 23 years has been six times as high as that from other deer ranges in Mendocino County. The main effect of the higher harvest at the station has been a higher rate of fawn production and survival there compared with the rest of the county. We believe that this increased rate of fawn production results primarily from reduction of competition for available food accomplished by the relatively heavier take of deer on the station. If even more deer were taken each year, fawn production would be expected to increase commensurately. Studies of deer population dynamics show that on the Hopland Field Station two deer die of natural causes for every one taken by humans, while throughout Mendocino County the ratio of natural to hunting mortality is estimated to be about 16:1. Thus at Hopland we have simply been taking animals which otherwise would have died of natural causes. We believe that potential productivity of the deer at Hopland is actually 50 to 100 percent higher than that recorded in the table. In other words from 150 to approximately 200 deer could have been taken annually from the station without depleting the breeding population.

From this review of deer production at the Hopland Field Station it is apparent that deer in Mendocino County and, for that matter, in California at large have been under-utilized. Not all the deer ranges in the county have the potential of the Hopland Field Station, but the offtake could be increased at least 200 to 300 percent by taking antlerless deer as well as bucks.

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