MANAGEMENT PLAN FOR THE CASA DIABLO DEER HERD

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I INTRODUCTION

A long-term decline in deer numbers occurred throughout California since the mid-1960s prompting the Department decision in 1975 to formulate a general statewide plan to restore and maintain healthy deer herds. Additional objectives included managing herds at population levels compatible with their habitat, to increase the quantity of deer habitat, and to provide for diversified recreational use of deer.

In 1977 the Legislature mandated the Department through Assembly Bill 1520 (Perino) to develop plans for deer herd management units containing specified program elements, directing that a geographical unit of deer range will be considered distinct from adjacent ranges and that a management plan for that unit will be designed for that herd alone.

This document complies with the Department policy commitment and legislative mandate to describe the status and trend of the Casa Diablo herd and formulate a management program which will, if implemented 1) increase overall deer numbers, 2) improve the condition of the range, and 3) provide diversified use of Casa Diablo deer. To achieve these goals, this plan incorporates ecologically sound management concepts as the basis for specific program elements relating to herd size, production and survival, research needs, habitat preservation and improvement, harvest strategies, and other facets of herd management.

Deer herds are continually changing, so herd plans must be

dynamic. Since much information is lacking, study results and other new information will require plan revision and updating. It is intended to provide a basis to land management agencies and local governments for making resource allocations which will dictate the future of Casa Diablo deer. There are several major issues and concerns relating to management of the herd including: 1) high demand for multiple uses of the range, especially recreation, grazing and housing. 2) increasing demands for water for power production and housing development, 3) demand for increased deer harvest and hunting opportunity, 4) long term deer habitat reduction and deterioration, and 5) opportunities for deer habitat preservation and enhancement in conjunction with other resource management programs. These factors, in combination with appropriate laws, regulations and policies, were used in evaluating goals for the Casa Diablo herd. Since the attainment of these goals is a long-term process, this plan is intended to be effective for a period of 10 years with a target date for goals described as 1995.

II. DESCRIPTION OF THE HERD MANAGEMENT UNIT

A. Deer Herd Definition and History

1. Herd Definition.

This herd numbers about 1,500 migratory Rocky Mountain mule deer. The herd winters in three primary areas of eastern and southern Mono County: Casa Diablo Mountain vicinity, Marble Creek on the west slope of White Mountains and the Truman Meadows area, especially from the south-facing slopes to the north of Benton and Queen Valleys into Nevada near Montgomery Pass. The area of the herd's range includes about 550 square miles, much of which is not utilized by deer. About 150 square miles are summer range in western Mono and eastern Madera counties (Figure 1).Much of the area within the herd boundary is lightly used transition habitat utilized by animals moving between winter and summer habitats.

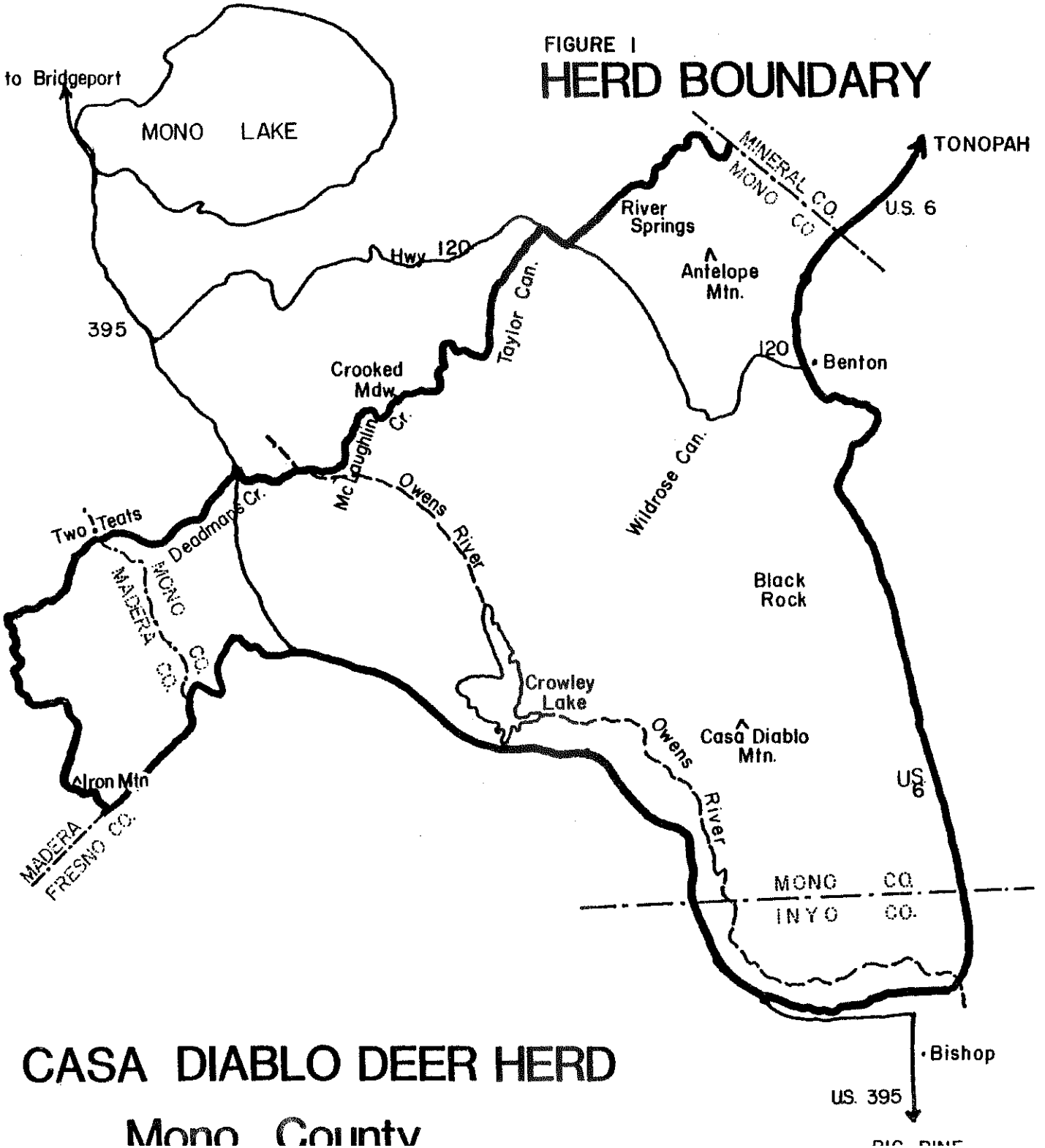
2. Herd History.

Before settlement by European man, deer were scarce in the unit area, but increased slowly between 1910 and 1930 (see range history for details). Deer tags were first issued by the California Division of Fish and Game in 1927; only 36 deer were reported taken in Mono County that year. Herds increased rapidly during the 1940s and 50s, stimulating high hunter success. By the late 1950s deer had increased to the extent they clearly exceeded the carrying capacity of the winter range.

The first antlerless hunts were held in 1955 to reduce excessive deer numbers. Tag quotas were set using the three-year average buck kill. It was felt that too few deer were taken to relieve

FIGURE 1

HERD BOUNDARY



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winter range abuse. In the mid-sixties, the number of antlerless tags was increased; the higher harvest rate and high herd losses during the severe 1969 winter combined to reduce the pressure on the range. It was known that large numbers of deer died on the Sherwin Grade herd winter range just south of the Casa Diablo herd, and it was assumed that many Casa Diablo deer were lost also. To allow numbers to increase no antlerless permits were authorized for the 1969 season nor have any been issued since. Data indicates only limited increases since that time. Some readily accessible portions of the herds apparently were severely reduced by antlerless hunting. The population trend is believed to be static at this time.

3.Seasonal Ranges and Migration.

In the absence of recent herd research, little is known of specific summer habitats or migration routes and holding areas. Winter ranges are better known; generalized present knowledge of these habitats is presented in Figure 2.

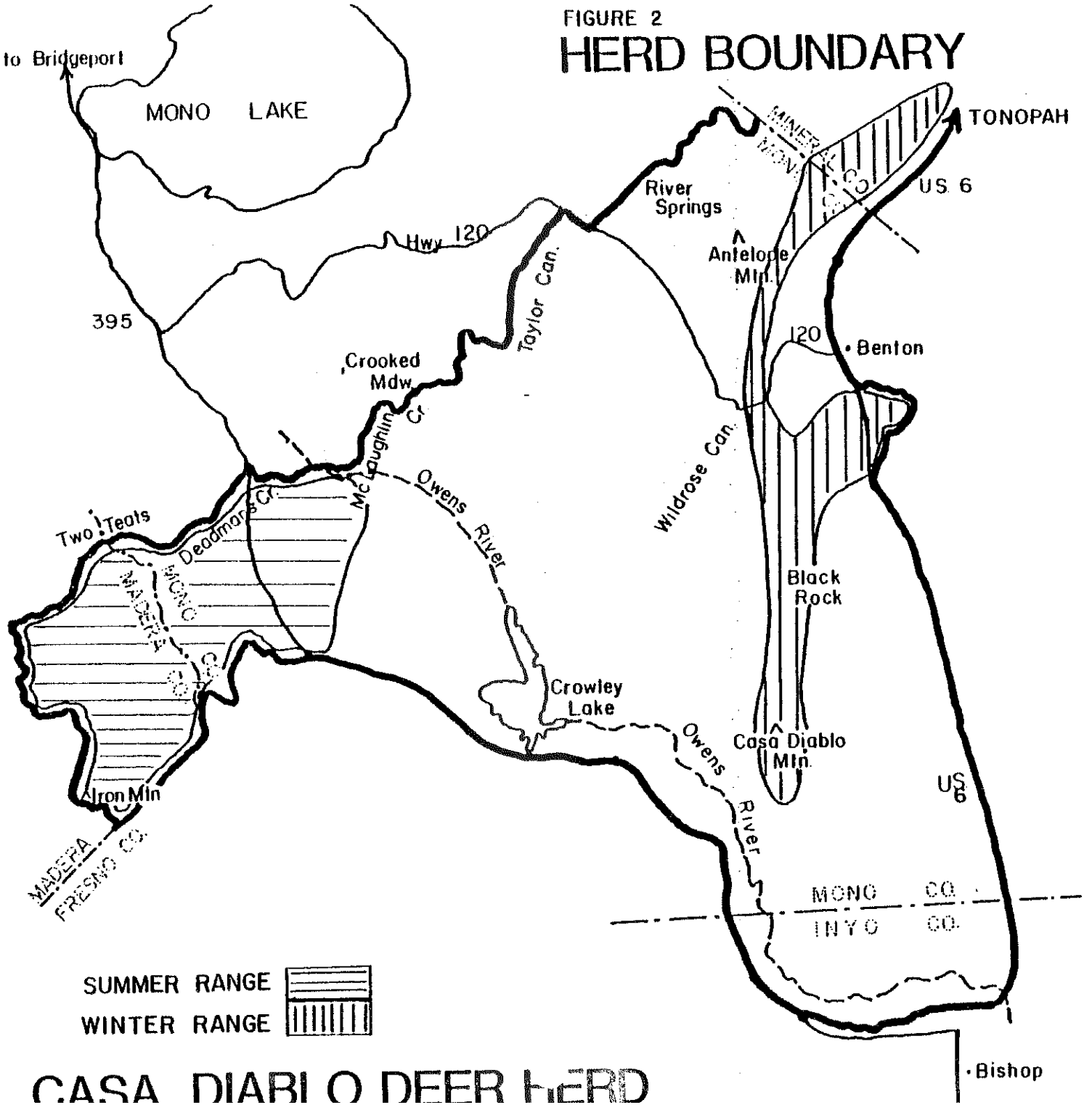
4.Harvest History.

Harvest has been recorded since 1957. Total annual kill averaged 177 during the 1960s; this average includes substantial antlerless harvest. The average number of deer harvested fell to 52 during the 70s. In the absence of antlerless hunting and due to a substantial drop in buck harvest after 1964, buck hunting seasons were set earlier and shorter during recent years, decreasing the size of the harvest. (Table 1).

In 1981, poor feed conditions and a storm occurred during the month-long hunting season, resulting in a high buck harvest

FIGURE 2

HERD BOUNDARY



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because of the availaility of bucks to the hunters. Buck ratios were impacted and the 1982 harvest was reduced to a level consistent to the long-term average (see Table 1).

The 1982 and 1983 springs brought late inclement weather which delayed migration and provided abundant forage. These factors created a situation favoring high buck harvest in spite of low buck ratios. Many bucks, migrating late in the spring stayed on lower, accessible ranges where feed conditions were excellent. These bucks were more available to hunters in the fall than usual. Due to superior feed conditions a high percentage of yearling bucks grew forked antlers. These young, inexperienced legal bucks were relatively easy targets and made up a large proportion of the 1983 harvest.

5.Herd Composition Records.

Casa Diablo herd composition counts have been taken only sporadically over the years due to the dispersed winter ranges used by the herd and relatively poor access to those wintering areas. Data collection has been consistent and sample sizes adequate in recent years due to the use of a Nevada state helicopter and contract helicopters funded by the Department and Mono County.

Low summer fawn production and survival is indicated by fall counts. Winter losses in recent years have been relatively light. Recorded buck ratios have never been very high and are currently low due to heavy hunter pressure and low recruitment.(Table 1)

6.Mortality Factors.

a.Predation. Mountain lions and coyotes are the common predators inhabiting the Casa Diablo deer range. Lions are "deer specialists" and no doubt take deer from this herd. In addition, it seems likely that lion numbers have increased under existing regulations that prohibit lion hunting and trapping. No reliable estimates of lion numbers on the range are available. Their overall effect on total deer numbers in the herd is unknown.

Coyotes are numerous on much of the range, and are probably the major source of predation mortality on deer simply because of the far greater number of coyotes compared to other predators. Again, their overall effect on total deer numbers is unknown.

Table 1

Casa Diablo Deer Herd

Composition Counts/100 does

Year	Harvest		Fawns			
	Buck	Doe	Bucks	Fall	Spring	Fall Sample
1956			14	38	29	
1957	440	120	-	-	-	
1958	221	310	-	-	-	
1959	NA	207	10	48	-	
1960	129	226	21	43	-	
1961	114	-	18	36	24	
1962	102	-	27	65	65	
1963	284	137	-	-	-	
1964	151	99	-	-	-	
1965	82	108	-	-	-	
1966	91	121	18	40	-	
1967	84	42	-	-	-	
1968	71	-	15	36	-	
1969	87	-	-	-	-	
1970	26	-	-	-	-	
1971	46	-	-	-	-	
1972	74	-	-	-	-	
1973	60	-	-	-	-	
1974	80	-	-	-	-	
1975	75	-	-	-	-	
1976	81	-	-	-	-	
1977	58	-	-	-	-	
1978	35	-	-	-	-	
1979	56	-	13	-	-	
1980	77	-	13	58	47	
1981	150	-	10	54	50	358
1982	64	-	7	41	28	403
1983	97	-	8	35*	46	526
1984	117	-	7	43	42	366

*Sampling and/or recording error

For an in-depth discussion of the variable effects of predation and predator control, see Connolly in "Mule and Balck-Tailed Deer of North America" (1982; pgs. 282-285).

An unknown number of deer are killed and/or harrassed by domestic dogs each year in areas near human habitation. The winter range is generally not developed for housing. Harrassment of deer by dogs is probably greatest around Mammoth Lakes where housing is expanding. Uncontrolled dogs accompanying backpackers can harrass deer on the summer range, stressing pregnant or nursing does. Dogs associated with livestock operations probably disturb deer also, but to a lesser extent.

Although bears, eagles, and bobcats also occupy the herd's range, their effect on the population is believed to be minor since they aren't abundant and do not specifically prey on deer.

b.Winter Kill. Although limited, recent composition count data indicate fluctuating winter fawn losses (19%, 1980; 7%, 1981; 32%, 1982). An unknown number of adults die each winter also.

Bitterbrush quality varies on the winter range; in some areas (e.g. Marble Creek), good quality bitterbrush provides subsistance feed even during heavy snow cover. In other areas where browse is limited (e.g. Truman Meadow), extended snow cover will decrease available feed to a critical point.

Future winter mortality cannot be accurately predicted but will vary according to duration and depth of snow cover in browse deficient areas.

c.Summer Fawn Loss. An average of only 47 fawns per 100 does has reached the winter range in each of the last four years. Reasons for this early fawn loss are unknown, but the figures reveal a loss of fawns either prenatally, at birth, or during the first months of life.

d.Disease and Parasites. No information on diseases or parasites of the herd has been collected so nothing is known about the incidence of these factors.

e.Nutrition. Nutritional deficiencies probably occur at times on some areas of the winter range. No specific information is available relating to summer range forage quality although deer observed appear in good condition and bucks harvested are usually in excellent condition. Nutritional factors may be involved in early fawn losses.

f.Illegal kill. An unknown number of deer are killed illegally each year. This factor is believed to be relatively minor based on the number of reports and discoveries of field evidence during recent years. It is impossible to evaluate the effect of illegal kills on the population without a specific investigation of this factor.

g.Human encroachment and disturbance. Housing and recreational encroachment is a major factor impacting the Casa Diablo herd. The City of Mammoth has usurped key deer habitat and continues to expand further into important areas, forcing deer further into the periphery of historic range. San Joaquin Ridge and Sherwin Bowl, believed to be important deer habitats, are being

considered as possible areas for ski development. If a project is constructed, preservation of the deer resource will be a substantial challenge to biologists and planners.

Recreational use of the backcountry is high and demand is increasing; many trails receive heavy and almost continuous traffic. Backpackers camp in key deer habitat and displace deer. Loose dogs accompanying backcountry users are known to harass deer.

Herd Range Description and History

1.Topography, soils, climate.

The area of the Casa Diablo herd extends through elevations from about 5,000 feet on the Marble Creek winter range to well over 10,000 foot elevation on the Sierra crest. It is known that some east slope deer summer on the Sierra west slope down to about the 6,000 foot elevation. The herd's range includes gently sloping brushlands at the low and intermediate elevations, and sheer granite escarpments and moderately sloping woodlands on the west slope of the Sierras. Much of the summer range topography is very steep and rocky and of low value as deer habitat.

The soils of the summer range are described as being shallow to moderately deep (10-40 inches) and generally having a sandy loam texture. Rock content varies from 0-35%; the steeper slopes are usually more rocky. Water retention capability tends to be low and in inverse proportion to rock content. Much of the Sierra escarpment is a massive granite barrier.

Soils of the winter range are highly erodable decomposed granites

with an admixture of sandy loams, generally shallow and rocky. The higher quality soils on the winter range are devoted to agriculture, but are used by deer to a minor degree.

The climate of the unit is characterized by heavy snowfall and low temperatures during the December to April period. Average annual precipitation is approximately 60 inches at 10,000 feet and about 10 inches at 5,000 feet. Most of this precipitation is in the form of snow, but winter rains are common at the lower elevations and summer thunderstorms are common at higher elevations.

3. Range History.

Reports by early explorers Walker, Fremont, and Von Schmidt indicated sparse game populations (primarily bighorn and antelope) in the general region. The mining industry stimmulated development in Mono County and during the 1860s a grazing economy was established. Large bands of domestic sheep were grazed beginning in the 1870s and by the turn of the century, many thousands of sheep were grazing the range. At about the same time, heavy hunting pressure combined with excessive grazing of the bunchgrass virtually eliminated the antelope and bighorn. Bunchgrass ranges were converted to browse, largely bitterbrush and sagebrush which provided increased deer feed and promoted a gradual increase in deer numbers until the 1930s.

Grazing restrictions on National Forest lands and the passage of the Taylor Grazing Act in 1934, which regulated grazing use of public domain lands, reduced grazing pressure significantly. Browse species continued to flourish and deer numbers increased dramatically during the 1940s and 50s.

3.Seasonal Ranges.

a.Winter RAnge. This deer herd inhebits three major key winter range areas: the Truman Meadow area in Mono County, California and Mineral County, Nevada; the Marble Creek area in Mono County on the White Mountains west slope; and a long narrow strip of habitat from Black Rock Mine to Casa Diablo Mountain, where deer use is spread thinly along the east slopes of the Benton Range (Figure 1).

The plant communities on these areas are composed of bitterbrush (Purshia tridentata),sagebrush (Artemesia tridentata), rabbitbrush (Chrysothamnus spp.) with some upper slopes grading into Pinyon pine (Pinus monophyllus). Various grasses and forbs, including Poa species, Stipa species, filaree (Erodium spp.), etc. provide deer feed when snow does not cover the ground. The majority of the winter range is administered by BLM. Cattle grazing is a primary use on BLM land. Feral horses and burros also utilize portions of the winter range.

b.Summer and Intermediate Range. Specific migration corridors are not known so detailed description of the intermediate range is not possible. Deer are known to move through the Glass Mountain range and to cross Long Valley west of Crowley Lake. The summer range is believed to be primarily west of Highway 395 to the Sierra crest, though some deer are known to summer on the Sierra west slope, especially in the upper San Joaquin river drainage. The eastside summer range includes the following major drainages:

Deadman Creek, Glass Creek, Sherwin Creek, Mammoth Creek, and possibly Laurel, Convict and McGee creeks. In the latter five drainages mentioned, it is likely that Casa Diablo herd deer share summer habitat with deer which are classed as Sherwin Grade herd animals.

Plant communities occurring on the intermediate/summer ranges include the following: (Munz, 1965)

1. Sagebrush scrub; indicated by:
   Sagebrush, Bitterbrush, Rabbitbrush and Rubber weed
   (Haplocappus nanus)

2. Red Fir Forest; indicated by:
   Red fir (Abies magnifica), Lodgepole pine (Pinus murrayana), Chinquapin (Castanopsis sempervirens), aspen (Populus tremuloides), and Jeffrey Pine (Pinus jeffreyi).

3. Lodgepole Forest; Indicated by:
   Lodgepole pine, Mountain Hemlock (Tsuga martensiana), Mountain whitethorn Ceanothus cordulatus), sagebrush (Artemisia rothrockii).

4. Yellow Pine Forest.
   Yellow pine (Pinus ponderosa), White Fir (Abies concolor), Bitterbrush, Mountain mahogany (Cercocarpus ledifolius).

In addition to those major communities recognized in the literature, the following ecotypes are important to this herd on its summer range:

1. Montane chaparral, indicated by:
   Greenleaf manzanita (Arctostaphylos patula)
   Bitter cherry (Prunus emarginata)
   Mountain whitethorn (Ceanothus cordulatus)
   Current (Ribes cereum)

2. Meadows, indicated by:
   Various grasses and forbs such as Clovers (Trifolium spp.), Poa spp., Lupines (Lupinus spp.), Sedges (Carex spp.), Rushes (Juncus spp.), and Cinquefoil (Potentialla spp.).

Basins with a mixture of forest, browse, and riparian habitats provide favored deer use areas and are also heavily used by recreationists. Surface water is abundant throughout the summer range.

4.Recent Fire History.

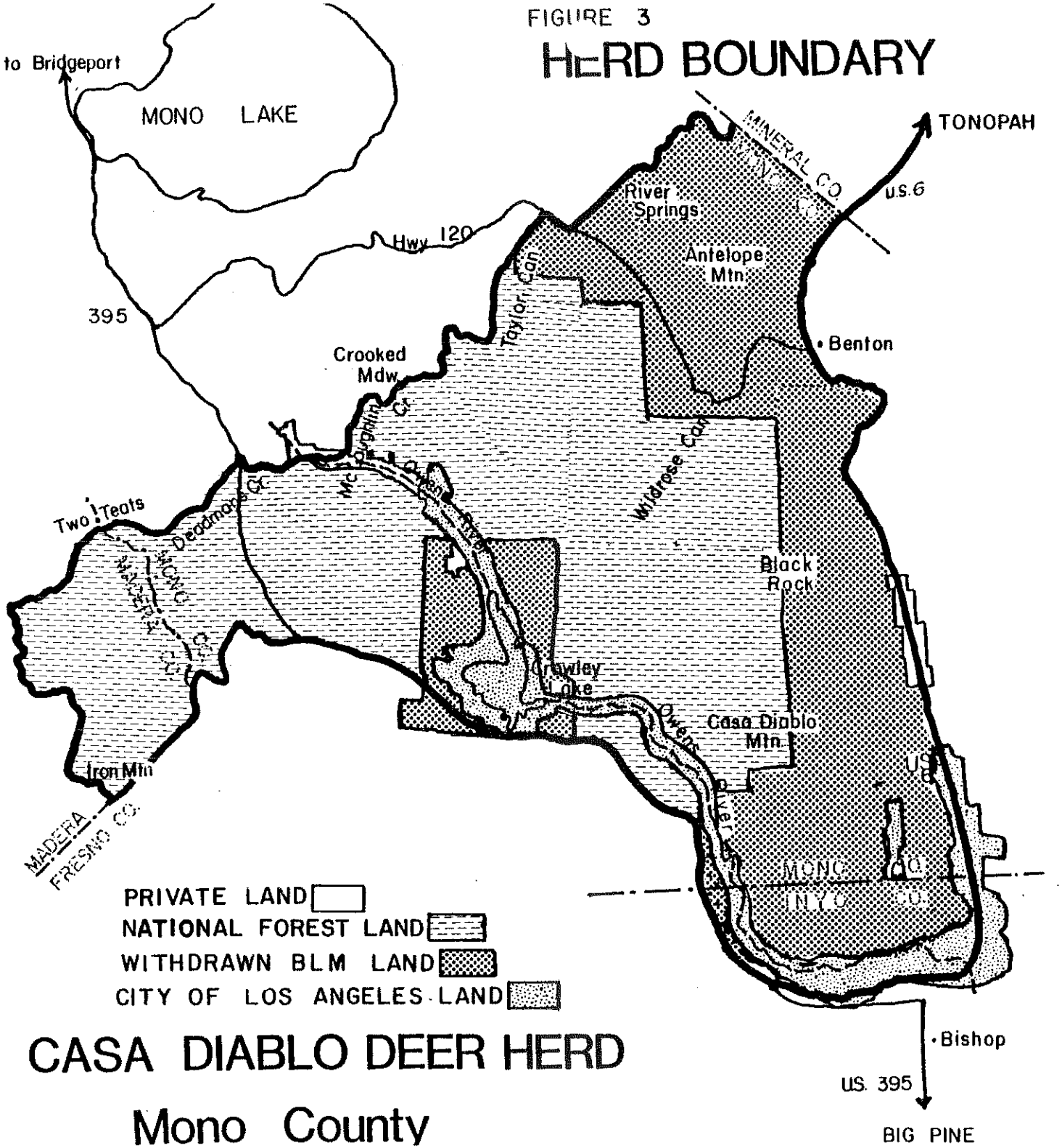
The Mono Lake Ranger District, Inyo National Forest, has record of two small fires within the herd's range. Both occurred in 1977, on the southwest slope of Black Mountain in intermediate range. A burn of less than 100 acres occurred in the Dry Creek drainage (Sec. 33), the other consumed between 100 and 300 acres in the Sawmill drainage (Sec.3:2SR30E). The Crestview fire of 1977 (Sec.22-23T2NR27E) burned about 700 acres just outside the defined herd boundary and the area is providing good deer forage.

No fire history data was received from the Mammoth Ranger District. Only "very small lightening fires" were noted by the White Mountain District. It appears that recent fires have had very minor influence on the range of the Casa Diablo herd and that decadence of browse stands is increasing as a result.

5.Land Ownership and Use.

The herd's range is largely publicly owned, administered by the U.S. Forest Service (70%), Bureau of Land Management (20%), and Los Angeles Department of Water and Power (8%). Private inholdings are limited (2%) (percentages approximate). The range falls within the boundaries of the USFS Mammoth and Mono Lake Ranger Districts (see Figure 3).

FIGURE 3



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The winter range lands are predominately BLM administered with some small private inholdings. Land uses of the winter range include livestock grazing and trailing, mining, limited housing, and limited alfalfa hay production.

The intermediate range is owned by LADWP and USFS. Since key intermediate habitats are not well known, it is not known to what degree deer use these lands. Essentially all of the intermediate range is used for grazing and some mining, housing, and dispersed recreation use occurs as well.

The summer range is almost totally USFS holdings. Livestock grazing is a primary economic use of the range and substantial commercial logging has occurred in recent years. The summer range is heavily used by recreationists.

6. Current Grazing Utilization.

Table 2 presents current (1983) public land range allotment data.

Figures given are for cattle, except as noted.

Table 2

Allotment/Agency	Dates	Months	AUM
Adobe Valley (BLM 6027 sheep or cattle)	6/15-11/15	5.0	1636
Antelope, USFS	6/20- 7/29	1.3	130
	6/2 - 7/29	1.3	195
	7/29- 8/13	.5	125
Black Canyon, USFS	7/15-10/10	2.8	759
Black Lake (BLM 6028 sheep or cattle)	7/1 -10/31	5.0	24
Blind Springs (BLM 6082)	6/15- 2/28	8.5	180
Bramlett (BLM 6038)	10/1- 5/31	7.5	1082
Casa Diablo USFS sheep	6/15-10/1	3.5	12,250*
Casa Diablo (BLM-cattle or sheep -6081)	Unspecified		321
Chidago USFS	---	---	---
Deadman USFS sheep, Antelope Mtn Unit	6/16-7/7 (odd years) .7 6/29-7/20(even years) .7		1,320*
Deadman USFS sheep	7/1 -9/20	1.7	3,980*
	7/1 -9/1	2.0	3,000*
Frazier Canyon USFS	7/15-11/15	4.0	228
Hammil Valley (BLM 6024)	10/1-6/15	8.5	1950
Hot Creek (overlaps into Sherwin Grade herd range)	Unspecified		321
Long Valley (BLM 6044 cattle or sheep)	5/1-10/31	5.0	100
Long Valley USFS	6/16-7/15	1.0	600

	7/16-9/15	2.0	436
Marble Creek (BLM 6025)	Year long	12.0	871
Mathieu (BLM 6026 sheep or cattle)	9/1-9/30	1.0	50
Sherwin-Deadman	7/1 -9/20	2.6	3,390*
USFS sheep	7/1 -8/1	2.0	9,000*
Symons (BLM 6037 sheep)	6/1 -9/30	4.0	144
Turner USFS	6/5 -8/5	2.0	650
Volcanic Tablelands (BLM 6007)	5/1 -6/15	1.5	1,382*
Wilfred Creek (BLM 6022)	5/16-10/15	5.0	315

* sheep months

As on most public lands, the demand for grazing use in this unit is high. Heavy use occurs on Los Angeles Department of Water and Power holdings as well. Essentially all lands within the herd unit boundary are used for cattle or sheep grazing and sheep trailing, except some remote summer range areas which are lightly grazed by pack stock.

7.Logging

The Smoke and Antelope timber compartments lie on important deer habitat. Some USFS survey data on the Smoke and Antelope compartments is available indicating light to moderate total deer days usage as would be expected in migration habitat. The value of these areas to the herd should not be understated, however, since appropriate cover and forage conditions are necessary for such key migration corridors.

Logging is scheduled in the Earthquake and Deer Mountain compartments in 1988. The combination of timber removed,

increased road densities, and direct human disturbance could be highly detrimental to the main artries of herd migration, to the core of the herd's summer range, and to several vital fawning areas. These impacts should be given weighty consideration before any timber harvests occur in this area.

8.Range Surveys.

From 1960 through 1980, fall bitterbrush leader length was measured on 15 line-point transects, five on each of three key winter areas. Percent spring utilization was calculated during the 1976-1980 period. During those four years deer pellet group counts were used to calculate deer days use per acre (Table 8).

In addition, range reconnaissance surveys were conducted in 1955 and 1956. At that time, no young bitterbrush plants were noted on the three key areas, existing bitterbrush was rated "largely available, moderately hedged, satisfactory condition." (Marble Creek) or "all available, heavily hedged, satisfactory condition" (Casa Diablo and Chidago area).

A 1975 memo relating reconnaissance of the Marble Creek area noted "the majority of the (bitterbrush) plants were in a decadent condition". Some improvement in browse appears to have occurred there during recent wet years.

Table 3

Browse Survey Data and Deer-days per Acre

Truman Area

Year	Bitterbrush Leader Length	% Spr.Utilization	Deer days/acre
1960-61		--	--
1961-62	3.6	--	--
1962-63	2.7	--	--
1963-64	1.9	--	--
1964-65	2.1	--	--
1965-66	2.3	--	--
1966-67	2.6	--	--
1967-68	1.8	--	--
1968-69	3.4	--	--
1969-70	3.7	--	--
1970-71	2.5	--	--
1971-72	1.8	--	--
1972-73	-	--	--
1973-74	-	--	--
1974-75	-	--	--
1975-76	1.1		
1976-77	1.7	40	21
1977-78	2.2	45	25
1978-79	3.0	45	21
1979-80	3.1	46	11

Marble Creek

1960-61	1.7	--	--
1961-62	4.8	--	--
1962-63	2.9	--	--
1963-64	1.9	--	--
1964-65	2.1	--	--
1965-66	2.6	--	--
1966-67	3.0	--	--
1967-68	1.8	--	--
1968-69	3.7	--	--
1969-70	3.8	--	--
1970-71	2.2	--	--
1971-72	2.0	--	--
1972-73	-	--	--
1973-74	-	--	--
1974-75	-	--	--
1975-76	1.1	--	--
1976-77	0.2	8	06
1977-78	1.7	17	27
1978-79	4.4	12	19
1979-80	2.7	10	6

	Casa Diablo		
1960-61	1.2	--	--
1961-62	2.5	--	--
1962-63	3.0	--	--
1963-64	1.8	--	--
1964-65	1.4	--	--
1965-66	1.7	--	--
1966-67	2.6	--	--
1967-68	-	--	--
1968-69	4.6	--	--
1969-70	3.3	--	--
1970-71	2.0	--	--
1971-72	2.1	--	--
1972-73	-	--	--
1973-74	-	--	--
1974-75	-	--	--
1975-76	0.2	--	--
1976-77	0.4	4	12
1977-78	0.6	0	3
1978-79	3.4	7	55
1979-80	1.3	2	5

C. Major Factors Regulating the Population

Factors which regulate a deer population cannot be considered as separate aspects. They are complex and interrelated, and the additive effects of several can combine to produce a markedly favorable or unfavorable set of circumstances for deer survival and production. However, these complex factors can be classified into two general categories, human influences and environmental influences. Undoubtedly, the most profound influences fall into the first category.

1.Human Influences.

This section will discuss separately the various human influences affecting the herd. However, it must be emphasized that the cumulative impacts of several human activities can create very harmful additive effects. Each individual project may have only limited impact, but the combined effects of several projects may

be highly detrimental. For example, a ski area alone will create a certain level of impact to deer habitat, a level which may be possible to mitigate. In the same area, the accompanying residential development, roads, warming huts, lodges, parking areas, coffee shops, etc. will severely impact the habitat and the herd, resulting in severe reducton or elimination of deer (and other wildlife) there. When dog harrasement, grazing disturbance, geothermal plants and pipelines, hydropower developments, campgrounds and trailer parks, and other factors are added, the prospects for the future of wildlife become bleak.

a. Encroachment on Habitat.

Residential Development. Expansion of the City of Mammoth Lakes constitutes an important impact on the Casa Diablo herd. Much high-quality migration and summer habitat has already been lost there. Deer are increasingly forced to detour around historic key areas and to summer in less favored habitats. Free-roaming dogs associated with housing developments greatly enlarge the area of impacted habitat. New housing projects can be expected in other areas of the range as well.

The Mono County planning process does not give adequate recognition to the values of key deer habitats when project proposals are reviewed. In some cases, finalized "Negative Declarations" (i.e. findings of no significant impacts) have been issued without prior consultation regarding wildlife values on a project. Projects have been approved in this manner; irreversible inroads into key deer habitats are the result. Residential development of such habitats is especially

inappropriate in an area such as Mono county where recreation is of major economic value. Recent analysis has shown that developed residential property can produce more costs than revenue and that undeveloped land pays more in revenues than the corresponding costs to service that land (Goldman, et al,1979).

In an effort to provide advance notice to planners, engineers, and landowners, current DFG efforts are concentrated on delineating specific key habitats throughout the county. As such delineations are completed (through telemetry studies or other means) they are provided to planners and will be appended to this plan. The County Planning Commission feels this to be the most positive means to reduce further impacts from development.

Human Disturbance

Dispersed recreational use of the intermediate/summer range is high throughout the summer season. People, dogs, and packstock all contribute to disturbance of deer, often in key fawning habitats where reproduction and survival of fawns may be affected.

Recreational Development The existing ski development on Mammoth Mountain has usurped a large area of once-preferred deer summer range (See appendix A). The proposed Sherwin Bowl ski area would occupy another large area of deer summer range and a migration corridor. The fate of a significant portion of the herd will depend upon whether this area is developed and, if so, how it will be constructed and operated. Any development on nearby San Joaquin Ridge would also impact summer and migration habitat. The additive effects of two or three ski areas would impact much of the herds key summer habitat.

Some of the many existing campgrounds within the herd's range have encroached upon important deer habitats. Meadows and areas along stream courses are the most critical of these.

Hydroelectric and Geothermal Energy Projects. The potential exists for construction of small hydro-electric and large scale geothermal energy projects within the herd's range. Potential impacts to the herd vary from nearly negligible to significant, depending on type, size, and location of the project. Coordination with land managing agencies and local governments is ongoing in an attempt to minimize adverse effects. Careful evaluation of each site will be necessary to protect wildlife resources.

b. Livestock/Grazing. Detailed specific effects of grazing on deer are not known due to lack of extensive field survey effort and the difficulty of defining impacts. The locations and use periods of some allotments suggest the probability of conflict with deer use, especially on the winter range. USFS and BLM field surveys indicate poor range conditions for some allotments, but since consent of the lessee is generally required for allotment adjustments, the opportunity to improve deer habitat is not great.

The Truman Meadows key winter range area is one area where livestock use is believed to be in conflict with deer needs. USFS personnel have stated that grazing levels are to remain constant on that key habitat, however.

Further investigation into deer-livestock interactions is sorely

needed on this herd's range.

c.Logging Timber harvest can have beneficial effects on deer forage production by opening the canopy and stimulating herbaceous growth and browse production. Some such benefits to Casa Diablo deer may have resulted from past logging. Roads existing on the logged areas within these units are a definite detriment to wildlife habitat. Cover and forage have been seriously impacted, since roads now form a dense network throughout the harvest area. New roads are created every year without any apparent Forest Service control.

c.Hunting. Hunting of bucks is the major consumptive utilization of Casa Diablo deer and is a major factor influencing buck numbers, ratio, and age structure in the population. Annual buck seasons have varied in the past from 3 to 6 weeks. Three week seasons ending before any significant storms have tended to reduce harvest somewhat. During the 1981 season of 4 weeks an early storm caused an early migration, resulting in a dramatic increase in hunter take and decrease in buck ratio to the current level (8 bucks:100 does,1984). Under current harvest strategies, it is not believed that hunting is responsible for reducing the total herd population. However, the continued high level of hunting pressure and take is the major cause of the present low buck ratio. Bag checks and composition counts demonstrate that a low percentage of bucks are surviving past 2 or 3 years of age. Yearlings make up a high percentage of surviving bucks and bucks in the bag in recent years.

Crippling loss and illegal kill must be considered, since various researchers Stapley, 1971; Costly, 1948; Robinette et al 1977

estimate these losses at between 61% and 72% (Longhurst et al. 1952; Connolly and Longhurst 1975) of the recorded legal take where bucks only were legal. Crippling losses are another factor influencing the sex ratio of the herd.

For more detailed discussion of the effects of hunting, see "The West Walker Deer Herd Management Plan" (DFG 1984) and Connolly in "Mule and Blacktailed Deer of North America" (Wallmo, 1981).

e. Road Kill Twice each year, most Casa Diablo deer must migrate across Highway 395; these migratons and other routine crossings result in an unknown number of road kills each year. These deer-vehicle collisions represent a public safety hazard, expense to motorists, and trauma to individual deer. However, it is not believed that road kills are sufficient to significantly alter the herd's population.

f. Feral horses and burros An unknown level of competition exists between deer and feral horses and burros on the Truman Meadow winter range. The severity of this competition needs definition, since it is believed that numbers of horses especially are increasing. DFG efforts are currently being initiated to manage wild horse numbers.

2. Environmental Influences.

a. Weather It is known that prolonged deep snow cover on the winter range creates a stressful situation and many deer are lost in such conditions. In Wyoming, crusted snow .3 meter (1.0 foot) deep caused deer to move to other areas with less snow (Strickland 1978). Late, snow persisting on intermediate and summer ranges can delay spring migrations. Such delay also

creates stress and could reduce fawning or recruitment that year. Telemetry studies of the West Walker herd during the springs of 1981 and 1982 which had prolonged snow cover revealed does in habitats well below normal fawning areas. Fawn survival may have been affected.

Other, more subtle effects of weather are less dramatic and not well understood. For example, early precipitation during the 1981 fall promoted the growth of grasses and forbs during October and November. Deer arrived early on the winter range, because of the early storm system, and found good herbaceous feed. This weather pattern appears to have created a (short-term) favorable feed situation which sent the deer into winter in good condition.

The influence of weather can affect timing of migration and may affect rutting. Migrations, in particular, are generally held to be habitual but may be accelerated or delayed by unseasonable snowfall or cold (Geist 1981). The effects of such a weather pattern were graphically illustrated during the 1981 deer hunting season. An early storm, coupled with a lack of feed at higher elevations due to low precipitation the previous year, prompted deer to migrate to such an extent that essentially the entire herd was accessible to hunters. An exceptional hunter take of mature bucks resulted.

Free water is abundant throughout most of the range of the Casa Diablo herd, but may be limiting deer distribution on some areas of winter range. Prolonged drought can reduce availability of water throughout the range. Another pronounced effect of drought conditions is reduction or absence of annual browse and forb

production. Poor spring green-up can reduce the quality of nutrition for pregnant and lactating does; poor fawning success can result.

Summer thunderstorms can be locally important to Casa Diablo deer by providing for young herbaceous forage through the summer months and even into fall. Weather can also affect predation. It has been theorized that dry years reduce the alternative prey base for coyotes, so fawns are subjected to heavier predation. Cover for fawns is reduced by dry years, which increase their vulnerability.

b. Predation. The precise influence of predation on the Casa Diablo herd is not known. It is known that predators kill substantial numbers of deer in many herds (Connolly 1981). Only careful study would define the true effect on the population. Conversely, predation by coyotes or mountain lions has never been documented as the principal cause of a mule deer decline (Connolly 1981).

Fall fawn ratios are low, and it is assumed that predation has some effect on fawn mortality. However, predation losses can be accentuated by poor fawning habitat, grazing practices, weather, poor nutrition, etc. Only through complete analysis of these factors can it be determined if predation causes deer to be less numerous than they would be in the absence of predation (Connolly, 1981).

III POTENTIALS FOR RESTORATION AND MANAGEMENT UNIT GOALS.

A. Potentials for Restoration.

The statewide goal for California deer herds is to restore and maintain healthy deer populations and to provide for high quality, diversified use of the deer resource. However, before stating specific objectives and programs to achieve those objectives, several fundamental determinations must be made, including: (1) possible mechanisms for restoration; (2) the factors which inhibit or conflict with restoration; (3) the overall potential levels for restoration; (4) potential harvest strategies and intensities of utilization and (5) considering the mix of all major issues and concerns, the preferred level of restoration and utilization.

The Nevada Department of Wildlife, with information provided by the California Department of Fish and Game, arrived at a goal of reasonable deer numbers for their portion of the herd (Nevada Department of Wildlife 1978). This goal was developed using average and extreme population estimates.

The 1962-78 pre-season population average calculated by Nevada Department of Wildlife was 1,403. The high population level, estimated at 3408, was reached in 1964. The low was estimated at 330 in 1970. The goal was set at 2,245 animals which represents about a 50% increase in the average number. It is also about a 50% increase over the 1984 estimated population.

This goal is still reasonable today since essentially all of the herd's range is publicelly owned, and assuming that excessive human impacts (pg.18) can be avoided. Further the winter ranges

are large areas with substantial management opportunity. Some historical summer habitats are currently receiving little or no use. Evaluation and management of such habitat is necessary.

Deer numbers appear to have remained stable since Nevada's 1978 report was prepared. Increasing the size of the herd will require diligent habitat management, since it is believed that the herd is near the carrying capacity of some winter and transition ranges. Increases can only be accomplished through improved habitat condition, reduced competition for forage, and improvements in sex and age ratios in the herd. With improvements in these factors and in the general health of the herd, the impacts of severe winters or other negative factors will be moderated.

It is generally recognized by the land and wildlife management agencies and the public that many key areas of the range are in poor to fair condition at present. Therefore, a desirable goal of this plan is general improvement of deer habitat; improvement of wildlife habitat condition is in line with multiple-use prinicples of public land management. Public sentiment supports habitat improvement for wildlife on public lands. Economic stability in Mono County depends to a large extent on visble fish and wildlife resources, therefore improving habitats is in the best interest of the local economy.

Basic to this improvement is maintenance of quality ground cover of diverse species makeup, providing ample hiding cover, browse, and herbaceus forage, which also protects soils.

Grazing programs tailored to preserving these basic resources are the major prerequisite. Control of off-road vehicle use is also vitally important. We cannot realistically

hope for improvement in the entire southern end of Mono County, however. Priorities must be placed on maintenance and improvement of key habitats vital to the deer resource. As such areas are identified, information on their values, deficiencies and needs will be provided to land managers.

B. Attainable Levels of Restoration.

The current population is estimated to be approximately 1,300 animals. This estimate is based on numbers projected from herd composition counts in each known key winter range area. Precise population estimates are not available.

Habitat losses have occurred on a small portion of the summer range near Mammoth Lakes, and recreation impacts have somewhat reduced deer habitat quality. However, the herds key winter range is intact and habitat quality there is near static or only slightly declining. For these reasons, and because of the high public demand for use of California deer herds, it is felt that efforts to increase the herd are justified and reasonable. Therefore, the stated target level of herd restoration of this plan, in agreement with Nevada's 1978 goal, is 2,245 deer.

C. Utilization Levels and Alternative Strategies.

At present only forked horn or better bucks are harvested. The length of the season and a zone wide tag quota of 2,000 are the only restrictions on hunter pressure currently (1989). Post seasons buck ratios during the past three years (7 bucks/100 does, 1982; 8 bucks/100 does,1983; 7 bucks/100 does, 1984) reveal that a maximum harvest of bucks is occurring.

Such an intensive harvest of bucks has certain drawbacks. The average age of animals killed is related inversely to the size of the harvest (Connolly 1981). Large, older animals are almost absent in the harvest, since nearly all bucks killed are less than 4 years of age. Field studies (Brownlee 1975) and computer modeling (Gross 1973; Anderson et al. 1974) have demonstrated this decline in older animals with increasing harvest. Such an intensive rate of buck harvest also tends to depress the buck-doe ratio in the herd. Again, field studies (Robinette 1956) and computer modeling (Anderson et al. 1974) attest to this fact. The low buck/doe ratio and resultant low percentage of older bucks in the herd is cause for concern by some professionals and the public.

Considering the low buck ratio, and the fact that total population is near the carrying capacity of the winter range, good biological management should be directed toward increasing the buck ratios.

Current season recommendations again call for a 3 week buck hunting season with a 3,000 tag quota for the new, reduced zone X-9. Some feel that the 3 week season will stimulate increases by reducing the buck take. This has not occurred during 1982,1983, or 1984.

An alternative strategy of buck utilization is initiating a more restrictive quota system, enabling annual adjustments in hunter numbers in response to herd performance. Hunting pressure would decrease, success rate would rise, and buck ratios could be increased. Subsequent buck hunter quotas could be increased in

response to increases in buck ratios. This strategy is recommended if the three-week season does not soon (post-season 1985) yield buck ratio increases.

D. Preferred Levels of Restoration and Utilization.

In formulating the preferred goal, a number of criteria were considered: (1) social acceptance and support; (2) economic factors, both costs and benefits of implementing restoration, (3) tradeoffs with other land uses; (4) current and projected demand for uses of deer.

1. Herd Goals

	Current	1994 Target
a. Fall Population Size	1500	2245
b. Herd Composition		
Bucks/100 does	8	20
Spring fawns/100 does	85 (av.)	50
Total Hunting Harvest		
Bucks	60	100
Antlerless	0	0

d. Flexibility in harvest level is required to attain and maintain stated goals. Variability in seasons' timing, length, and/or tag quotas is required to achieve such flexibility.

2. Habitat Goals

	Current	1994 Target
a. Summer range (150 sq.mi.) Average deer density	10/sq.mi.	15/sq.mi.
b. Winter range (100 sq.mi.) Average deer density	15/sq.mi.	22.5/sq.mi.

c. Improve current habitat conditions and reduce competition and disturbance on key summer/intermendiate habitats.

d. Improve current habitat conditions and reduce competition on the winter range.

IV MANAGEMENT PROBLEMS

1. Summer range herd composition counts have not been conducted and are difficult to obtain.

2. Key habitats on intermediate and summer ranges are not identified.

3. Summer range forage quality and quantity is unknown.

4. Competition between deer and livestock on all seasonal ranges is poorly understood.

5. High fawn mortality occurs during the summer, fall, and winter.

6. The nutritional plane of wintering deer is unknown.

7. Current harvest strategy has resulted in diminished numbers of mature bucks and low buck ratios.

8. Low buck ratios reduce hunting success and may affect breeding success.

9. Future residential developments will reduce the summer range, and funds for land acquisition are not available.

10. Uncontrolled domestic dogs harrass deer on migration corridors, areas of summer range frequented by backpackers, and near Mammoth Lakes.

11. Backpacking and other summer recreational uses disturb deer.

12. Future hydro-power and geothermal projects may impact summer and intermediate habitats.

13. Demand for additional ski development threatens important summer and migration habitat.

14. On certain areas water may be poorly distributed on the winter ranges.

15. Funds are needed for aerial herd composition surveys.

16. Regeneration of bitterbrush is limited on the winter range.

17. The net effects of logging activities on intermediate and summer ranges are questionable but logging roads have degraded wildlife habitat.

e) Winter range reconnaissance to determine water-deficient areas.

f) Evaluation of public attitudes and concerns to be accomplished through public tours and seminars, Boards of Supervisors meetings, W/L Advisory Commission mettings, etc. These steps would explore the social acceptability of investigative and management directions.

B. Herd Management and Mortality Control Element.

1)Herd Size

Herd management will aim for a stabilized population of about 2,245 animals (about a 50% increase).

2)Sex Ratio, Age Class Structure, Recruitment.

Problems of sex ratio and buck age class structure exist in the herd. Low buck ratios reduce hunting success and may affect reproductive vitality of the herd. The low percentage of older bucks in the population severely limits the hunter's chance for a larger animal, and also may affect the reproductive vitality of the herd. Reduction of hunting pressure by lowering hunter quotas, and/or adjusting the timing and length of the season may increase buck ratio and improve buck age distribution.

3)Herd Management and Mortality Control Programs

a.Herd Size

1) Objective: Maintain in healthy condition an average population of 2,245 animals. This represents approximately a 50% increase in population size and is an attainable goal considering existing habitat quality and the extent of public ownership of the range.

reducing fawning success.

c. Evaluate early fawn mortality through telemetry study and apply new information.

d. Improve winter range habitat.

C.Habitat Management Element

1.Vegetative Succession.

The pinyon-juniper woodland plant community has spread greatly into other habitat types during the past century. This expansion has been attributed to grazing, protection from fire, and/or climatic shifts (Burkhard and Tisdale 1976) and generally occurs at the expense of understory vegetation used more by deer (Folliott and Clary 1972). The extent and effects of pinyon encroachment on the herd are not fully known and surveys are needed.

2.Conflicting Land Uses

a.Grazing The total effects of livestock grazing on the herd are not thoroughly understood, but data on livestock use periods and numbers on known key areas indicate the probability of conflict with the deer resource. Specific investigation of the effects of livestock is needed to define conflicts. Some definition of conflicts would result from intensive herd telemetric monitoring. Influencing public land managers and lessees to alter grazing practices is the next step toward reducing observed conflicts.

b.Logging The total effects of logging on various habitats are questionable, but the detrimental impact of the many remaining logging roads is certain. Further coordination between wildlife personnel and timber personnel is needed to determine and reduce

expansion of the Mammoth Airport will have a growth-inducing effect on the area, including impacts to wildlife habitats.

4.Habitat Quality

Summer habitat quality could be heightened by reducing harrasement by people and dogs on fawning sites. Public education is recommended.

5.Habitat Management Programs

a. Objective: Attain and maintain habitat quality sufficient to achieve the stated herd management objectives.

b. Recommendations

(1) Identify key seasonal habitats and any deficiencies therein (see research)

(2) Evaluate effects of grazing and make recommendations to benefit deer.

(3) Review grazing management and allotment plans. Provide planning recommendations to protect and enhance such key habitats as aspen groves, meadows, and riparian areas where grazing-wildlife conflicts are demonstrated. Evaluate timing of grazing and adjust to eliminate conflicts on key migration routes and holding areas. (Options include: changes in season-of-use, exclosures, herding, quota reduction, etc.)

(4) Coordinate implementation of recommendations with land managing agencies.

(5) Formulate other habitat improvement techniques such as pinyon thinning, browse planting, grazing manipulation, tree felling, or fencing, as needed on a site-by-site basis.

(6) Review all hydro-power and geothermal power proposals, conduct surveys, and provide recommendations to safeguard wildlife resources.

(7) Evaluate the effects of logging; and make recommendations to benefit habitat(e.g; rehabilitate old logging roads).

(8) Influence planners to reduce losses of habitat to subdivisions and other developments.

(9) Evaluate closely all effects of ski development and

The public expresses a vavariety of attitudes relative to deer harvest. Opinions range from a lack of concern to adamant approval of, or opposition, to changes in strategies. However, it is obvious that many people are ready for a change in deer management. Numbers of hunters in the field have suggested lower buck taotas, lamenting low buck ratios and the harvest of mostly young bucks. On the other hand, some hunters, especially local residents, oppose any change, supporting the status quo. These various public attitudes will be deciding factors when antlerless hunting is discussed. However, antlerless hunting should be considered when herd and habitat conditions warrent.

2. Non-consumptive Utilization

Casual viewing and photography of deer, especially on the intermediate and summer ranges, constitutes the major non-consumptive use of the herd. The outdoor exprience of thousands of summer visitors to Mono County is enhanced by the opportunity to see deer and other wildlife in natural habitat. Total day-use figures or economic value of these uses are not known, but are substantial and increasing. At present, no problems relating to such non-consumptive use are known to exist. The relatively open terrain and highly scenic qualities of the herd range provide accessible, natural benefits for casual users of the resource.

E. Law Enforcement Element

Enforcement personnel feel that illegal kill during the hunting season is the major law enforcement problem in this herd. Out-of- season poaching is believed to be relatively light during recent years as evidenced by the few signs of kills found or reported. Increasing off-road enforcement in the field during the hunting season is recommended to put a warden at the scene of the in-season illegal kills. As always, increased numbers of wardens throughout the season are desirable in such large areas of deer habitat. Continuing the opening weekend surveillance flights is also recommended to aid law enforcement activities.

Enforcement personnel encourage public education to improve hunter ethics, as in Hunter Safety Classes. Public meetings or news releases could increase public awareness of problems of illegal kill and general hunter ethics.

1. Law Enforcement Program

a. Objective: Improve the level of compliance with deer regulations.

b. Recommendations

1) Continue the intensive opening weekend patrol effort using wardens from other districts.

2) Continue opening weekend reconnaissance flights.

3) Extend the intensive patrol effort to include other periods of peak hunting activity such as the last weekend of the season.

4) Educate the public concerning hunting regulations and ethics through formal presentations, news releases, and informal contacts.

b. Recommendations

(1) Utilize local media and/or regional outdoor publications to publicize newsworthy herd information.

(2) Develop a summary of the herd plan for publication.

(3) Attend governmental meetings and conduct public briefings to convey information on the herd and plan.

(4) Place copies of the completed plan in local libraries.

(5) Inform the public of CalTip program.

(6) Create a narrative display at the Sherwin Grade scenic overlook or Crestview rest station on Highway 395, designed to provide herd and habitat information.

G. Review and Update

1. Objective: Annually review and update the herd plan to maintain a current data base, evaluate progress and prioritize future management steps.

2. Recommendations

a. Conduct deer management meetings to discuss progress, new information and direction.

b. Incorporate annual data in plan appendices.

c. Use new information (research results, herd performance data, etc) to update plan text as needed.

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State of California

Memorandum

To : File

Date : July 14, 1985

From : Department of Fish and Game, Ron Thomas, Wildlife Biologist

Subject: Wildlife Habitat Survey of Mammoth Mountain Ski Area

Yesterday I hiked the circumference of Mammoth Mtn. at the 9500-10,000 foot elevation. The purpose was to evaluate habitat conditions on the ski area and to check on reports that deer are abundant in the developed areas.

In fact, thedeveloped runs are nearly totally denuded of vegetation and many are seriously eroded. Scattered deer sign was found only inthose areas not developed for skiing, and in one pocket of undisturbed habitat among ski runs on the east slope at about 8700 feet elevation. The most concentrated (but still sparce) deer sign was found on the south slope where no ski development has disturbed soils and vegetation. Here, ample cover is provided by conifer stands and the open forb-grass slopes provide forage. Two major deer migration trails were found in thatarea and one was located on the north-west slope, in undisturbed habitat among developed ski runs.

Water is very scarce or absent where I hiked, yet pipelines are conveying water to sprinkle new runs. However, no serious attempts at revegetation are apparent. The source of the piped water is unknown; the question is whether spring flows have been usurped for ski area development, to the detriment of wildlife habitat needs.

My conclusions are: 1) Due to poor soils and probable scarcity of water, it is likely that Mammoth Mountain was never very high quality wildlife habitat. 2) Any habitat values it once may have provided have been effectively wiped out in those major areas where ski development has occured. 3) Except for a few rodents, no wildlife or wildlife sign was seen in the areas fully developed for skiing. 4) Serious soil erosinn is occuring at many locations in existing ski runs and will increase with current management where expanded new disturbance is now occuring. Soils, plantlife, habitats, and stream quality will suffer further. 5) There is much to be learned on Mammoth Mountain about ski area development and its effects on natural resources.

(Photos available)

R.D. Thomas
Wildlife Biologist

Casa Diablo Deer Herd Plan

Annual Update - 1985

I. Standard routine data collection was performed during 1985 including post-season and spring composition counts, harvest data, and buck age data, gathered on opening and closing weekends of the season.

Composition Counts

Year	Bucks	Fawns		Fall Sample	Spring Sample
		Fall	Spring		
1985	15/100	61/100	21/100	444	153

Severe winter weather caused substantial fawn loss.

1985 Harvest

144

Buck Age Data - 1985

Yearling	2 years	3 years	4+ years
3 (21%)	4 (28%)	6 (43%)	1 (7%)

II. No habitat improvement projects were undertaken during 1985. An intensive telemetry study was initiated in early 1986.

III. No major changes in the plan in 1985.

Table 1

Casa Diablo Deer Herd

	Harvest		Composition Counts/100 does			
			Fawns			
Year	Buck	Doe	Bucks	Fall	Spring	Fall Sample
1956			14	33	29	
1957	440	120	-	-	-	
1958	221	310	-	-	-	
1959	NA	207	10	48	-	
1960	129	226	21	43	-	
1961	114	-	18	36	24	
1962	102	-	27	65	65	
1963	234	137	-	-	-	
1964	151	99	-	-	-	
1965	82	108	-	-	-	
1966	91	121	18	40	-	
1967	34	42	-	-	-	
1968	71	-	15	33	-	
1969	27	-	-	-	-	
1970	26	-	-	-	-	
1971	46	-	-	-	-	
1972	74	-	-	-	-	
1973	60	-	-	-	-	
1974	30	-	-	-	-	
1975	75	-	-	-	-	
1976	61	-	-	-	-	
1977	58	-	-	-	-	
1978	35	-	-	-	-	
1979	56	-	13	-	-	
1980	77	-	13	58	47	
1981	150	-	10	54	50	358
1982	64	-	7	41	23	403
1983	57	-	8	35*	46	526
1984	117	-	7	43	42	366
1985	144	-	15	51	21	444

*Sampling and/or recording error

State of California

The Resources Agenc

Memorandum

To : Wildlife Management, Region 5

Date : September 24, 1987

From : Department of Fish and Game

Ron Thomas

Subject : Casa Diablo Deer Herd Plan - 1986

I. Composition and harvest data were collected during 1986. The first year of the two-year telemetry research project was completed.

Composition Counts

Year	Post Season bucks/100 does	Post Season fawns/100 does	Post Season Sample	Spring Fawns	Spring Sample
1985-86	15	61	444	21	153
1986-87	6	60	293	39	602

Harvest

Year	Buck
1985	144
1986	106

Buck Ages

Yr	2yr	3yr	4+
8(38%)	9(43%)	4(19%)	0

II. No habitat improvement projects were undertaken. Telemetry research has revealed severe sheep grazing damage to habitats in important areas of the Parker, Walker, and Bohler drainages, however.

III. The recommendation to create a new hunting zone (X-9A) encompassing the Casa Diablo and Mono Lake herd ranges, based on telemetry study findings, and constitutes a major change in the plan in 1986; effective in 1985.

Ron Thomas

Ron Thomas
Wildlife Biologist

cc: V. Bleich
J. Davis

State of California

The Resources Agency

Memorandum

To : Wildlife Management, Region 5

Date : October 14, 1988

From : **Department of Fish and Game** --Ron Thomas

Subject: Casa Diablo Deer Herd Plan Annual Update, 1987-88

I. Composition Counts

Year	Post Season Bucks/100dd	Post Season Fawns/100dd	Post Season Sample	Spring Fawns	Spring Sample
1986	6	60	293	39	602
1987	6	36	940	18	406

Harvest: 1986 - 100
1987 - 118

II. No habitat projects were undertaken. Telemetry research was completed and was effective in defining herd boundaries.

III. New information from telemetry research shed light on herd boundaries. This information, coupled with herd performance as indicated by composition counts, suggest the advisability of realigning hunt zone boundaries.

Ron Thomas cc

Ron Thomas
Wildlife Biologist

RT:lp

cc: J. Davis

CASA DIABLO DEER HERD MANAGEMENT PLAN 1990 UPDATE

I. Update of biological data

A. Composition Counts

Year	Post-season bucks/100dd	Post season fawns/100dd	Spring fawns	Fall sample	Spring sample
1985-86	15	61	21	444	153
1986-87	6	60	39	293	602
1987-88	6	36	18	940	406
1988-89	12	18	15	159	349
1989-90	9	22	26	172	626

B. Buck kill

Year	1985	1986	1987	1988	1989
	141	100	140	175	201

C. Telemetry research

During the report period, the two-year Hill Bill funded telemetry study of the herd was completed, providing information on habitat use, timing of use, animal condition, predation, and other aspects. Copies of the final report have been distributed and are available on request.

D. Collections/necropsies

During 1987 and 1988, deer were shot and necropsied on three different winter ranges used by this herd. This effort was part of the intensive Hill Bill funded telemetry study of the herd and was the subject of a separate report "The Casa Diablo Deer Herd: Reproduction and Condition, 1987-1988", compiled by Tim Taylor, contract biologist. The report has been circulated; copies are available on request.

E. Browse production (inches of bitterbrush leader growth)

Year	1986	1987	1988	1989
	2.8"	1.9"	.32"	--

II. Update of habitat improvement projects for 1988 and 1989

The final report of the herd telemetry study identified water deficient areas on the winter range and recommended water developments there. Three big game

guzzlers were subsequently ordered, funded by the Hill Bill program, and have been recieved but not yet installed. Installation will be completed before deer arrive in the fall of 1990.

III. Other changes to the herd plan

The effects of the ongoing drought are depressing herd productivity, but to a lesser degree than in some other Mono County herds.

State of California The Resources Agency

MEMORANDUM

To : Mono Unit File

Date : May 27, 1991

From : Department of Fish and Game, Ron Thomas, Biologist

Subject : 1990 Deer Age Data

The following data is the result of sectioned buck teeth collected from animals taken during the 1990 hunt season in Mono County:

Zone X-12

Sample: 75

Yearling	2 yr.	3 yr.	4+ yrs.
8 (11%)	43 (57%)	20 (27%)	4 (5%)

Zone X-9A

Sample: 47

Yearling	2 yr.	3 yr.	4+ yrs.
13 (28%)	26 (55%)	5 (11%)	4 (8%)

All Mono County Herds

Sample: 122

Yearling	2 yr.	3 yr.	4+ yr.
21 (17%)	69 (57%)	25 (20%)	8 (6%)

CC: D. Paine
K. Brown
M. Walter
L. Sitton
Please distribute to wardens

VA 5-30-91

The preponderance of young animals in the bag reveals a relatively high rate of harvest of bucks in the herd; this evidence is supported by herd composition data which indicates a Mono County average buck ratio of 12:100 does. The low percentages of older age class animals in the bag is consistent with the relatively high harvest rates occurring; a relatively low percentage of bucks are surviving past three years of age.

Recent necropsy data indicates that all does are being bred while very low fall and spring fawn ratios in recent years reveal a high loss of fetuses and young fawns: relatively few new animals are being recruited into the populations. This fact is due to the effects of the drought on winter range forage, coupled with other factors including high predation rates (indicated by losses of telemetered animals and other field observations), known high losses to highway kills, competition with domestic livestock on key habitats, and continuing losses of critical habitats to other land uses.

Although hunter buck kill has been relatively constant, the effects of the above factors combine to create a prediction of a static or downward trend in herd populations and hunter harvests in future years. Although the return of wetter years could help to stimulate limited herd increases through increased winter range forage, the long term and cumulative impacts of the other factors may be unavoidable.

CASA DIABLO DEER HERD PLAN UPDATE

1992-93

I. Update of biological data

A. Composition counts

year	Post-season bucks/100dd	Post-season fawns/100dd	Spring fawns	Fall sample	Spring sample
1986-87	15	61	21	444	153
1987-88	6	60	39	293	602
1988-89	6	36	18	940	406
1989-90	12	18	15	159	349
1990-91	9	22	26	172	628
1991-92	17	38	29	206	507
1992-93	13	49	21	512	577
1993-94	27*	28	22	325	321

* A newly-surveyed winter habitat located this year (through telemetry research data) had higher buck numbers than areas surveyed in the past, substantially raising the buck ratio. It is not to be assumed that the buck ratio actually doubled in this one-year period.

B. Buck kill

Year:	1985	1986	1987	1988	1989	1990	1991	1992
	141	100	140	175	201	175	165	195

1993

149 (A zone X9-A total; no comparable data available at this time.)

II. Update of habitat improvement projects for 1992:

None

III. Other changes to the herd plan

The severe winter of 1992/93 caused stress and high fawn losses in the herd. It is likely that adult animals also were affected and a reduction in total population is suspected. Accordingly, buck hunt tag quotas for the 1993 season will be reduced by 50%. Increased buck ratio this winter has provided for an increase in rifle tag quota for the 1994 season.

The effects of unlimited numbers of archers hunting this population has been addressed this year through implementation of an archery quota of 500 tags in zone X-9A (new zone A-16) to control intense hunting pressure which has been increasing rapidly, especially with reduced rifle quotas. It is hoped that it will now be possible to effect herd buck ratio increases through positive control of total buck harvest.

State of California The Resources Agency

MEMORANDUM

To : File

Date : January 25, 1993

From : Department of Fish and Game, Mono Wildlife Unit

Subject : Deer herd Composition Data

Sherwin Grade Herd Composition

year	Post-season bucks/100dd	Post-season fawns/100dd	Spring fawns	Fall sample	Spring sample
1985-86	7	35	19	691	794
1986-87	7	28	15	706	400
1987-88	10	34	12	718	307
1988-89	11	22	15	936	294
1989-90	12	21	18	572	622
1990-91	12	27	13	468	343
1991-92	12	22	22	289	378

Round Valley Herd Composition

(Beginning in 1993, herd composition data of the Sherwin and Buttermilk herds will be combined and reported as the Round Valley herd, based on current knowledge of herd parameters.)

1992-93	15	36		462	

Casa Diablo Herd Composition

1985-86	15	61	21	444	153
1986-87	6	60	39	293	602
1987-88	6	36	18	940	406
1988-89	12	18	15	159	349
1989-90	9	22	26	172	628
1990-91	6	22	13	154	279
1991-92	17	38	29	206	507
1992-93	13	49		512	

Mono Lake Herd Composition

1985-86	6	52	20	257	272
1986-87	no sample obtained				
1987-88	17	41	35	317	285
1988-89	22	31	--	250	---
1989-90	12	26	16	388	350
1990-91	14	29	34*	238	239
1991-92	18	38	24	175	472
1992-93	no sample obtained				

East Walker Herd Composition

1985-86	15	44	28	456	469
1986-87	11	48	35	170	573
1987-88	22	37	21	239	234
1988-89	9	20	17	227	333
1989-90	19	19	15	231	340
1990-91	19	30	25*	263	265
1991-92	36	39	24	251	636
1992-93	18	46		266	

West Walker Herd Composition

1985-86	10	51	32	732	2173
1986-87	14	54	31	207	999
1987-88	18	40	21	457	1421
1988-89	9	23	17	715	1042
1989-90	13	21	17	606	1169
1990-91	10	26	22*	522	520
1991-92	18	37	25.5	643	1229
1992-93	10	33		657	

* These spring fawn ratios are believed to be unrealistically inflated since the "spring" counts were conducted on February 28, before the only severe storms of the '90-91 winter which occurred in March and persisted for about three weeks.

Composition Counts: Hunt Zone Totals

Zone X-12*

Year	Post Season bucks/100dd	Post-season fawns/100dd	Spring fawns	Fall sample	Spring sample
1989-90	16	20	16	1225	1859
1990-91	13	28	25	1023	1563
1991-92	22	38	25	1069	2131
1992-93	12	36		923	

Zone X-9A**

1989-90	12	22	20	1479	1711
1990-91	10	26	13	622	727
1991-92	15	24	24	909	1248
1992-93	14	42		974	

* Includes West Walker, East Walker, and Mono Lake Herds.

** Includes Casa Diablo, Sherwin Grade, and Buttermilk herds.

THE CASA DIABLO DEER HERD

REPRODUCTION AND CONDITION IN 1987

Timothy Taylor
P.O.Box 191
June Lake, Ca. 93529

THE CASA DIABLO DEER HERD, REPRODUCTION AND CONDITION IN 1987

Within the past decade, mule deer (Odocoileus hemionus hemionus) from the Casa Diablo herd have been of management concern because of poor fawn survival and low recruitment. In March 1987, deer were collected from three different areas on the Casa Diablo winter range in order to investigate reproductive parameters and physical condition.

STUDY AREA AND METHODS

Deer were collected from three different wintering areas on the Casa Diablo deer herd range. These areas include: Truman Meadows, located some 10 miles north of Benton, California on the west side of Highway 6 at an elevation of approximately 1,900 m; Marble Creek, located about 4 miles south of Benton at the base of the White Mountains and east of Highway 6 at an elevation of 1,850 m; and Banner Ridge, situated some 10 miles southwest of Benton near the east end of the Glass Mountain Range at approximately 2,300 m. Winter range vegetation is Great Basin sagebrush type consisting mostly of big sagebrush (Artemisia tridentata), bitterbrush (Purshia tridentata), and rabbitbrush (Chrysothamnus spp.). A great majority of the Banner Ridge wintering area is comprised mainly of pinion/juniper woodland.

Deer were shot either in the head or anterior portion of the body cavity by DFG personnel and brought to a field processing station where they were measured and weighed to the nearest pound ("bled carcass weight" BCW; Anderson et al. 1972). External carcass measurements included chest girth, total body length, and hindfoot. Reproductive tracts (uterus and ovaries) and right kidneys were extracted and eventually frozen for later analysis. The ages of all animals collected were estimated by tooth wear and replacement (Larson and Taber 1980).

Once reproductive tracts were thawed the ovaries were sectioned by hand and examined macroscopically for the presence of copra lutea (Cheatum 1949). All fetuses were counted, sexed, weighed, and measured, but only the larger in litter sizes of two was used in the present analysis. Fetal measurements included hindfoot length, crown to rump length, and total or contour length. Fetal hindfoot length was used to estimate fetal age, and thus conception, and fawning dates (Salwasser and Jessup 1978). Kidneys were used to determine the kidney fat index (KFI; Riney 1955).

RESULTS

On 16, 17, 18 and 19 March 1987 a total of 21 deer (20 females and 1 male) were collected from 3 different areas on the Casa Diablo deer herd range. Ten deer (9 adult females and 1 male) were collected from the Banner Ridge area. Six deer (5 adult females and 1 yearling female) were collected from the Truman Meadows wintering area. Five deer (4 adult females and 1 yearling female) were collected from the Marble Creek range.

Table 1 displays summary data for Casa Diablo deer collected between 16 and 19 March 1987, stratified by range and by age (adult or yearling). Pregnancy rates for the 18 adult does collected throughout all three ranges was 100% in 1987. Fetal rates averaged 1.74 fetuses/adult doe and as indicated by one-way ANOVA there was no significant difference in fetal rates between herds (P=0.05).

Table 1. SUMMARY TABLE OF REPRODUCTION FOR CASA DIABLO DEER COLLECTED BETWEEN 16 AND 19 MARCH 1987. ADULTS AND YEARLINGS SEPERATE.

	ADULTS											YEARLINGS				
RANGE	# AD	AVE AGE	BCW (lb)	% PREG	C.L. RATE	FETAL #/ DOE	RATE #/ PREG	FETAL HINDFOOT (mm) AV	MIN	MAX	KFI	#	BCW (lb)	% PREG	FET RATE	KFI
TM	5	3.6	107	100	2.00	1.6	1.6	59	44	78	.40	1	70	0	0	.20
MC	4	4.0	108	100	2.00	1.75	1.75	70	56	81	.24	1	80	100	1	.098
BR	9	3.6	106	100	2.00	1.88	1.88	55	28	78	.58	0				
$\bar{X}, \Sigma$	18	3.7	107	100	2.00	1.74	1.74	61	28	81	.41	2	75	50.0	1	1.05

TM = TRUMAN MEADOWS
MC = MARBLE CREEK
BR = BANNER RIDGE

Table 2. Frequency of Occurrence of Fetuses in Casa Diablo Mule Deer Does by Age Class

Year Class	Number of Fetuses 0 %	0 No.	1 %	1 No.	2 %	2 No.	Total Number of Fetuses	Total Number of Does	% and Total No. Pregnant Does %	Pregnant Does No.	Fetuses per Doe	Fetuses per Pregnant Doe
1	50	1	50	1	0	0	1	2	50	1	0.50	1.00
2	0	0	20	1	80	4	9	5	100	5	1.80	1.80
3	0	0	20	1	80	6	13	7	100	7	1.86	1.86
4	0	0	0	0	100	2	4	2	100	2	2.00	2.00
5+	0	0	25	1	75	3	7	4	100	4	1.75	1.75
$\bar{X}$, Σ	.05	1	.0	4	75	15	34	20	95	19	1.70	1.79

Table 2 presents age-specific data by year class for the 20 does collected from the Casa Diablo herd and again, there was no significant difference in fetal rates between adult age classes (P=0.05).

As indicated by one-way ANOVA, there was no significant difference in fetal size between deer from Truman Meadows, Marble Creek and Banner Ridge (P=0.05). Figure 1 shows conception and fawning dates for 19 pregnant does collected from the Casa Diablo herd as estimated from fetal hindfoot length measurements.

A total of 34 fetuses (12 male and 22 female) were examined from the 19 pregnant does collected from the Casa Diablo herd. Figure 2 shows the percentages of male to female fetuses by range for the Casa Diablo herd.

As indicated by one-way ANOVA, there was no significant difference in KFI between deer from Truman Meadows, Marble Creek, and Banner Ridge (P=0.05). Also, there was no significant difference in BCW between ranges (P=0.05).

DISCUSSION

Due to the small sample size of the 1987 Casa Diablo deer herd collection and the fact that no previous information regarding reproduction in the herd has been recorded, it is possible only to make general remarks when considering the productivity of the herd.

All 18 adult does collected from the Casa Diablo deer herd were found to be pregnant and no differences were found between the number of corpora lutea counted and the number of fetuses. This may suggest that prenatal mortality within the Casa Diablo deer herd in 1987 was minimal indicating adequate maternal nutrition among adult does.

Data compiled on fetal sex ratios for the three populations sampled, Truman Meadows, Marble Creek, and Banner Ridge, strongly favored female fetuses (54 males per 100 females). In Utah, Robinette et al (1977), found a fetal sex ratio of 79 males per 100 females on good range, while on poor range the fetal sex ratio was 192 males per 100 females. Verme (1969) found that males constituted 70 percent of births from white-tailed does on a poor diet at breeding, compared with 47 percent from does on a good diet (Wallmo 1981). Thus, the preponderance of female fetuses within the three populations sampled is another indication of adequate maternal nutrition among Casa Diablo does resulting from good range conditions.

Estimated dates of conception, for deer collected from the three populations sampled, ranged from 1 December 1986 through 5 January 1987. Consequently, fawning was estimated to occur from between 20 June through 27 July 1987. The only available published data which offers any sort of geographical comparison to these dates is provided by Bischoff (1957), who found that breeding and thus conception dates for 67 Inyo mule deer (O. hemionus inyoensis) from the Buttermilk herd ranged from between 5 December through about 24 January.

The fact that data obtained from Casa Diablo does collected in 1987 show high rates of ovulation, conception, and pregnancy may be somewhat misleading when considering reproduction in other years.

FIG.1 ESTIMATED CONCEPTION AND FAWNING DATES OF THE CASA DIABLO DEER HERD

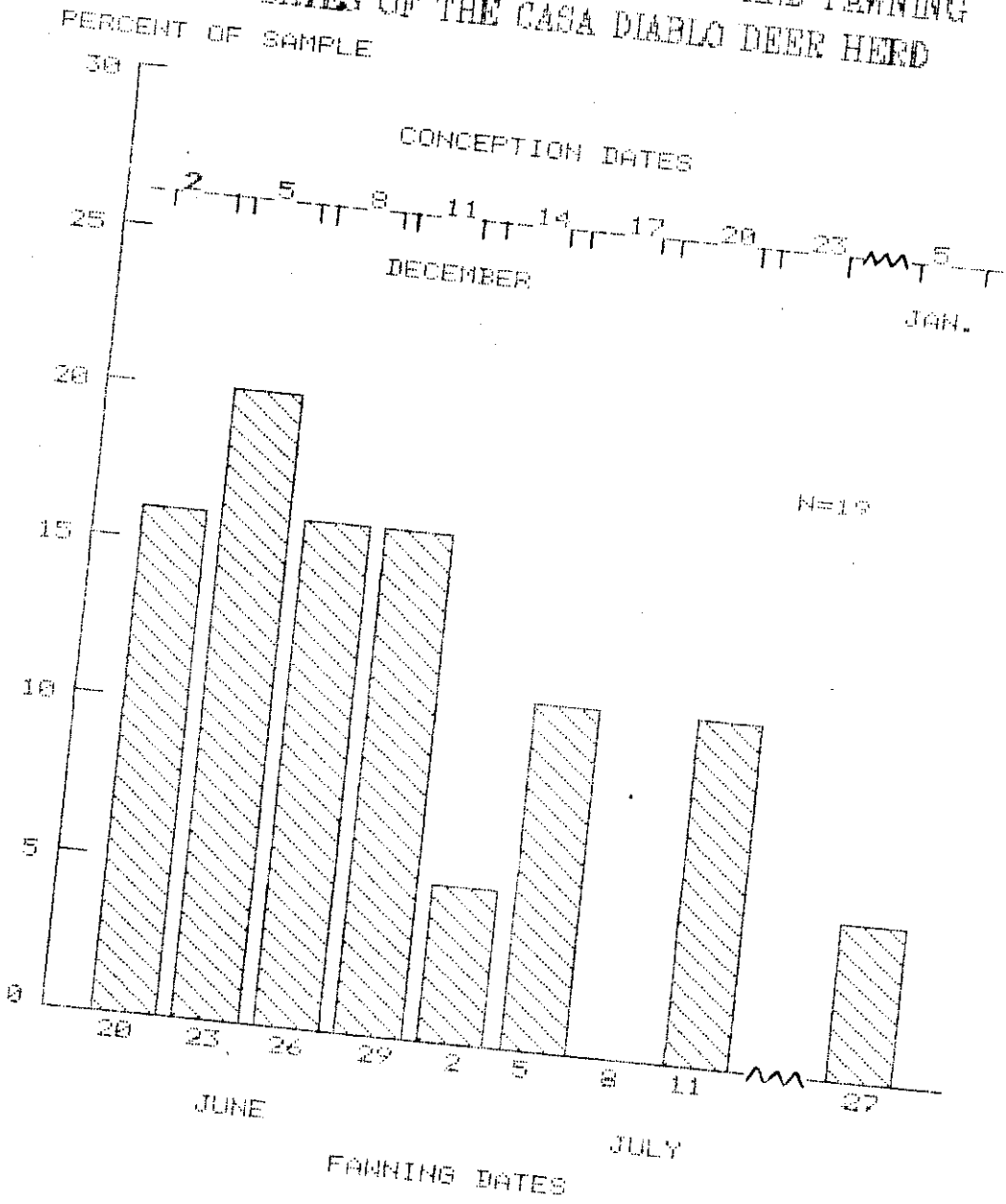
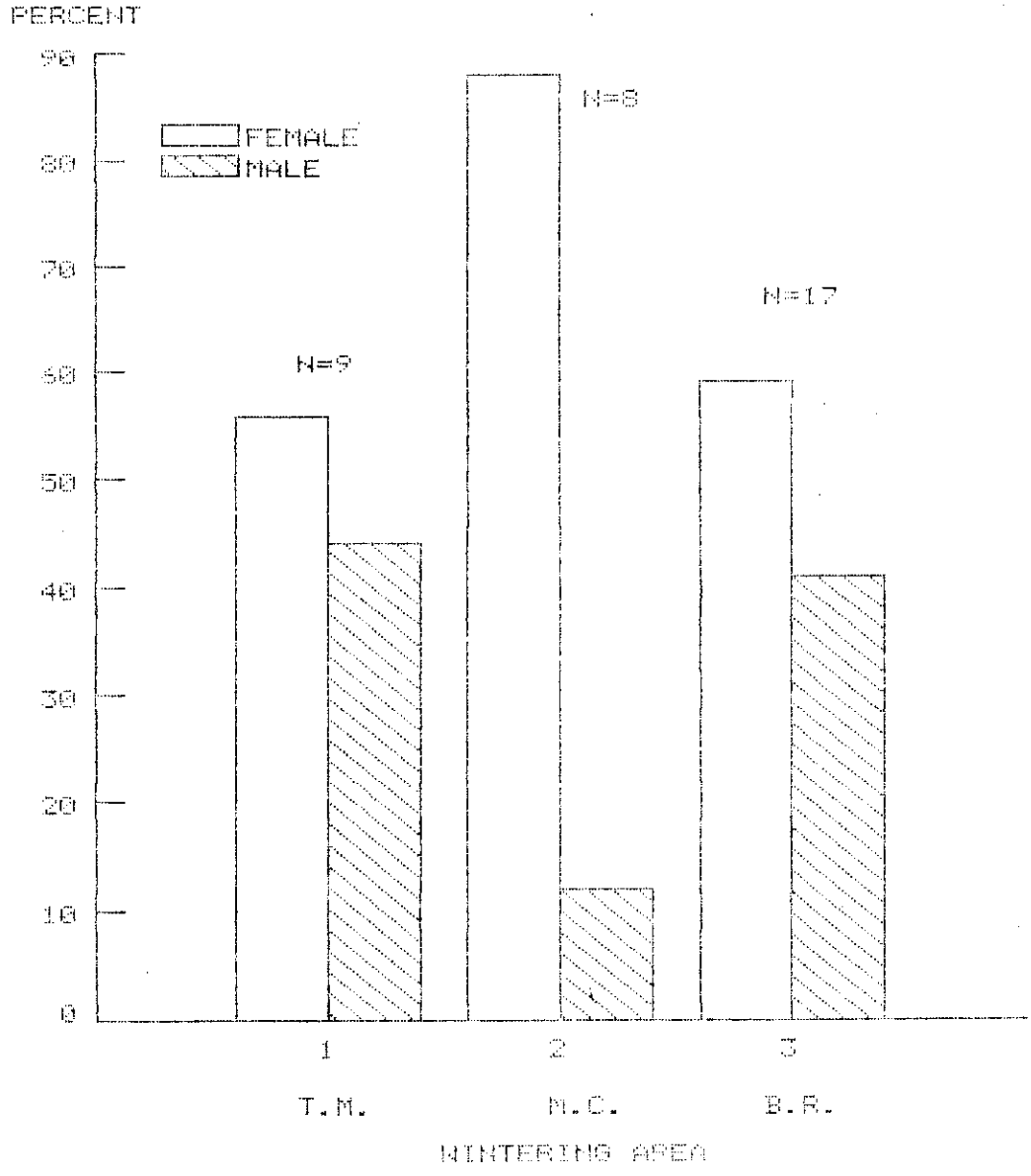


FIG.2 PERCENT OF MALE AND FEMALE FETUSES
TRUMAN MDWS, MARBLE CRK, BANNER RIDGE



It must be stressed that the winter of 1986/87 was one of well below average precipitation and snowfall in the eastern Sierra. Thus, deer which normally occupy wintering areas of Great Basin sagebrush vegetation at lower elevations were found to spend the majority of the winter months in 1987 at higher elevations in pinion/juniper woodland. This is especially true of deer from Truman Meadows and Banner Ridge. Deer in both of these areas were found to take advantage of light snow conditions by feeding on an extremely large pinion nut crop which had resulted from the wet winter of 1985/86. Consequently, by consuming large quantities of pinion nuts, a food low in protein and minerals, but high in fat, pregnant does were able to maintain a high level of nutrition throughout the winter months. This in turn resulted in better animal condition, and thus higher pregnancy and fetal rates among adult does from Truman Meadows and Marble Creek in 1987. This point is reinforced by the fact that animal condition in mid March, as measured by KFI, was found to average .58 and .40 respectively for deer from Banner Ridge and Truman Meadows, and .24 for deer from Marble Creek.

It is suspected that in winters of average to above average precipitation and snowfall when deer are forced to concentrate at lower elevations, ovulation, conception, pregnancy, and fetal rates among adult does in the Casa Diablo herd are probably well below that found in 1987.

In order to better determine "true" reproductive performance within the herd, it would be necessary to conduct collections in years covering a variety of climatic conditions.

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CASA DIABLO DEER STUDY

INTERIM REPORT

Timothy Taylor
P.O.Box 191
June Lake, Ca.

CASA DIABLO DEER STUDY

Recent plans for recreational, geothermal and urban development on critical Rocky Mountain mule deer (Odocoileus hemionus hemionus) range in parts of Mono County, has prompted the California Department of Fish and Game to begin a study of the Casa Diablo deer herd. Prior to this study, little was known about specific locations of migratory routes, spring holding or summering areas used by the Casa Diablo deer herd. This study, which was initiated in early January of 1985, first aims at defining critical Casa Diablo deer use areas, especially those which may be subject to alteration from proposed developments.

Proposed recreational and geothermal developments on spring and summer Casa Diablo deer herd range near the Mammoth and June Lake areas in south-western Mono County, are currently the biggest problems confronting wildlife managers. These developments include the proposal of one new ski facility in the Mammoth Lakes area and the possible future connection of the Mammoth and June Mountain ski areas via San Joaquin Ridge, an important Casa Diablo herd migration corridor. Several geothermal projects, both existing and proposed, along with a demand for urban expansion in the Mammoth Lakes area, also threaten important deer habitats. Thus, an urgent need exists to identify all critical deer use areas within Casa Diablo deer herd boundaries.

Other problems with the Casa Diablo deer herd such as low buck ratios and low productivity, as indicated by spring fawn-doe ratios of 20-50 fawns per 100 does, has also been of concern to DFG biologists for the last several years. Therefore, a better knowledge of Casa Diablo deer herd demography (ie. reproductive and mortality rates and population trends) is needed. Also, a need exists to analyze the quality and quanity of vegetation on critical Casa Diablo deer use areas, particularly where livestock grazing is prevalent, and to assess the impacts of grazing on these habitats.

OBJECTIVES

The objectives of the Casa Diablo deer herd study are mainly those of the California Department of Fish and Game. The investigator has agreed with the State of California to complete the following objectives:

1. To delinate all key habitats used by the Casa Diablo deer herd.
2. To analyze the quanity and quality of all key habitats defined.
3. To assess the impacts of other land uses, existing and proposed (livestock, recreation, geothermal etc.), on deer habitat.
4. To identify habitat factors limiting the Casa Diablo deer herd and to formulate recommendations to reduce the impacts of these factors.

STUDY AREA

The deer herd under study, the Casa Diablo deer herd, winters on six major areas located between 20 and 65 km north of Bishop, California in the south-eastern part of Mono County (Fig. 1). From north to south these wintering areas include: 1. Truman Meadows, located at the northern end of the Casa Diablo winter range, approximately 65 km north of Bishop, California and 13 km north of Benton, California; 2. Marble Creek, located approximately 48 km north of Bishop, California at the base of the west slope of the White Mountain Range; 3. Blind Spring Hills, located due west of Marble Creek on the west side of U.S. Highway 6 in the Benton Range; 4. Chidago Flat, located 35 km north of Bishop, California and 15 km west of U.S. Highway 6; 5. Casa Diablo Mountain, located 28 km northwest of Bishop, California; 6. The Volcanic Tablelands, located approximately 24 km north of Bishop, California at the south end of Casa Diablo Mountain.

Average elevation on the winter range is 6100 feet with Casa Diablo Mountain being the highest at 6800 feet and The Volcanic Tablelands the lowest at 5400 feet. Winter range vegetation is a Great Basin shrub type consisting mostly of big sagebrush (*Artemisia tridentata*), bitterbrush (*Purshia tridentata*) and rabbitbrush (*Chrysothamnus* spp.) with pinyon/juniper woodlands occupying areas with elevations above 6500 feet.

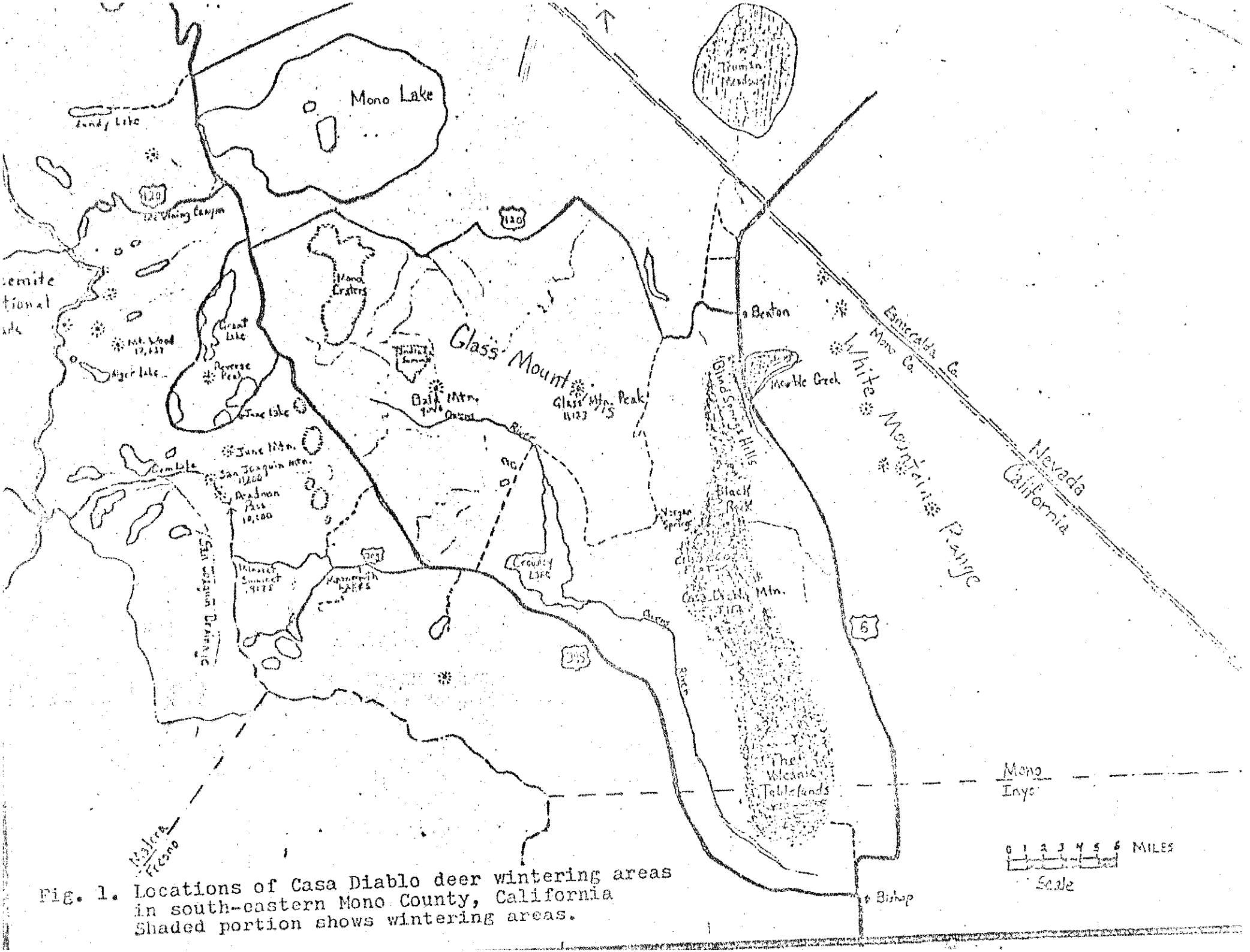

Fig. 1. Locations of Casa Diablo deer wintering areas in south-eastern Mono County, California Shaded portion shows wintering areas.

METHODS

1. Capture and marking.

Between 14 January and 7 March 1986 deer were captured on the Casa Diablo winter range using Clover traps (Clover 1956) baited with alfalfa and drive nets. All deer captured were physically restrained, no chemical restraint was used, and marked with large, numbered cattle ear tags color coded to wintering area. Twenty-three deer, all adult does, were fitted with radio telemetry collars. An additional adult doe was captured on its spring range by use of a tranquilizer dart, fitted with a radio collar and released.

2. Animal movements.

Radioed animals were located from the ground on a daily basis and from a DFG fixed-wing aircraft. Any marked deer observed on the winter range or during spring migration was recorded, along with its location and other animals it was with. All unmarked deer observed on the winter range or during spring migration were also counted and recorded.

3. Deer herd composition.

Deer were classified by sex and age in both early January and late March of 1986 by the investigator and DFG biologists. Post season (fall) composition counts were conducted from a contract helicopter over the entire winter range. Spring composition counts were conducted on foot in more accessiable portions of the winter range.

RESULTS

1. Capture and marking.

A total of 104 deer (76 females and 28 males) were captured, marked and released on six different areas of the Casa Diablo winter range (Table 1). Thirty-one of these were fawns (10 females and 21 males), 7 adult males and 66 adult females. Twenty-three adult deer (22 females and 1 male) were fitted with radio transmitter collars. This includes 5 females on Marble Creek, 5 females and 1 male at Blind Springs, 4 females at Truman Meadows, 3 females at The Volcanic Tablelands, 3 females at Casa Diablo Mountain and 2 females at Chidago Flat. Eighty-one deer were

Table 1. Total number and composition of deer captured, marked and released on each of the Casa Diablo wintering areas.

LOCATION	ADULT		FAWNS		TOTAL
	MALE	FEMALE	MALE	FEMALE	
Marble Creek	4	25	9	6	44
Blind Springs	2	16	5	1	24
Truman Meadows	0	5	2	0	7
Tablelands	0	9	3	0	12
Casa Diablo Mtn.	0	3	0	0	3
Chidago Flat	1	8	2	3	14
TOTAL	7	66	21	10	104

marked only with large, numbered cattle ear tags color coded to wintering area. One additional adult female was captured and fitted with a radio collar on a spring holding area located near the headwaters of the Owens River, some 10 km north of Mammoth Lakes, California.

2. Animal movements (spring migration).

Deer began leaving the Casa Diablo winter range in early April. The first radioed deer to migrate left the Marble Creek wintering area on 3 April 1986. The last radioed deer to begin migrating, also from Marble Creek, left on 10 May 1986.

Of the twenty-three radioed deer on the Casa Diablo range, 21 or 91.3% of the total radioed sample migrated west toward the east slope of the Sierra Nevada. Two radioed deer (8.7%), both from Marble Creek, migrated up the west slope of the White Mountain Range.

Nineteen (82.6%) of the radioed deer to migrate west did so by first following the base of the south slope of the Glass Mountain Range to Bald Mountain and the headwaters of the Owens River (Fig.2). Two radioed deer (8.7%) migrated along the north side of the Glass Mountain Range to reach their summering destinations near the June Lake Loop.

Of the nineteen radioed deer to migrate along the south slope of the Glass Mountains to Bald Mountain, thirteen or 56.0% of these continued north via Clark and Alpers Canyons, and around the southern end of the Mono Craters to the Aeolian Buttes. Here deer were observed crossing U.S. Highway 395 before continuing west around the north end of Grant Lake and across U.S. Highway 158 to a large spring holding and summering area located near the Parker Lake, Walker Lake and Bohler Canyon drainages. From here 6 deer (26%) continued north, 4 to Lee Vining Canyon, 1 to Lundy Canyon and 1 to Twin Lakes.

Five radioed deer remained in the Owens River-Bald Mountain area throughout the spring. One of these was killed by a mountain lion (Felis concolor) on 26 April 1986 on the south slope of Bald Mountain. Its radio collar was put on another adult doe on 10 May 1986 in the same area. This deer never migrated further and is now summering on Lookout Mountain, just south of the Owens River. The other four radioed deer spent approximately

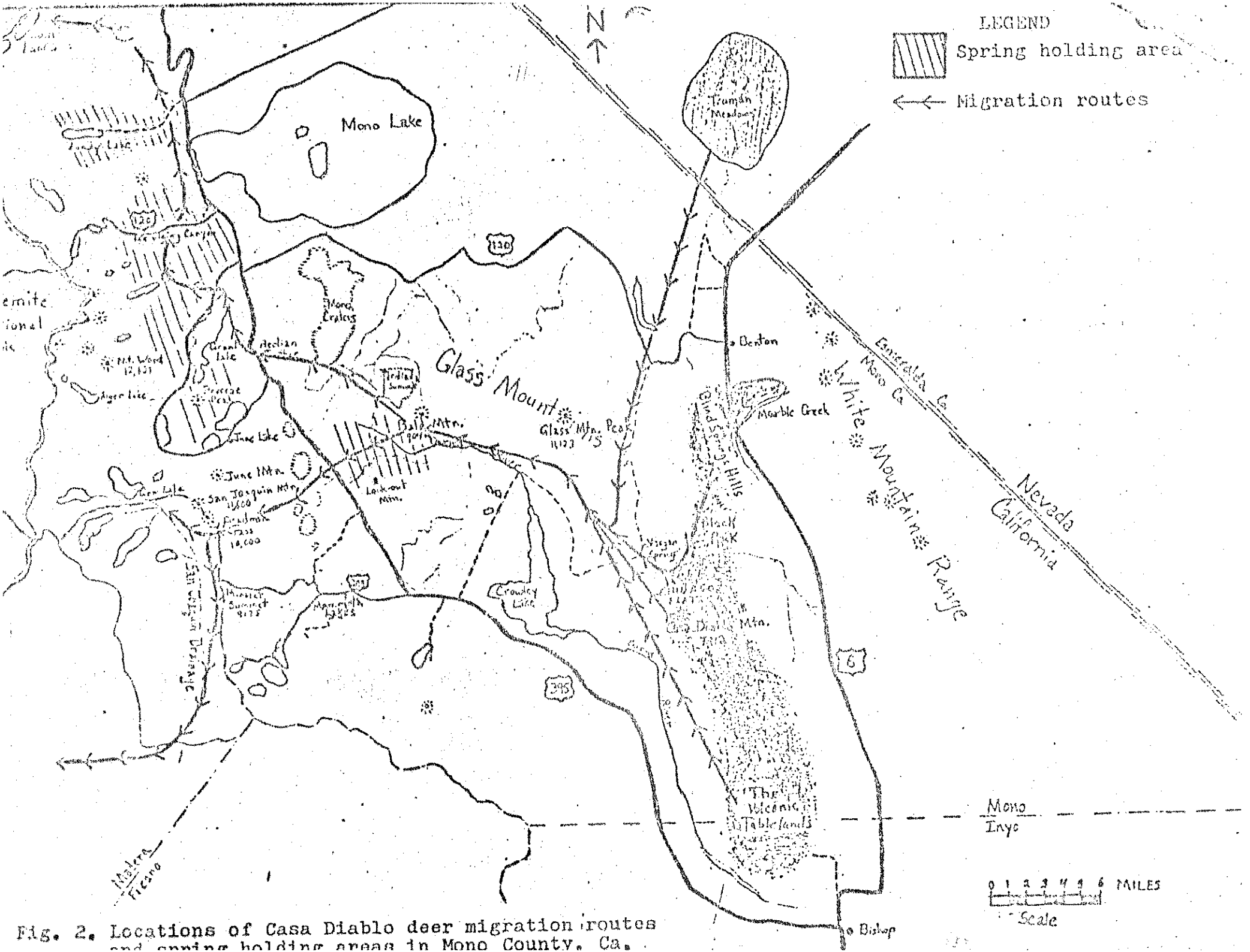

Fig. 2. Locations of Casa Diablo deer migration routes and spring holding areas in Mono County, Ca.

one month (21 April-24 May 1986) in the Bald Mountain-Owens River holding area before continuing west across U.S. Highway 395 toward San Joaquin Ridge. Three of these crossed over San Joaquin Ridge to their summering areas on the west side of the Sierra Nevada, while one has remained just east of San Joaquin Ridge on the south slope of White-Wing Mountain.

One radioed deer, the only male, migrated about one-third the way along the south slope of the Glass Mountain Range before going high up into O'Harrel Canyon where it is now summering.

A total of 43 individually marked Casa Diablo deer or 42% of the total marked sample were observed during migration. Thirty-seven of these were seen by the investigator and 6 by members of the public.

Deer were found to concentrate on five major spring holding areas before moving onto their summering areas. From north to south these areas include: the Lundy Canyon drainage; the mouth of Lee Vining Canyon; the Bohler Canyon, Walker Lake and Parker Lake drainages; the Reverse Peak area of the June Lake Loop; the Owens River-Bald Mountain area (Fig. 2).

Summer Range

Twenty-one of 23 radio collared deer (91.3%) are known to summer west of their wintering areas (Fig. 3). Of these 21, thirteen (57.0%) are known to summer on the east slope of the Sierra Nevada, from the Deadman Creek drainage north to Twin Lakes near Bridgeport (Fig.4).

Another five radioed deer (22%) summer east of U.S. Highway 395 from O'Harrel Canyon in the Glass Mountain Range, west to the headwaters of the Owens River and north to the Mono Craters.

Three radioed deer (13.0%) summer west of the Sierra Crest, two in the San Joaquin drainage and one in Madera County near Bass Lake.

Two radioed deer (8.7%), both from Marble Creek, are summering on the west slope of the White Mountain Range (Fig. 5).

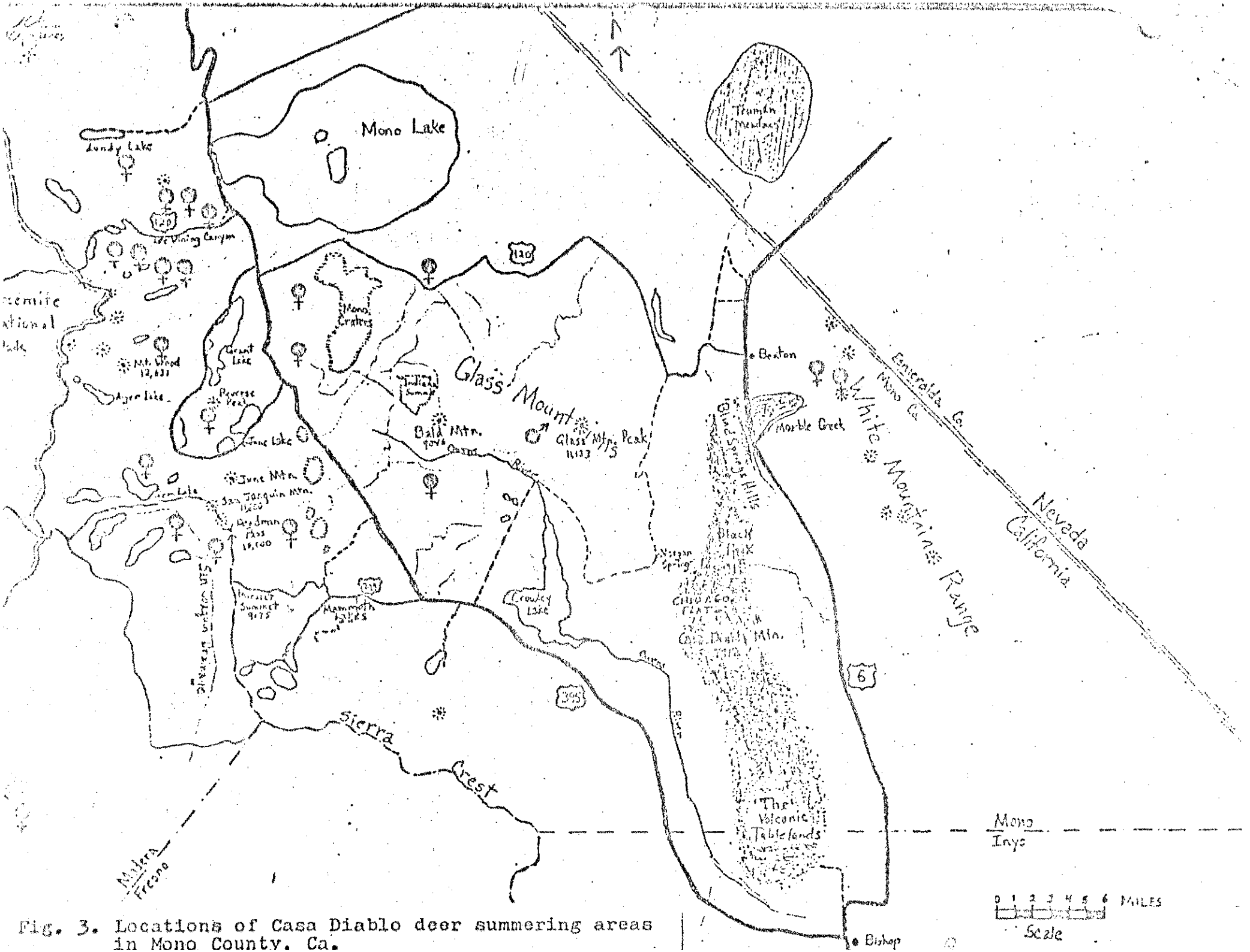

Fig. 3. Locations of Casa Diablo deer summering areas in Mono County, Ca.

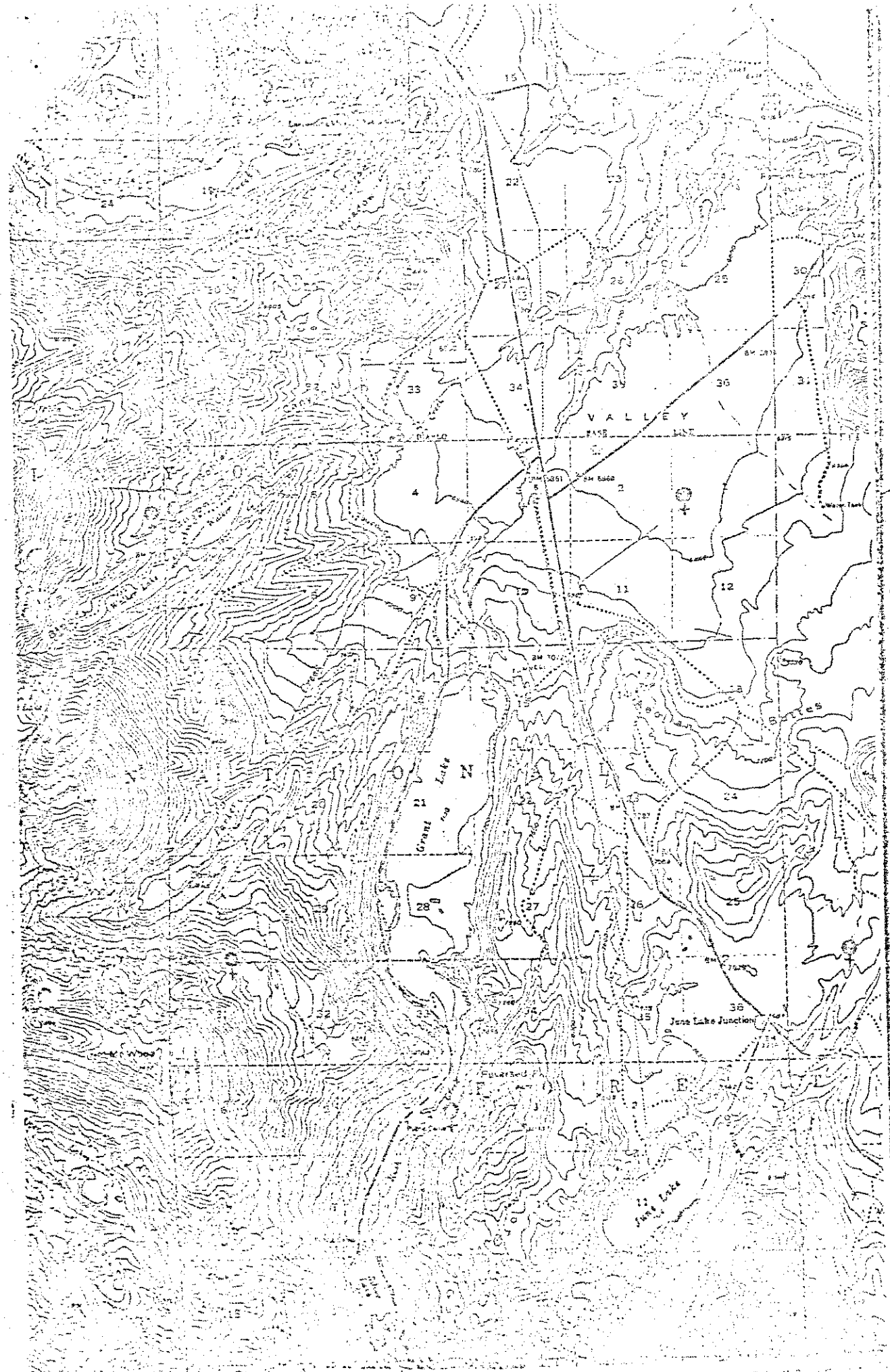

Fig. 4. Location of [illegible] area [illegible] to Los Valles

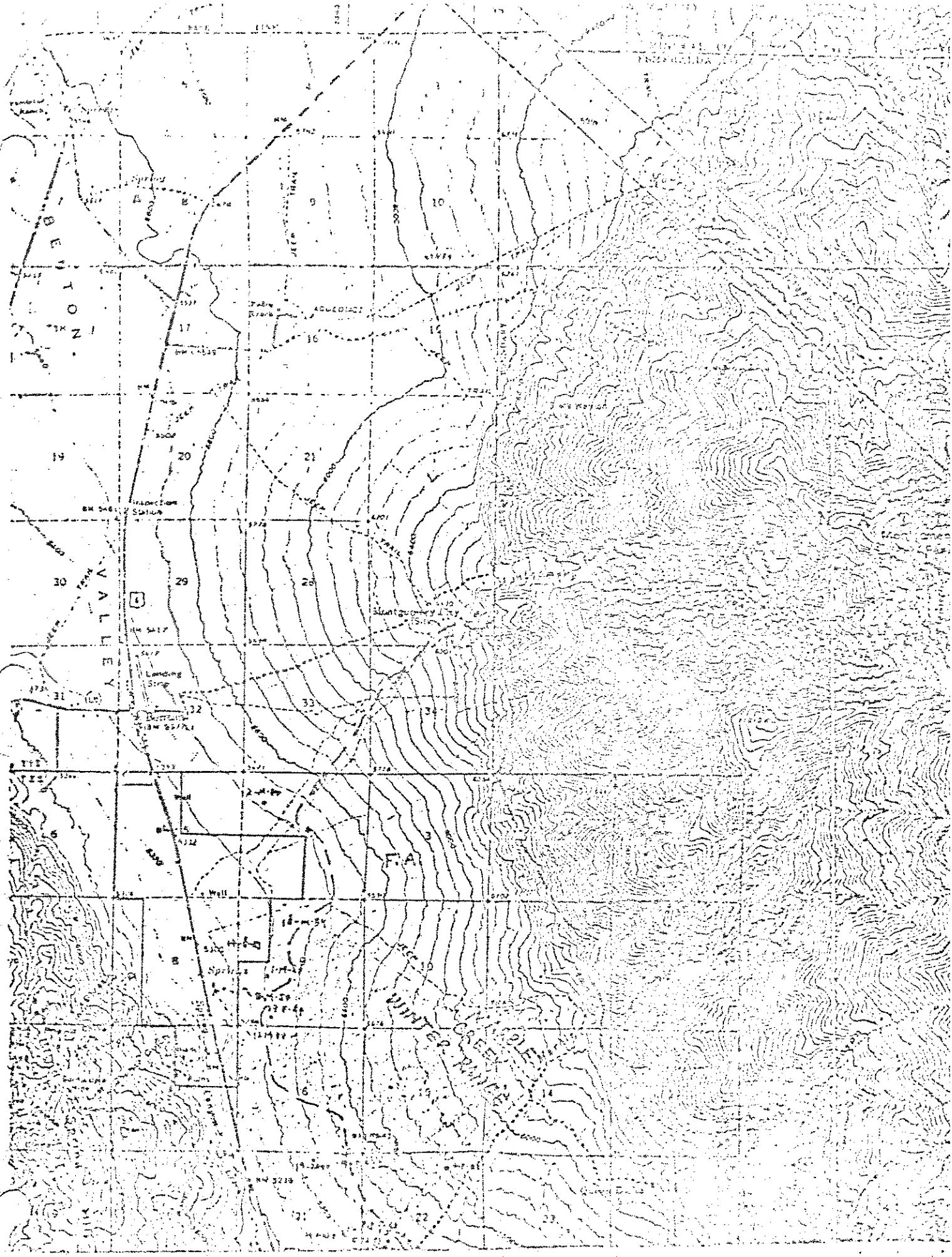

Fig. 5. Locations of the two Coon Rapids deep aquifers in the

3. Herd composition.

Post season herd composition counts conducted from a helicopter on 7 January 1985 by the investigator and DFG biologists revealed buck:doe ratios of 15:100 and fawn:doe ratios of 61:100. Spring composition counts conducted on foot in late March of 1986 showed a fawn:doe ratio of 21:100.

DISCUSSION

Provided the radio sample of deer is representative of the entire population, it can be assumed that approximately 83% of the Casa Diablo herd summers on the east side of the Sierra Nevada. Thus, about 1200 of 1500 deer from the Casa Diablo winter range occupy summering habitat on the east side of the Sierra Nevada.

Approximately one-half of the Casa Diablo deer herd, about 700 animals, summer in or near major drainages on the east slope of the Sierra Nevada, from the Deadman creek drainage north to Twin Lakes. Another 330 deer, or 26% of the entire herd, summer on the east side of U.S. Highway 395 from the headwaters of the Owens River, north to the Mono Craters and east to the Glass Mountains.

It can be estimated that about 200 deer from the Casa Diablo winter range, 13% of the entire population, cross over San Joaquin Ridge via Deadman Pass and passes further north to gain access to their west side summering areas. San Joaquin Ridge is also known to be used by deer from the Round Valley wintering area to gain access to their summer ranges in the San Joaquin drainage and places further south. Thus, the importance of San Joaquin Ridge as a migration corridor is now evident and any ski area development may eliminate or reduce access to large portions of summer range used by hundreds of deer.

Although approximately 40 km separate the northern most wintering area, Truman Meadows, from the southern most wintering area, The Volcanic Tablelands, there was no distinct difference in selection of migratory routes or summering areas of Casa Diablo deer. Radioed deer from Truman Meadows and The Volcanic Tablelands were found to occupy summering areas of close proximity and to use the same migration routes and spring holding areas.

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CASA DIABLO DEER STUDY

SECOND INTERIM REPORT

Timothy Taylor

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INTRODUCTION

Recent plans for recreational, geothermal and urban development on critical Rocky Mountain mule deer (Odocoileus hemionus hemionus) range in parts of Mono County, has prompted the California Department of Fish and Game to begin a study of the Casa Diablo deer herd. Prior to this study, little was known about specific locations of migratory routes, spring holding or summering areas used by the Casa Diablo deer herd. This study, which was initiated in early January of 1986, first aims at defining critical Casa Diablo deer use areas, especially those which may be subject to alteration from proposed developments.

Proposed recreational and geothermal developments on spring and summer Casa Diablo deer herd range near the Mammoth and June Lake areas in the south-western Mono County are currently the biggest problems confronting wildlife managers. These developments include the proposal of one new ski facility in the Mammoth Lakes area and the possible future connection of the Mammoth and June Mountain ski areas via San Joaquin Ridge, an important Casa Diablo deer herd migration corridor. Several geothermal projects, both existing and proposed, along with a demand for urban expansion in the Mammoth Lakes area, also threaten important deer habitats. Thus, an urgent need exists to identify all critical deer use areas within Casa Diablo deer herd boundaries.

Other problems with the Casa Diablo deer herd such as low buck ratios and low productivity, as indicated by spring fawn-doe ratios of 20-50 fawns per 100 does, has also been of concern to DFG biologists for the last several years. Therefore, a better knowledge of Casa Diablo deer herd demography (ie. reproductive and mortality rates and population trends) is needed. Also, a need exists to analyze the quality and quantity of vegetation on critical Casa Diablo deer use areas particularly where livestock grazing is prevalent and to assess the impacts of grazing on these habitats.

OBJECTIVES

The objectives of the Casa Diablo deer herd study are mainly those of the California Department of Fish and Game. The investigator has agreed with the State of California to complete the following objectives:

1. To delineate all key habitats used by the Casa Diablo deer herd.
2. To analyze the quantity and quality of all key habitats defined.
3. To assess the impacts of other land uses, existing and proposed (livestock, recreation, geothermal etc.), on deer habitat.
4. To identify habitat factors limiting the Casa Diablo deer herd and to formulate recommendations to reduce the impacts of these factors.

STUDY AREA

The deer herd under study, the Casa Diablo deer herd, winters on six major areas located between 20 and 65 km north of Bishop, California in the south-eastern part of Mono County (Fig. 1). From north to south these wintering areas include: 1. Truman Meadows, located at the northern end of the Casa Diablo winter range, approximately 65 km north of Bishop, California and 13 km north of Benton, California; 2. Marble Creek, located approximately 48 km north of Bishop, California at the base of the west slope of the White Mountain range; 3. Blind Spring Hills, located due west of Marble Creek on the west side of U.S. Highway 6 in the Benton Range; 4. Chidago Flat, located 35 km north of Bishop, California and 15 km west of U.S. highway 6; 5. Casa Diablo Mountain, located 28 km northwest of Bishop, California; 6. The Volcanic Tablelands, located approximately 24 km north of Bishop, California at the south end of Casa Diablo Mountain.

Average elevation on the winter range is 6100 feet with Casa Diablo Mountain being the highest at 6800 feet and the Volcanic Tablelands the lowest at 5400 feet. Winter range vegetation is a Great Basin shrub type consisting mostly of big sagebrush (Artemisia tridentata), bitterbrush (Purshia tridentata) and rabbitbrush (Chrysothamnus spp.) with pinion/juniper woodlands occupying areas with elevations above 6500 feet.

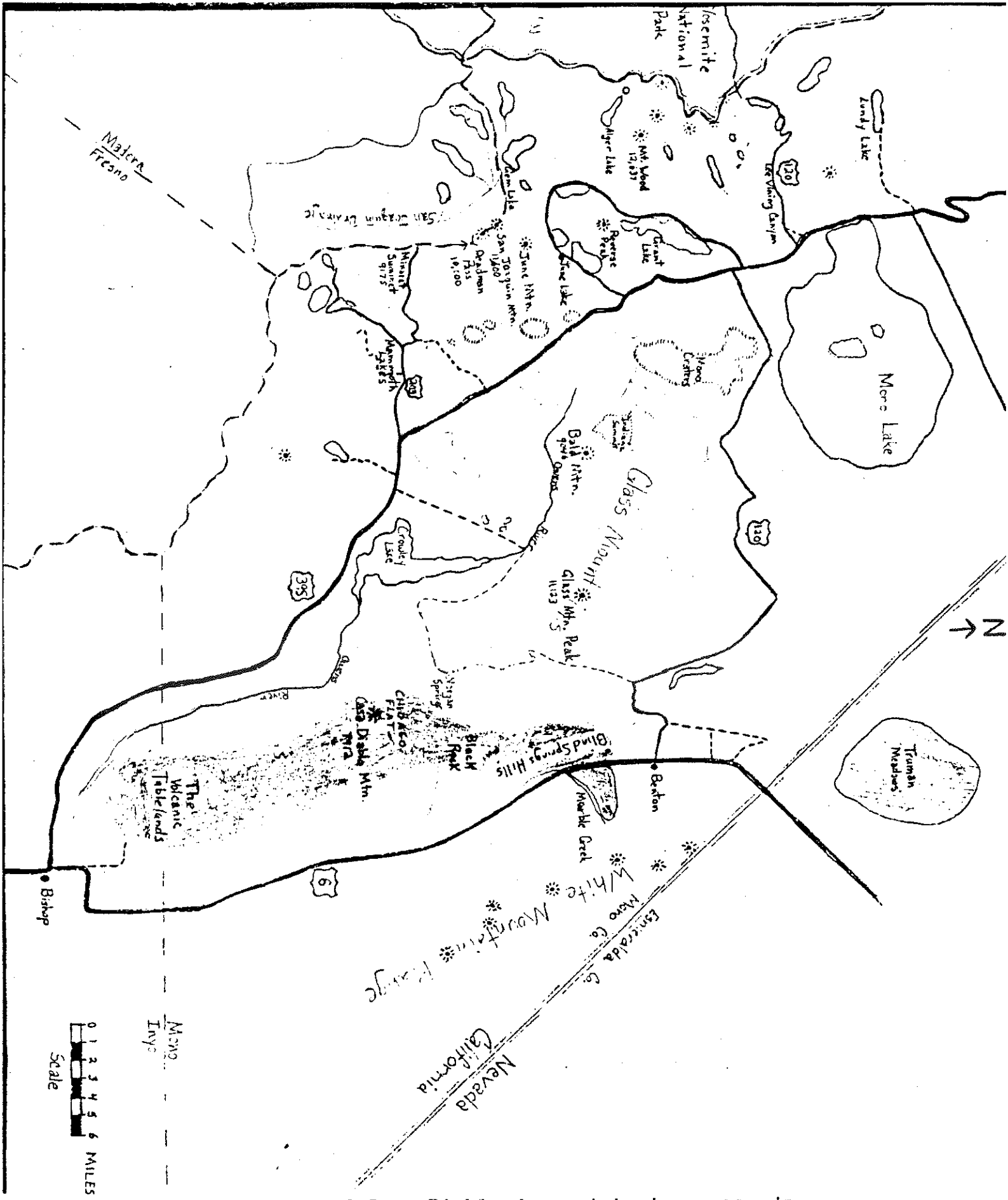

Figure 1. Location of Casa Diablo deer wintering areas in South-eastern Mono County, California. Shaded portion shows wintering areas.

METHODS

1. Capture and marking.

Between 14 January and 7 March 1986 deer were captured on the Casa Diablo winter range using Clover traps (Clover 1956), baited with alfalfa, and drive nets. All deer captured were physically restrained, no chemical restraint was used, and marked with large, numbered cattle ear tags color coded to wintering area. Twenty-three deer, all adult does, were fitted with radio telemetry collars. An additional adult doe was captured on its spring range by use of a tranquilizer dart, fitted with a radio collar and released.

2. Animal movements.

Radioed animals were located from the ground on a daily basis and from a DFG fixed-wing aircraft. Any marked deer observed on the winter range, summer range or during spring and fall migration was recorded, along with its location and other animals it was with. All unmarked deer observed on the winter and summer ranges and during spring and fall migration were also classified and recorded.

3. Deer herd composition.

Post season (fall) deer composition counts were conducted over the entire winter range by use of a contract helicopter on 7 January 1986. Spring composition counts were conducted on foot in March and early April 1986 in more accessible portions of the winter range. Preseason composition counts were conducted in August and early September 1986 on the summer range. On 24 and 25 September 1986 an early post season composition count was conducted along a portion of the Casa Diablo deer herd migration corridor during the peak of fall migration. On 6 January 1987, a helicopter was used to conduct post season composition counts only over the Marble Creek wintering area. During each composition count all deer observed were counted and classified according to sex and age.

RESULTS

1. Capture and marking.

A total of 104 deer (76 females and 28 males) were captured, marked and released on six different areas of the Casa Diablo winter range (Table 1). Thirty-one of these were fawns (10 females and 21 males), 7 adult males and 66 adult females. Twenty-three adult deer (22 females and 1 male) were fitted with radio transmitter collars. This includes 5 females on Marble Creek, 5 females and 1 male at Blind Springs, 4 females at Truman Meadows, 3 females at the Volcanic Tablelands, 3 females at Casa Diablo Mountain and 2 females at Chidago Flat. Eighty-one deer were marked only with large, numbered cattle ear tags color coded to wintering area. One additional adult female was captured and fitted with a radio collar on a spring holding area located near the headwaters of the Owens River, some 10 km north of Mammoth Lakes, California.

2. Mortalities and radio failure.

Two (8.7%) of the 23 deer radioed on the Casa Diablo range died during the spring and summer. One, a radioed female, was killed by a mountain lion on 26 April 1986 on her spring range near the south slope of Bald Mountain. The other, a radioed female from Marble Creek, died in late August on her summer range near lower Rush Creek. Three ear tagged males marked on the Casa Diablo range during the winter of 1986 were shot by hunters in September of 1986. Two of these, one from Truman Meadows and one from Chidago Flat were harvested as yearlings. The other, from Marble Creek, was harvested as a two year old.

Transmitter failure occurred in the radio of one female (.110) from the Marble Creek winter Range. She was last located from the air on 28 October 1986 on the Marble Creek wintering area. On a flight conducted on 4 November 1986, no location for her was recorded. On 1 December 1986 she was observed on the Marble Creek winter range by the investigator and no radio signal could be received.

Table 1. Total number and composition of deer captured, marked and released on each of the Casa Diablo wintering areas.

LOCATION	ADULTS MALE	ADULTS FEMALE	FAWNS MALE	FAWNS FEMALE	TOTAL
Marble Creek	4	25	9	6	44
Blind Springs	2	16	5	1	24
Truman Meadows	0	5	2	0	7
Tablelands	0	9	3	0	12
Casa Diablo Mtn.	0	3	0	0	3
Chidago Flat	1	8	2	3	14
TOTAL	7	66	21	10	104

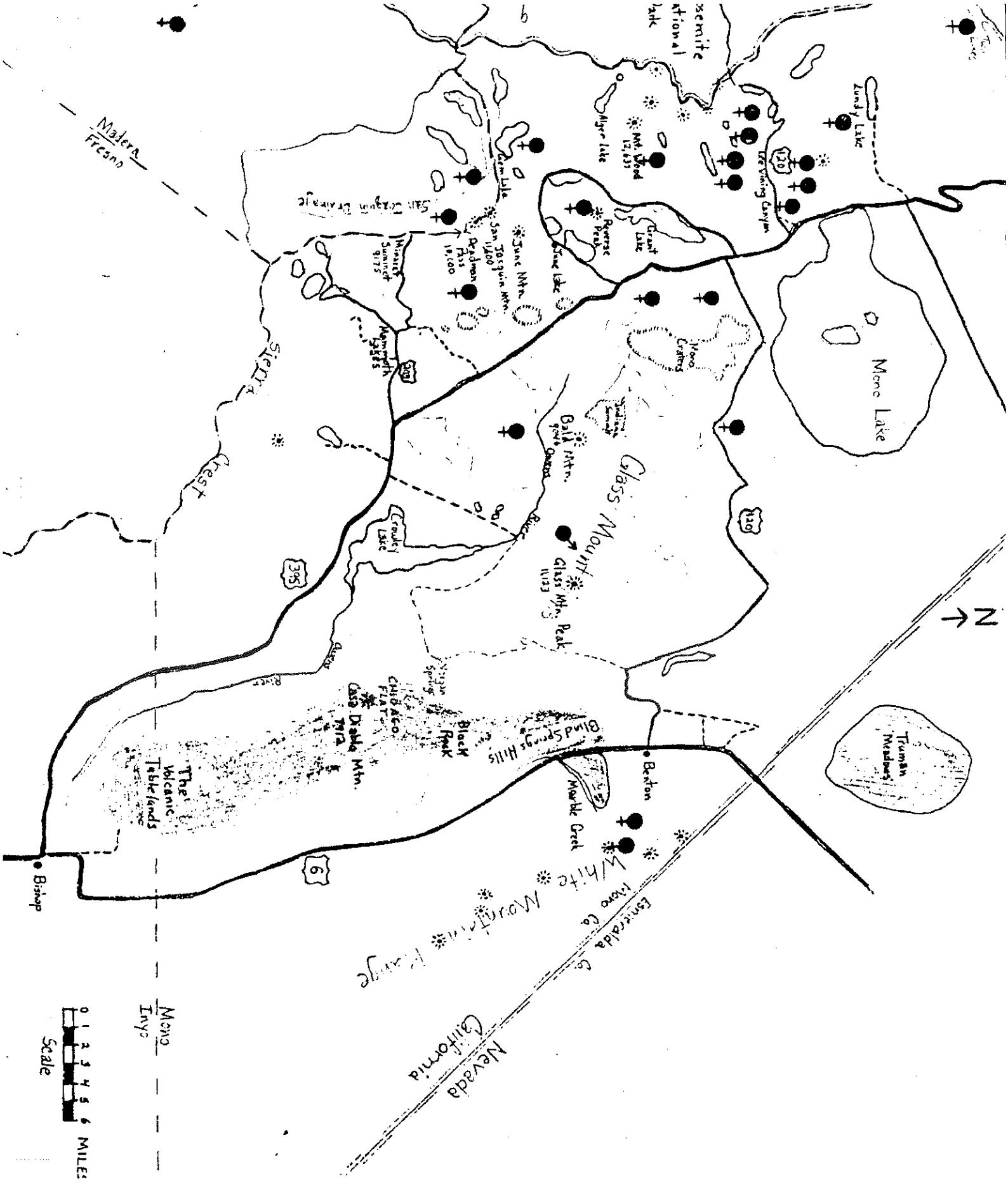

Figure 3. Locations of Casa Diablo radioed deer summering areas in Mono County, California.

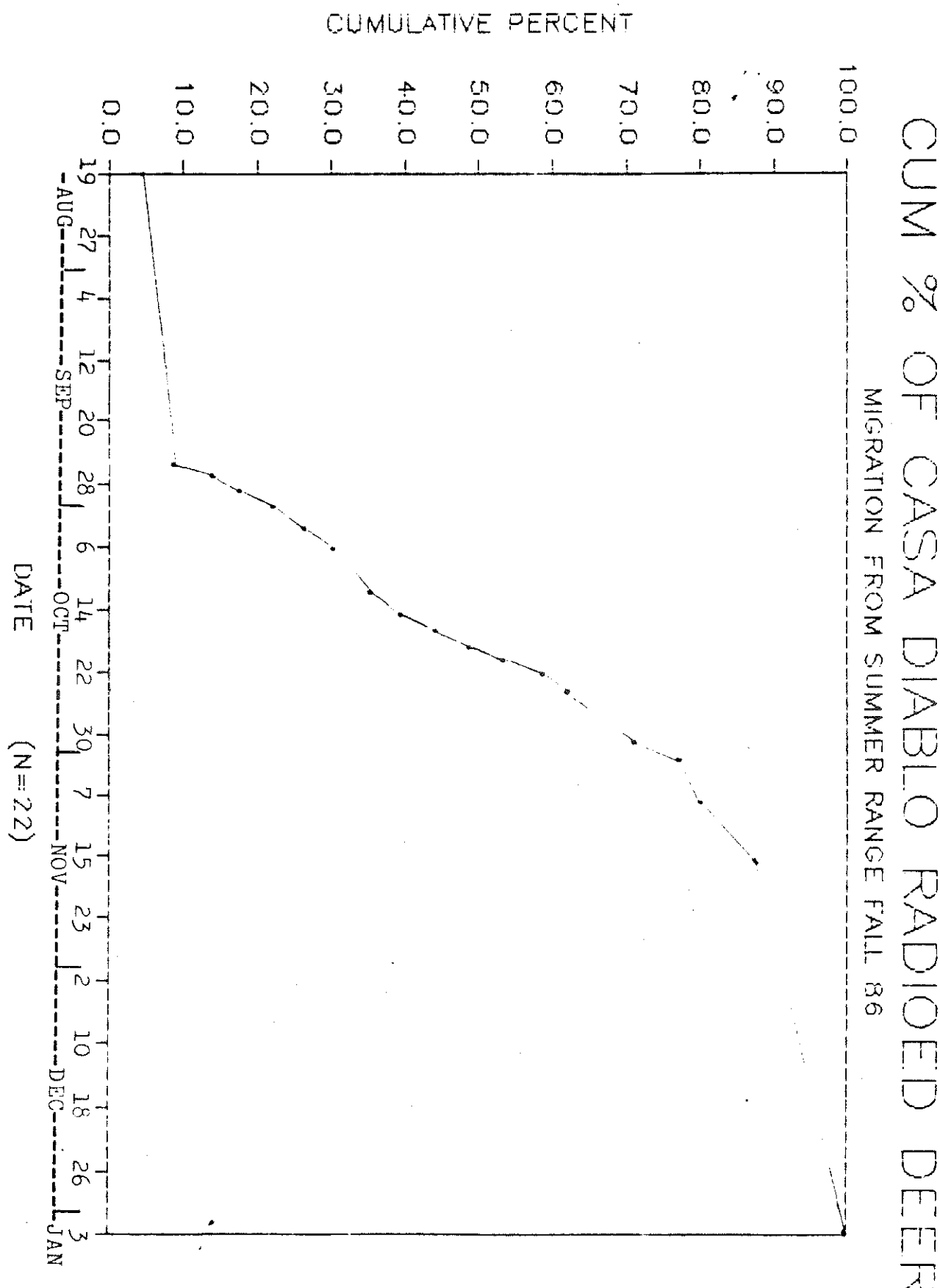

Figure 4. Cumulative percent of Casa Diablo radioed deer exiting the summer range by date (fall 1986).

storm triggered a very gradual movement of deer from both the east and west side Sierra summer range. Due to the fact that no subsequent storms entered the region until 3 January 1987, the leisurely pattern of the 1986 fall migration carried over into the new year.

From Figure 4 it can be seen that 19 of the 22 radioed deer (86.0%) returning from the summer range had migrated by 15 November 1986. Thirteen of these 19 radioed deer returned from summering areas on the east slope of the Sierra Nevada. Three returned from summering areas on the west side of the Sierra crest and 3 from summering areas east of Highway 395 from the headwaters of the Owens River north to the Mono Craters. Only 6 of these 19 radioed deer, 4 from Truman Meadows and 2 from Marble Creek, returned directly to their wintering areas. The other 13 migrated only as far as a transition range located at approximately 7,000 feet near the southeast end of the Glass Mountains and the Banner Ridge. These 13 radioed deer had remained widely dispersed on this pinion-sagebrush transition range throughout November and December of 1986 and early January of 1987.

Three radioed deer remained on their summer ranges until 3 January 1987 when a major winter storm deposited 2 feet of snow at the 7,800 foot level (U.S.F.S., Unpublish.). Two of these radioed deer summered on the east slope of the Sierra, one in Lundy Canyon and one near lower Twin Lake. Both animals migrated immediately subsequent to the storm on 3 January returning directly to their wintering areas. The other, the only radioed male, summered in the east fork of O'Harrel Canyon at approximately the 10,000 foot level. He migrated only as far as the Banner Ridge area in response to the storm on 3 January.

4. Deer herd composition and size.

Post season herd composition counts conducted from a helicopter on 7 January 1986 by the investigator and DFG personnel revealed buck:doe ratios of 15:100 and fawn:doe ratios of 61:100. Spring composition counts conducted from the ground in April of 1986 showed a buck:doe ratio of 5:100 and fawn:doe ratio of 36:100.

Preseason herd composition counts conducted on the summer range of Casa Diablo deer between 13 August and 12 September 1986 revealed a buck:doe ratio of 14:100 and fawn:doe ratio of 40:100.

On 22 and 24 October 1986, a total of 272 deer, 8 males, 101 fawns and 163 females were observed migrating in an easterly direction along the base of the south slope of the Glass Mountain Range. This early post season composition count revealed a buck:doe ratio of 5:100 and a fawn:doe ratio of 62:100. On 6 January 1987, a post season composition count was conducted from a helicopter only over the Marble Creek wintering area. The buck:doe ratio of the Marble Creek range was 12:100 and fawn:doe ratio 64:100.

Deer herd size has been estimated at approximately 1,500 animals over the last several years using a ratio estimation method (Anderson et al. 1974), a technique employing hunter kill and herd composition data.

5. Harvest

Figure 5 shows the buck harvest totals for the last 9 years (1978 - 1986) for the Casa Diablo deer herd (Thomas 1984). The average yearly kill figure for the last 9 years is 86 bucks per season. In 1981 and in 1985, especially high harvest numbers for all herds in Mono County resulted from "early" snow storms where deer migrated during hunting season.

In 1986, a total of 78 bucks were reported harvested from within the original Casa Diablo deer herd summer range boundaries identified by DFG biologists. These boundaries include an area lying west of the Deadman Creek drainage, east to Highway 6 and north of Highway 395 to Benton. (Fig. 6).

Of the 78 bucks reported harvested from the Casa Diablo deer herd, 24 (31%) were shot on or near Bald Mountain. Another 20 (26%) were taken from an area lying between Lookout Mountain and Hot Creek. Twelve (15%) bucks were harvested from along the south slope of the Glass Mountains north and east to Benton. Twelve others were shot in the Doe Ridge area just north of the Mammoth-June Lake airport. Six (8%) bucks were taken from the Deadman Creek drainage and 4 (5%) from near Crowley Lake.

A total of three marked bucks from the Casa Diablo herd were reported harvested in 1986. Of these 3, 2 were shot north of the Casa Diablo deer herd summer range boundaries originally identified by DFG biologists and thus not included as part of the Casa Diablo herd kill.

DISCUSSION

Provided the radioed sample of deer is representative of the entire population, it can be assumed that approximately 87% of the Casa Diablo herd summers on the east side of the Sierra Nevada. Thus, about 1290 of 1500 deer from the Casa Diablo winter range occupy summering habitat on the east side of the Sierra Nevada.

Approximately 75% of the Casa Diablo herd summers along major drainages on the east slope of the Sierra Nevada from the Deadman Creek north to Twin Lakes. Thus, about 1,100 animals summer north of the administrative boundaries originally established for the herd by the DFG. These boundaries include an area lying to the north and west of Highways 395 and 6, and south and east of a line running from the Sierra crest through Bald Mountain, Taylor Canyon and River Springs (Fig. 6).

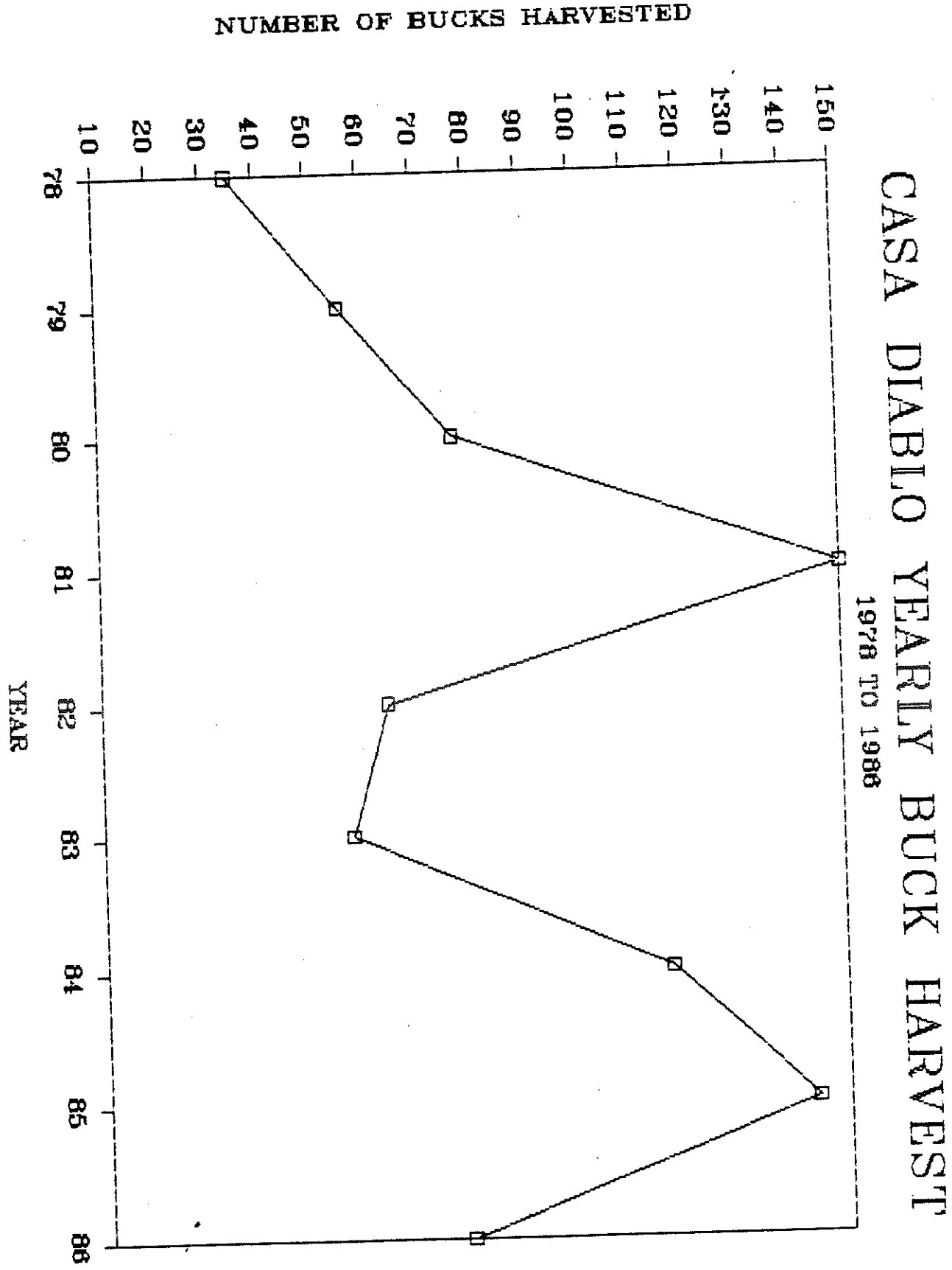

Figure 5. Buck Harvest totals of the last nine years for for the Casa Diablo deer herd (1978 - 1986) (Thomas 1986).

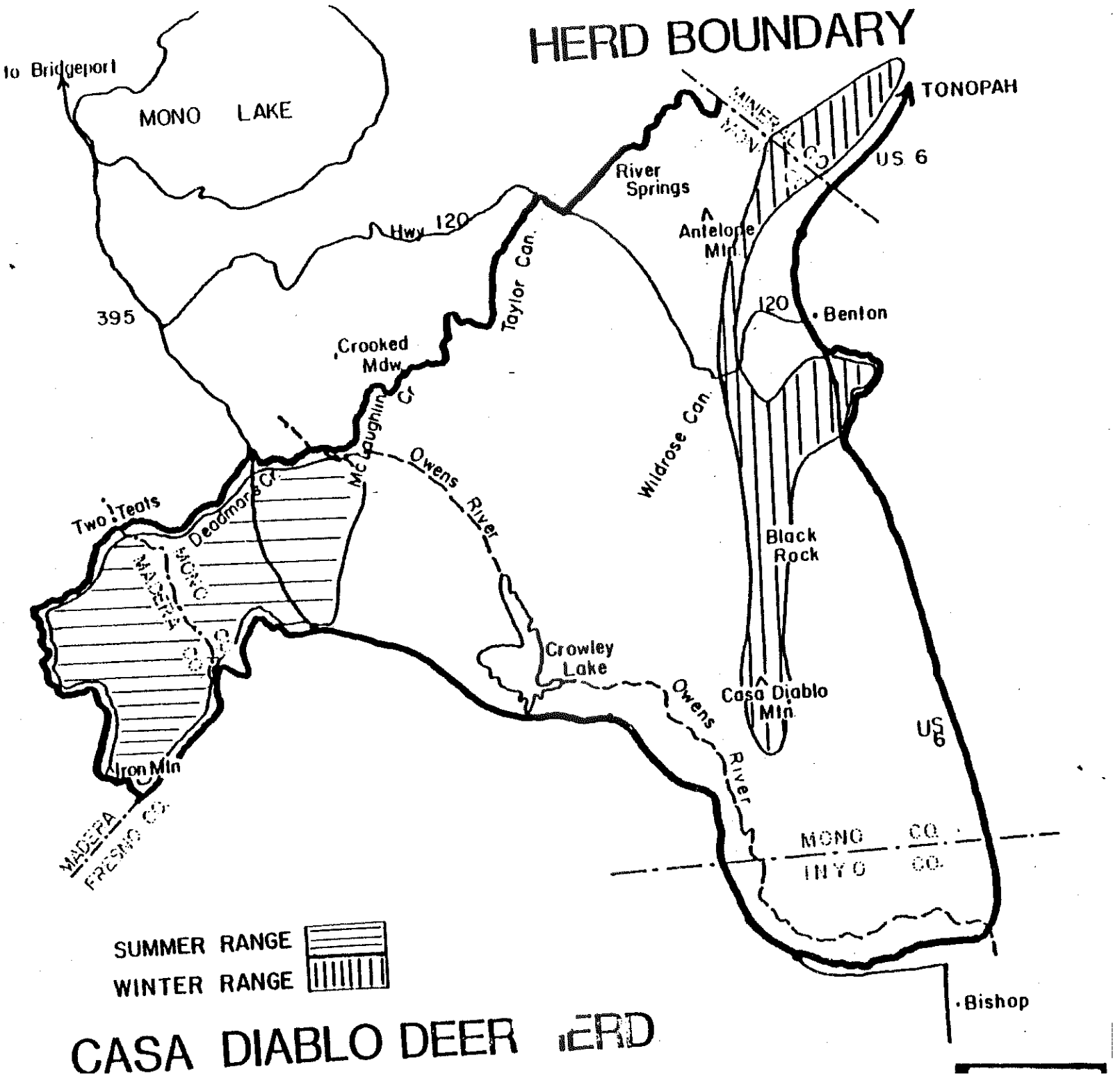

Figure 6. Casa Diablo deer herd seasonal ranges originally identified by DFG.

Since most of the Casa Diablo herd summers to the north of its originally designated summer range boundaries, it is likely that the buck kill totals compiled each year do not represent the actual number of bucks harvested from the herd. This is supported by the fact that in 1986, two marked Casa Diablo bucks were harvested within the administrative summer range boundaries of the Mono Lake and West Walker deer herds, and thus included as part of the total kill figures for these herds.

Since the Casa Diablo, Mono Lake and West Walker herds probably all share summering habitat along the east slope of the Sierra from the Deadman Creek drainage north to Bridgeport, it is virtually impossible to determine the true buck harvest for each herd. Consequently, herd size estimations based on hunter kill figures become useless.

It is also apparent that there are no real geographic separations between the wintering areas of these herds. For example, there is no clear-cut boundary between where the Casa Diablo herd winter range ends and that of the Mono Lake herd begins. Thus, it may make more sense both biologically and administratively to designate the Casa Diablo, Mono Lake and West Walker herds as one.

From the radioed sample of deer it can be estimated that a minimum of 200 deer from the Marble Creek wintering area summer in the White Mountain Range. Historically, the White Mountain Range has received substantially less hunter pressure than other areas in Inyo and Mono counties. This is reflected in higher post season buck ratios typical of the Marble Creek wintering area. Thus, including post season composition count data from the Marble Creek wintering area with that of other areas on the Casa Diablo range probably does not reflect the true buck ratio of the entire herd.

Also from radio telemetry data it can be estimated that about 200 deer from the Casa Diablo winter range, 13% of the entire population, cross over San Joaquin Ridge via Deadman Pass and other passes further north to gain access to their west side summering areas. San Joaquin Ridge is also known to be used by deer from the Round Valley wintering area to gain access to their summer ranges in the upper San Joaquin drainage. Thus, the importance of San Joaquin Ridge as a migration corridor is now evident and any ski area development may eliminate or reduce access to large portions of summer range used by hundreds of deer.

Although approximately 40 km separate the northern most wintering area, Truman Meadows, from the southern most wintering area, The Volcanic Tablelands, there was no distinct difference in selection of migratory routes or summering areas of Casa Diablo deer.

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MIGRATION AND SEASONAL HABITATS OF THE CASA DIABLO DEER HERD

CASA DIABLO DEER STUDY

March 1988

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APPENDIX

MIGRATION AND SEASONAL HABITATS OF THE CASA DIABLO DEER HERD

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ABSTRACT: One hundred and seventeen mule deer, Odocoileus hemionus hemionus, were captured on wintering areas from January-March 1986 and January-March 1987. Twenty-seven females and 1 adult male were radio-collared and monitored for two spring and two fall migrations in order to delineate migration routes and seasonal ranges. Timing of spring migration was similar during both years despite extremes in severity of winters. Two radio-collared does utilized different spring migration routes and wintering areas in consecutive years. Timing of fall migration was correlated with snowfall in 1987, but not in 1986. Deer remained on holding areas and delayed migration for up to 6 weeks during both spring and fall. Fifteen radio-collared deer occupied summer range on the east slope of the Sierra Nevada; 14 of these utilized aspen riparian habitats. Three radio-collared does crossed the Sierra crest to west side summer ranges. Those radio-collared does occupying summer range in Jeffrey pine (Pinus jeffreyi) habitat had larger home ranges than those in more diverse areas. All radio-collared deer exhibited strong fidelity to summer home ranges. Water was found to be the factor most limiting deer distribution and densities throughout portions of winter and summer ranges.

INTRODUCTION

The Rocky Mountain mule deer is the most adaptive and widespread western ungulate (Poole 1976). However, a decline of mule deer in the west has been a major concern of many state conservation agencies (Julander and Low 1976). A general statewide decline in California's deer herds has been occurring since the mid 1950's (Bertram and Rempel 1977, Dasmann 1981). Longhurst et al. (1976) concluded that the decline in California has resulted from a number of different causes including diminishing food supplies and loss of habitat resulting from changes in burning, logging, grazing practices, and other land use factors. On lower western slopes of the Sierra Nevada, increasing urbanization, recreational developments, construction of reservoirs and other land

uses have resulted in a serious decline in deer numbers (Dasmann 1981). Recent plans for recreational, urban, geothermal, and hydropower developments in areas of critical mule deer range on the east slope of the Sierra Nevada in Mono County have prompted the California Department of Fish and Game to conduct this study of the Casa Diablo deer herd.

The Casa Diablo herd, which consists of an estimated 1,500 animals, is the smallest of five migratory mule deer herds occurring in Mono County (Thomas 1984). Since this herd generally was known to occupy seasonal ranges throughout the southern and central portion of Mono County (where the majority of development is occurring) it was imperative that studies be conducted in order to delineate all critical habitats used by this herd. To effectively manage migratory deer in the Sierra it is crucial that migration routes and all seasonal habitats be delineated (Bertram and Rempel 1977). Prior to this study, little was known about specific locations of migration routes, holding and summering areas, and transitional ranges of the Casa Diablo herd.

The major objectives of this study, which was conducted from January 1986-January 1988, were to (i) delineate all critical habitats used by the Casa Diablo deer herd; (ii) analyze the quality and quantity of all critical habitats defined; (iii) assess the impacts of land uses, existing and proposed, on critical habitats; (iv) identify habitat factors limiting the herd; and (v) formulate recommendations to reduce the impacts of these factors.

STUDY AREA

The Casa Diablo deer herd occupies approximately 2,200 km^2 in Mono County, California. The herd winter range, located on the Inyo National Forest in southeastern Mono County (Figure 1), encompasses approximately 260 km^2, varying in elevation from 1,640-2,450 m. Winter range vegetation is a Great Basin sagebrush type, consisting mainly of big sagebrush (Artemisia tridentata), bitterbrush (Purshia tridentata), and rubber rabbitbrush (Chrysothamnus nauseosus). Singleleaf pinyon pine (Pinus monophylla) - western juniper (Juniperus occidentalis) woodland dominate vegetation between 1,950-2,450 m. Terrain is moderately sloping with soils consisting of an admixture of sandy loams which are generally shallow and rocky (Thomas 1984). Average annual precipitation, measured

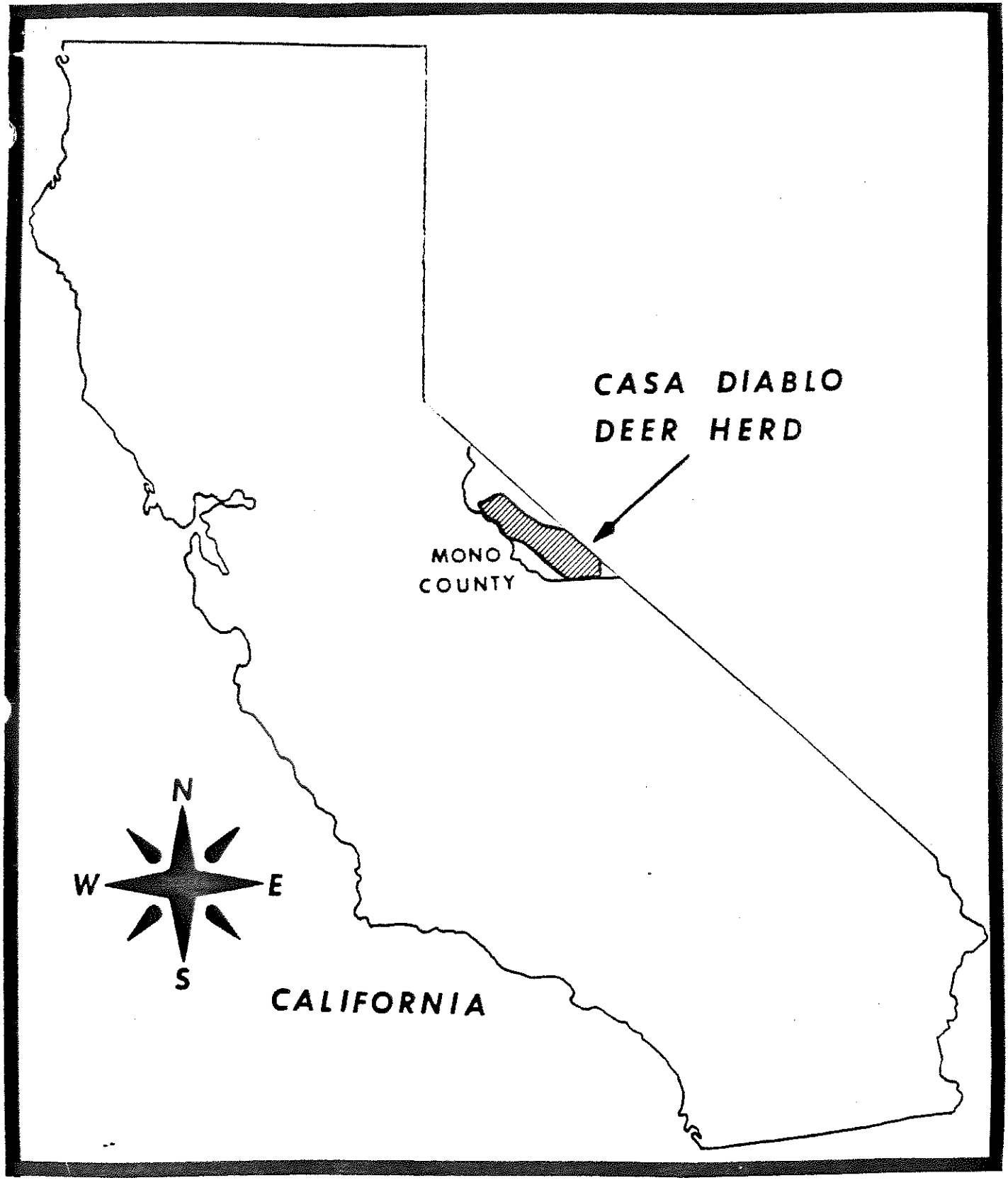

Figure 1. Location map, Casa Diablo deer herd.

at the Calif. Agric. Inspect. Sta. in Benton, California, is 150 mm, occurring mostly as snow in January and February.

The Casa Diablo winter range was divided into six subwintering areas based on major areas of deer concentration (Figure 2). From north to south these wintering areas include: Truman Meadows, located approximately 13 km north of Benton, California near the California-Nevada state line; Marble Creek, located approximately 7 km south of Benton at the base of the western escarpment of the White Mountain range and east of U.S. Hwy 6; The Blind Spring Hills area, located due west of Marble Creek and immediately west of Hwy 6 in the Benton Mountain Range; Chidago Flat, located approximately 21 km south of Benton and 14 km west of Hwy 6; Casa Diablo Mountain, located 29 km south of Benton and 14 km west of Hwy 6; and The Volcanic Tablelands, located 43 km south of Benton and 7 km north of Bishop, California.

Deer from the Casa Diablo herd occupy approximately 1,940 km^2 of summer range on the Inyo National Forest in west-central Mono County, mainly along the east slope of the Sierra Nevada (Figure 2). Portions of Madera County and Tuolumne counties on the west side of the Sierra are also used to a limited extent by summering deer. Nine major summer range habitat types, varying in elevation between 2,130-2,950 m were described in areas used by radio-collared and ear tagged deer (USDA 1981).

Singleleaf Pinyon Pine-Western Juniper----This type occurs mainly on dry south and east facing slopes of the Sierra Nevada and Glass Mountain ranges. Single-leaf pinyon pine is the dominant conifer species between approximately 2,070-2,600 m near Lee Vining and also dominates deer summer range on the west slope of the White Mountains. Associated understory species include curlleaf mountain mahogany (Cercocarpus ledifolius), big sagebrush, bitterbrush, and rabbitbrush.

Jeffrey Pine.----This type is open Jeffrey pine (Pinus jeffreyi) forest which occurs in large stands between elevations of approximately 2,200-2,450 m. Associated understory species include big sagebrush, bitterbrush, gooseberry (Ribes spp.), and mountain snowberry, (Symphoricarpos vaccinioides). This is also the dominant vegetation type found on all holding areas used by the Casa Diablo deer herd.

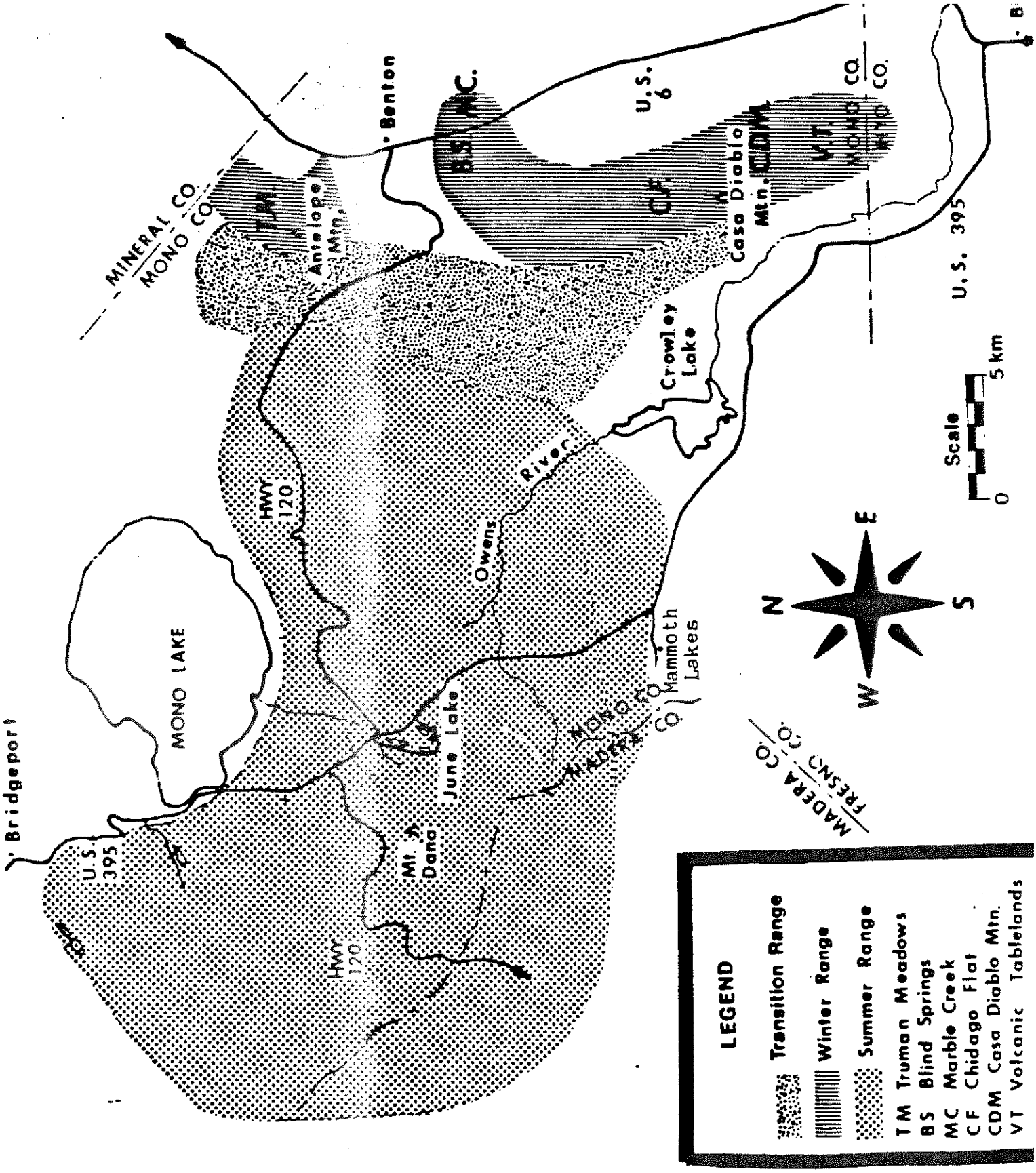

Figure 2. Location of Casa Diablo deer herd winter and summer ranges, Mono County, California.

Mixed Conifer Forest.----The codominants of this vegetation type occurring on the east slope of the Sierra Nevada between approximately 2,400 -2,600 m include Jeffrey Pine, white fir (Abies concolor), lodgepole pine (Pinus contorta), and western white pine (Pinus monticola). At higher elevations of the Mixed Conifer type, red fir (Abies magnifica) is an occasional associated species and white fir often occurs in pure stands at lower elevations.

Quaking Aspen Riparian.----This dense cover type occurs within a few meters of most stream channels on the east slope of the Sierra Nevada and throughout the Glass Mountains and is dominated by quaking aspen (Populus tremuloides), willow (Salix spp.), wild rose (Rosa woodsii), gooseberry, and snowberry. Groves of quaking aspen, which provide critical fawning and fawn rearing habitat, also are indicators of moist conditions and are located mainly near high elevation meadows.

Lodgepole Pine Forest.----This forest type is found above the Mixed Conifer type on the east slope of the Sierra and north slope of the Glass Mountains at elevations between approximately 2,600-3,000 m. It is composed of lodgepole pine which often occurs in large, dense, homogeneous stands. Within the lodgepole pine forest perennial grasses and forbs (needle-and-thread grass (Stipa comata), bluegrass (Poa pratensis), bromegrass (Bromus tectorum), lupine (Lupinus duranni), and pussy paws (Calyptridium caudiciferum)), dominate openings of poorly developed, dryer soils.

Montane Meadow.----This meadow type is found mainly at mid and upper elevations on the east slope of the Sierra and throughout the Glass Mountains and is composed primarily of sedges (Carex spp.), and rushes (Juncus spp.), and designates year long water availability. Perennial grasses, forbs, willows, quaking aspen, and lodgepole pine are associated with these meadows.

Whitebark Pine.----This forest type, dominated by whitebark pine (Pinus albicaulis), occurs on high windswept ridges at treeline on the east slope of the Sierra.

Great Basin Sagebrush.----This type generally occurs on dry slopes and plains from 1,220-3,320 m, east of the Sierra Crest. Big sagebrush is dominant with bitterbrush often occurring as a codominant. This type often is found in association with Jeffrey pine.

Montane Chaparral.---This type occurs on open flats and rocky ridges from 2,135-3,050 m. Greenleaf manzanita (Arctostaphylos patula), mountain whitethorn (Ceanothus cordulatus), Chinquapin (Castanopsis sempervirens), and tobacco brush (Ceanothus velutinus), occur as codominants. This type often is found in association with Great Basin sagebrush.

METHODS

Deer were captured on the Casa Diablo winter range from January-February 1986 and January-February 1987 using Clover traps (Clover 1956), baited with alfalfa hay. Three to five trap sites were located throughout each area and prebaited for two weeks with alfalfa hay. Traps were operated on 2-3 days each week until late February, at which time bait acceptance became poor due to the presence of herbaceous growth.

On 26 and 27 February and 7 March 1986, deer were captured and marked on all six subwintering areas (Figure 2) using linear, nylon tangle nets (2 x 90 m) and a Bell Jet Ranger III helicopter (Beasom et al. 1980). Deer were hazed slowly by the helicopter into nets placed at strategic locations, usually preselected by the pilot through aerial reconnaissance. Net sites usually employed natural escape routes, such as ravines. Anywhere from 1-10 deer were captured on several successive drives until desired numbers were obtained for each wintering area.

All deer were physically restrained and marked with two large, plastic, consecutively numbered cattle ear tags (7.5 x 11.5 cm; Apollo Tag Systems), color coded to wintering area. Twenty-six adult females were fitted with radio collars. In addition, one adult male was instrumented with a radio transmitter mounted on an expandable collar to allow for neck swell during the rut. A single adult female was captured on its spring range by use of a tranquilizer dart carrying 3 cc of a Rompon-ketamine hydrochloride mixture, fitted with a radio-collar (.220) and released.

Adult radio collars (159.021-159.450 MHz; Telonics, Inc., Mesa, Arizona), weighed 260-270 g and had an operational life of 24-36 months at 35-75 pulses/minute. Thirteen radios were equipped with mortality sensors that doubled the pulse rate of the signal when an animal was stationary for 3-5 hours.

The locations of all radioed animals were obtained by triangulation

from the ground or from a fixed-wing aircraft during the course of the study. Deer were located from the ground at least 2-3 times weekly during the winter and summer months and 5-6 times weekly during spring and fall migrations. Initial ground locations were made from a vehicle equipped with a Telonics TR-2 receiver with an attached programmer/scanner (TS-1) and a base loaded whip antenna. Triangulation bearings were obtained using a hand-held, 2-element antenna (RA-2A; Telonics, Inc., Mesa, Arizona). Visual sightings of radio collared deer were made whenever possible. Radio locations and visual sightings were marked on U.S. Geological Survey 7.5 minute series topographic maps.

Fixed-wing flights were conducted once weekly, weather permitting, during spring and fall migration and once every 2-3 weeks during the winter and summer, usually between 0900 and 1100 hours. Flights were conducted in a Cessna 185 at air speeds of 120-180 km/hour.

Migration routes, holding areas, and winter and summer home ranges were identified and then delineated using radio telemetry. Winter and summer home ranges (Burt 1943), were determined using the Modified Minimum Area Method (Harvey and Barbour 1965). Each home range included a minimum of five relocation points determined from visual observations. Radio-collared deer were considered to show fidelity to a specific seasonal home range if ranges in consecutive years overlapped.

Holding areas were recognized as sites along migration corridors where deer remained for several days or more during migration (Bertram and Rempel 1977). All holding areas identified were designated a number as to the position in which they occur along the migration corridor, e.g., HA-I.

Post season deer composition counts were conducted over the entire winter range by use of a Bell Jet Ranger III helicopter during early January 1986, 1987, and 1988. Spring composition counts were conducted on foot in March and early April of 1986 and 1987 in more accessible portions of the winter range.

RESULTS

CAPTURE AND MARKING

A total of 117 deer (86 females and 31 males) were captured, marked, and released on all of the 6 subwintering areas of the Casa Diablo

deer herd (Table 1). Thirty-eight of these were fawns (24 males and 14 females), 72 adult females, and 7 adult males.

TABLE 1. Total Number and Composition of Deer Captured, Marked, and Released on each of the Casa Diablo Wintering Areas. January-March 1986, January-February 1987.

	ADULTS		FAWNS		TOTAL
LOCATION	M	F	M	F	
MC	4	30	11	8	53
BS	2	16	5	1	24
TM	0	6	3	2	11
TL	0	9	3	0	12
CD	0	3	0	0	3
CF	1	8	2	3	14
TOTAL	7	72	24	14	117

MIGRATION CORRIDORS AND HOLDING AREAS

During the two spring and fall periods studied, 22 of 27 radio-collared deer marked on the Casa Diablo winter range in 1986 and 1987 migrated to the west of their respective wintering areas. Five deer, all from the Marble Creek wintering area, migrated to the east, up the west slope of the White Mountains.

Beginning in early April, deer leave their respective wintering areas and move in a westerly direction along separate migration routes toward the Glass Mountains (Figure 3, Appendix Figure 1a). These routes merge at the east end of the Glass Mountains and continue westward along the south slope. The Glass Mountains extend in a westerly direction from Benton, California, and are bordered by Crowley Lake and the Owens River to the south and Hwy 120 to the north. They encompass approximately 256 km^2 with an elevational range of 2,134-3,216 m.

During the spring of 1986, 19 of the 22 radio-collared deer which summered west of the Casa Diablo winter range migrated along the base of the south slope of the Glass Mountains. Deer movements were concentrated between 2,135-2,285 m, along the interface of pinyon-juniper woodland and Great Basin sagebrush habitat types. Deer typically preferred to remain in the more open sagebrush-scrub vegetation while migrating, perhaps in order to avoid predators and to take advantage of herbaceous vegetation occurring there.

Eighteen of the 19 radio-collared deer which migrated along the south slope of the Glass Mountains in spring of 1986, utilized a large spring holding area at the west end of this range near the headwaters of the Owens River. In addition, 16 non-radioed, ear tagged deer were observed on this holding area during the spring and fall migrations of 1986 and 1987 (Appendix Figure 2). This holding area, designated (HA-I), is located 29 km north of the Casa Diablo winter range. The average vertical rise in elevation between HA-I and Casa Diablo deer herd wintering areas is approximately 300 m. HA-I encompasses 26 km^2, varying in elevation between 2,134-2,256 m. The major habitat type occurring there is a mixture of Jeffrey pine and Great Basin sagebrush vegetation. This area also contained one large wet meadow, known as Alpers meadow, where deer often concentrated in significant numbers during the evening and early morning hours.

Radio-collared deer spent an of average 11 days on HA-I in 1986 (range 1-45), and 4 days (range 1-34) in 1987. Radio-collared deer which migrated to the west of HA-I spent an average of 22 days longer there in 1986, and 15 days longer in 1987, than deer which migrated to the north.

During the spring migration of 1986, 13 of the 18 radio-collared deer which utilized HA-I summered to the north, and 4 to the west. One radio-collared doe was killed by a mountain lion (Felis concolor), on 26 April near Alpers meadow. Its radio-collar was put on another adult doe in the same area on 10 May. This deer never migrated further, eventually summering near Big Springs at the headwaters of the Owens River.

The main migration corridor used by deer summering to the north of HA-I, extends in a northwesterly direction, contouring around the southern end of the Mono Craters toward the Aeolian Buttes (Figure 3, Appendix Figure 1a). Deer were found to cross a two lane section of Hwy 395 near the Aeolian Buttes, before continuing west around the northern end of Grant Lake to another spring holding area (HA-II), located at the foot of the Parker Creek and Walker Creek drainages. HA-II encompasses approximately 5.2 km^2 at elevations ranging from 2,195-2,439 m. The major habitat type occurring on HA-II is a mixture Jeffrey pine and Great Basin sagebrush which include dense pockets of 1-2 m high curlleaf mountain mahogany. HA-II also includes several wet meadows the largest of which is approximately 1 km^2. During the spring migration of 1986, 12 radio-collared deer, all of which spent some time on HA-I, utilized HA-II

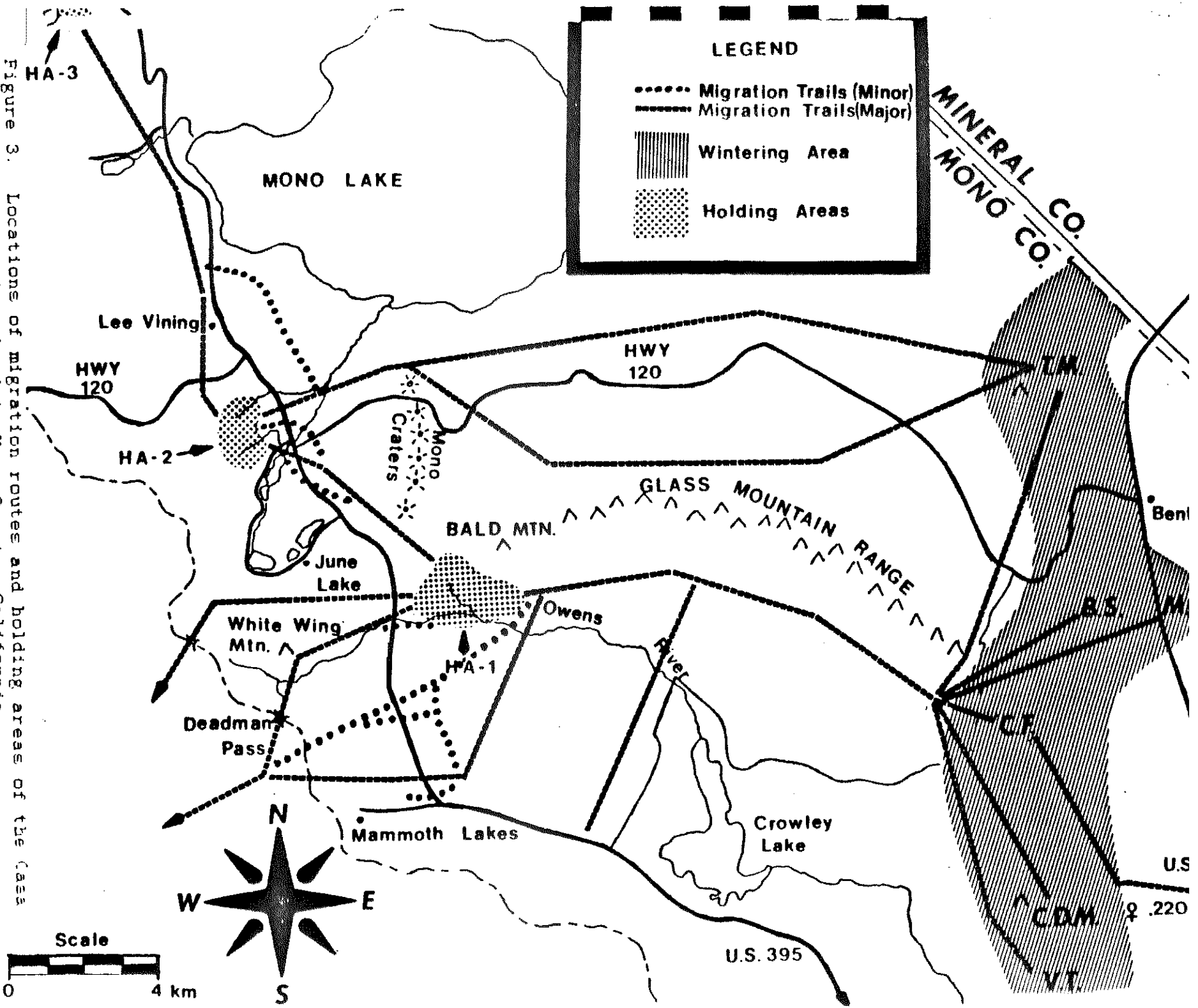

Figure 3. Locations of migration routes and holding areas of the Casa Diablo deer herd in Mono County, California.

from 1-47 days during April, May, and June. In addition, a total of 5 non-radioed, ear tagged deer were observed on HA-II during the spring migration of 1986 (Appendix Figure 2). Deer traveling to lower elevations did not use HA-II to the extent of those traveling to higher elevations.

One radio-collared doe was found to utilize HA-II during two different periods in the spring of 1986 before moving onto her summer range. This particular doe first arrived on HA-II on 12 April and remained there until 24 April after which time she traveled extensively to the north and west over an area encompassing 20 km^2 at elevations between 2,320-2,750 m. She returned to HA-II for a second time on 2 May and remained there until 5 May, after which time she traveled to the south and east over much of the Reverse Peak area before finally settling down on her summer range on 10 May. Her movements appear to have been directly influenced by weather and its effects on plant phenology on her summer range, which was located within a steep canyon where limited sunlight and cool daytime ambient temperatures resulted in late development of forage.

In 1986, 6 radio-collared deer migrated north of HA-II, 4 of which summered in Lee Vining Canyon, 1 in Lundy Canyon, and 1 near lower Twin Lake. The radio-collared doe which summered near Lower Twin Lake was found to occupy another spring holding area (HA-III), located at the north end of Lower Twin Lake on Honeymoon Flat. She remained on HA-III for 5 days (12-17 June) in 1986, before moving 3 km east to her summer home range. HA-III encompasses 5 km^2 at elevations ranging from 2,120-2,200 m and, like other holding areas, is composed of a mixture of Jeffrey pine and Great Basin sagebrush vegetation (Appendix Figure 1b).

As mentioned previously, 4 radio-collared deer migrated to the west of HA-I (Figure 3, Appendix Figure 1). These deer departed HA-I between 24 and 28 May in 1986 and traveled in a southwesterly direction, crossing what was then a two lane section of Hwy 395 just north of the Crestview maintenance station. One radio-collared doe migrated up the Glass Creek drainage on the north side of White-Wing Mountain before crossing San Joaquin Ridge to the west side of the Sierra. The other 3 radio-collared does migrated around the south side of White-Wing Mountain, two of which crossed San Joaquin Ridge over Deadman Pass (elevation 3,163 m). The other stopped approximately 1 mile east of the ridge where it summered on the south slope of White-Wing Mountain.

Although the winter range of radio-collared female .220, marked on HA-I, was never located, a portion of her migration route was delineated. Her migration route heads in an easterly direction from her summer range, located near HA-I, first contouring along the south slope of the Glass Mountains. It then proceeds through the Chidago Flat area and across the Volcanic Tablelands, after which it crosses Hwy 6, just south of the town of Chalfant and continues into the Piute Creek area of the White Mountains. The remainder of the migration route, like her winter range, was never delineated.

Sixteen of 22 radio-collared deer which summered to the west of the Casa Diablo winter range were monitored for both the 1986 and 1987 spring periods, and all but 2 used the same migration routes. These 2 deer, both from the Truman Meadows wintering area, migrated along the south slope of the Glass Mountains in 1986 in order to reach their summer range destinations. However, in 1987, both of these deer migrated along the north side of the Glass Mountains (Figure 3, Appendix Figure 1a). Doe .450 totally bypassed HA-I which she used in 1986, and migrated directly to her summer range. Doe .315 migrated along the north side of the Glass Mountains to as far as Sagehen Meadow, before turning south to HA-I.

SPRING MIGRATION

A total of 11 radio telemetry flights were made during the spring periods of 1986 and 1987 to locate deer during migration. All monitored deer from the Casa Diablo deer herd were migratory with distinct winter and summer ranges. Despite extreme differences in the amount of snowfall recorded during the winters of 1985-86 and 1986-87, little variation occurred in the overall timing of migration (Figure 4). The winter of 1985-86 was one of the wettest on record in the eastern Sierra, with 745.2 cm of snowfall recorded at 2,378 m at Mammoth Lakes, Mono County (USFS, Unpubl.). In contrast, during the winter of 1986-87, 255.8 cm of snowfall was recorded at the same location.

Deer migrated approximately two weeks later in 1986 than in 1987. However, the overall timing of migration to the summer range between the two years was quite similar. In 1986, deer began leaving the winter range on 3 April, with 50% of all radio-collared deer having migrated by 20 April (Figure 4). By 15 May, all radio-collared deer had left the winter

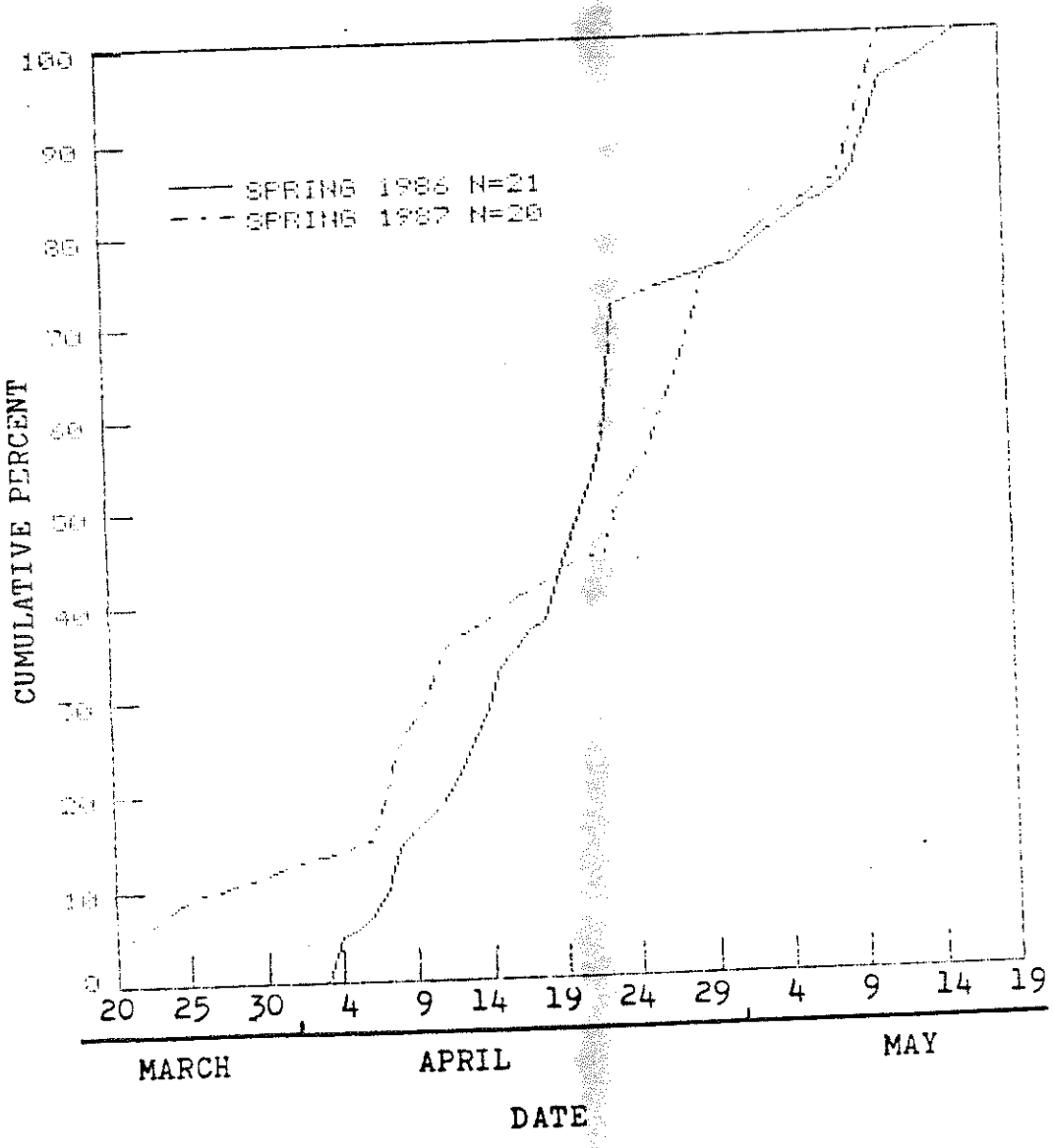

Figure 4. Cumulative percent of radio-collared deer migrating from the Casa Diablo winter range by date.

range.

In spring of 1987, 2 radio-colllared does migrated on 20 and 26 March. However, due to late development of spring green-up on the winter range, no other radio-collared deer were found to migrate until 6 April. By 22 April, 50% of all radio-collared deer had migrated and by 10 May, all had left the winter range. Migration from the winter range in spring of 1987 was more gradual than in 1986, with no peak periods of departure (Figure 4).

Deer that summered at higher elevations did not leave the winter range at a later date than those summering at lower elevations. However, deer which summered at higher elevations, or those having to cross the Sierra crest to gain access to west side summer ranges, did remain longer on spring holding areas. Changes in elevation between winter and summer ranges varied from 2,134-3,354 m. Distances traveled between winter and summer ranges varied from approximately 3.5 to 116 km.

Arrival dates of radio-collared deer on the summer range varied dramatically among some individuals during the two years studied and had no discernible pattern. Five deer arrived from 10-13 days later on their summer ranges in 1987 than in 1986. In contrast, five others arrived from 10-20 days earlier on their summer ranges in 1987 than in 1986.

FALL MIGRATION

Radio-collared deer were monitored for two consecutive fall seasons. Little variation exists in the timing of migration to the winter range between 1986 and 1987. However, migration to the winter range appeared to be less strongly correlated with weather in 1986 than in 1987. This mostly is due to the occurrence of only one minor storm in the fall of 1986, on 24 September. During the 1986 fall migration, 83% of radio-collared deer migrated between 3 October and 8 November (Figure 5). Two radio-collared does remained on their summer ranges until 3 January 1987, when the first significant winter storm occurred.

In 1987, the first radio-collared deer migrated from the summer range on 6 October. Eighty-two percent of radio-collared deer migrated in response to storms which occurred on 11-12, 22-23, and 27-28 October and 2-3 November.

Radio-collared does summering at higher elevations or west of the

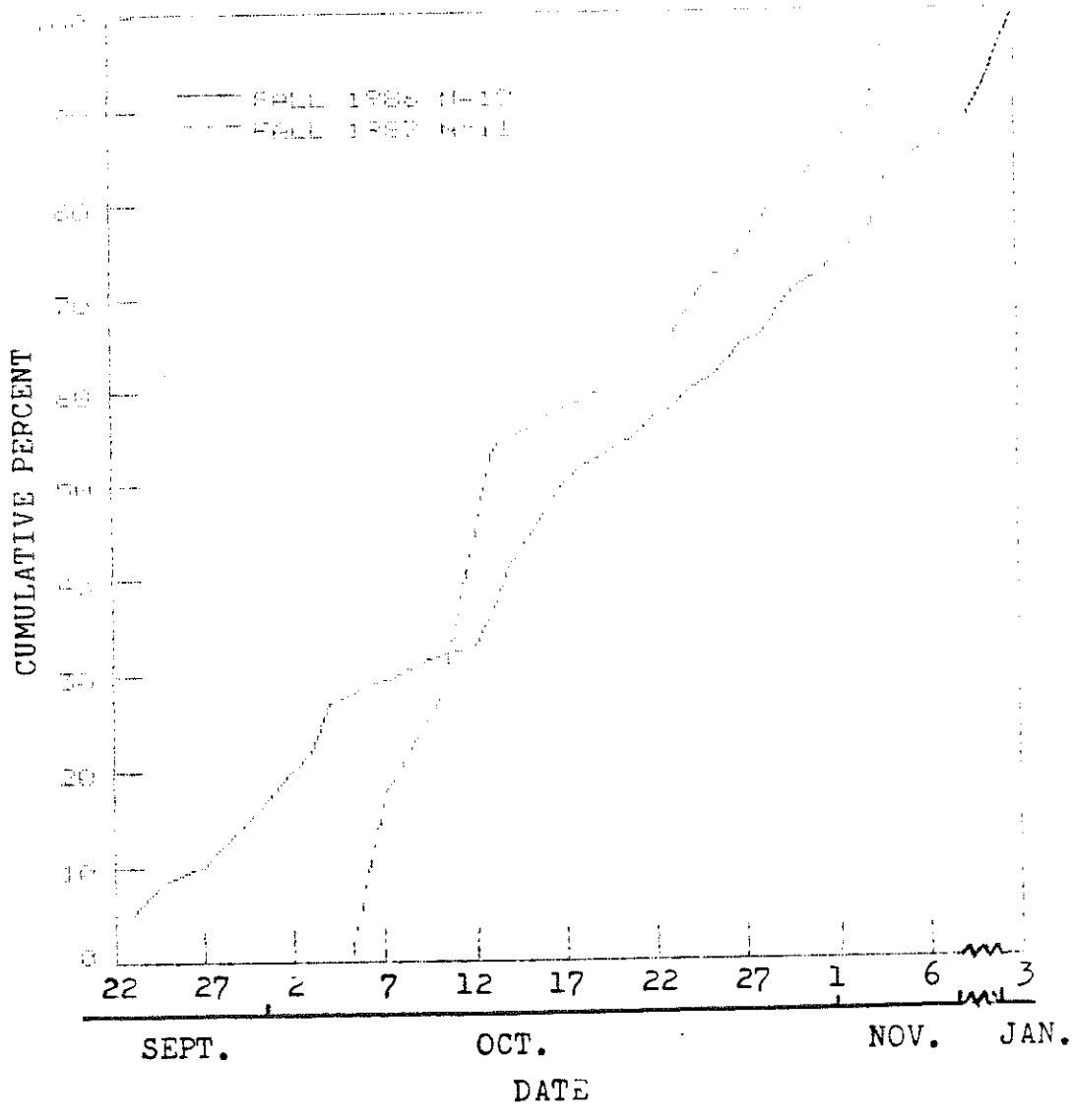

Figure 5. Cumulative percent of radio-collared deer migrating from summer range by date.

Sierra crest did not appear to migrate earlier than those summering at lower elevations. In both years, all deer known to migrate along the south slope of the Glass Mountains spent between 1 and 41 days on HA-I, remaining there until as late as mid-November before migrating further east. Here, a south-facing slope provided snow free areas of abundant browse. Once the deer left HA-I, movement generally was gradual, with deer taking as long as 15 days to reach wintering areas.

WINTER RANGE

Home range sizes for radio-collared deer on the winter range averaged 85 ha (range = 31-154 ha). During the dry winter of 1986-87, 19 of 22 radio-collared deer occupied higher elevation transition range west of their respective wintering areas. All utilized large stands of pinyon pine between 2,135-2,470 m, where they fed extensively on a large crop of pinyon nuts. Light to moderate snow conditions made pinyon nuts readily available throughout the entire winter. Home range sizes on transition range averaged 295 ha (range = 172-384 ha). Deer remained on transition range until approximately mid-March, after which time 16 radio-collared deer moved east an average of 11 km to lower portions of the winter range presumably in search of herbaceous spring forage.

During the winter of 1986-87, three radioed does, all of which were captured on Casa Diablo Mountain in January 1986, never returned to this wintering area (Figure 2). Two of these does spent the entire winter approximately 8 km northwest of Casa Diablo Mountain on transition range near the south end of Banner Ridge. These two does were the first radio-collared deer to migrate in spring 1987, on 20 and 26 March, departing directly from Banner Ridge. The other doe, which migrated along the north side of the Glass Mountains during the 1986 fall migration, traveled only as far as the Sagehen Meadow area where she spent the entire winter. In the spring of 1987, this doe migrated to her summer range directly from the Sagehen Meadow area on 7 April.

In fall of 1987, deer were monitored until 15 December. At this time, only 2 of 11 radio-collared deer had returned to the wintering areas where they were captured. The other 9 occupied transition range west of wintering areas, as they did during the winter of 1986-87.

SUMMER RANGE

Deer from the Casa Diablo herd occupied approximately 2,000 km^2 of summer range throughout west central Mono County, primarily along the east slope of the Sierra Nevada (Figure 2). Fifteen of 22 radio-collared deer which migrated to the west of the Casa Diablo winter range summered on the east slope of the Sierra Nevada, from the Deadman Creek drainage north to lower Twin Lake (Figure 6, Appendix Figure 3). Twelve of these 15 deer summered within a 22 km^2 area, from Grant Lake north to Lee Vining Canyon. A total of 22 non-radioed, ear tagged deer were observed along the east slope of the Sierra Nevada during the summers of 1986 and 1987 (1 June-1 October) (Appendix Figure 2). Radio-collared deer which summered on the east slope of the Sierra occupied home ranges located at an average elevation of 2,547 m (range = 2,135-2,960 m).

Four radio-collared deer summered east of Hwy 395 from the Mono Craters south to O'Harrel Canyon in the Glass Mountains at an average elevation of 2,515 m (range = 2,195-3,050 m). In addition, 10 non-radioed, ear tagged deer were observed east of Hwy 395 between 1 June and 1 October 1986 and 1 June and 1 October 1987 (Appendix Figure 2). Three radio-collared deer summered to the west of the Sierra crest, one in Madera County at Beasore Meadow near Chilkoot Lake, one in Yosemite National Park near Tuolumne Meadows, and one in the upper San Joaquin drainage near Shadow Lake (Appendix Figure 4). Four radio-collared deer, all from Marble Creek, summered on the west slope of the White Mountains directly above the winter range.

Marked deer from the same wintering area occupied portions of summer range in "family groups". This was most evident in deer from Chidago Flat in which 12 of 14 marked animals were found on the same summering area in Lee Vining Canyon. Conversely, marked deer from the same wintering area were also found to disperse to opposite ends of the summer range (Figure 6). For example, one doe from the Blind Spring Hills summered at the southern end of the herd range near the Deadman Creek drainage while another summered at the northern end of the range near lower Twin Lake. Gruell and Papez (1963), also found this to be true of deer in northeastern Nevada, where all deer wintering together did not summer together.

Marked deer from several different wintering areas were found to

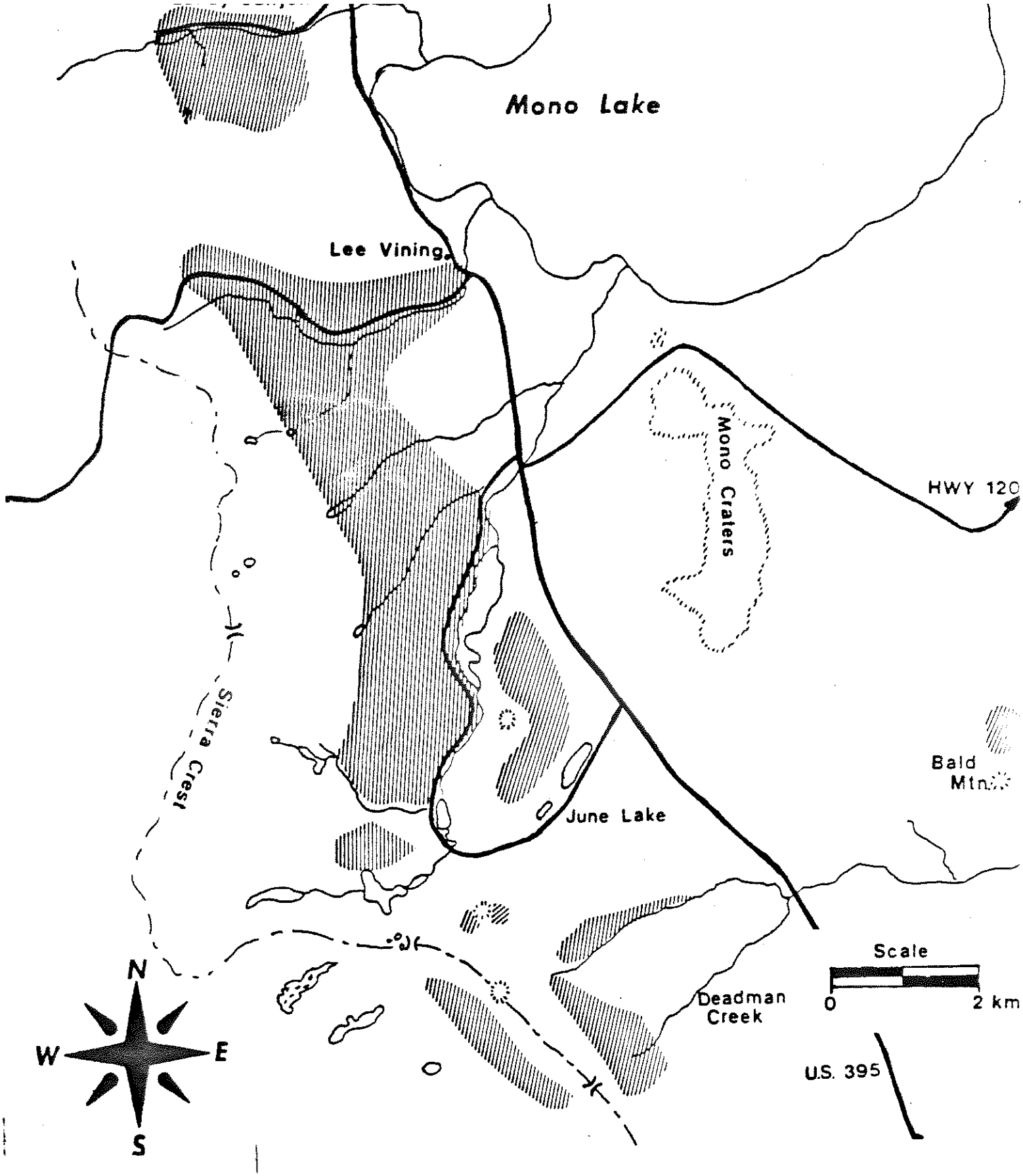

Figure 7. Locations of major fawning areas, Casa Diablo deer herd.

of 9 m.

Seven deer had home ranges including mixtures of both meadow and aspen riparian habitat types. Home ranges of these deer typically consisted of a portion of a large aspen grove and nearby associated meadows. All seven deer expanded their home ranges to include nearby Great Basin sagebrush and montane chaparral areas once meadow and aspen understory vegetation began to senesce, in late August of 1986 and in late June of 1987.

Three deer which summered east of Hwy 395 and south and east of Mono Lake had home ranges approximately 2 times larger than those that summered on the east slope of the Sierra Nevada. These does had summer home ranges averaging 384 ha in size which consisted primarily of Jeffrey pine and Great Basin sagebrush habitat types. Limited water distribution throughout the Jeffrey pine habitat type may have caused these does to range over a larger area. One doe, which summered east of Mono Mills (Figure 6), was observed drinking from a sheep watering trough 1.9 km west of the center of her home range. Another doe consistently was observed on her summer home range located approximately 2 km from the nearest water source. These does utilized large, open stands of Jeffrey pine consisting of an average of 243 trees per ha. Understory vegetation consisted primarily of 1-1.5 m high big sagebrush and bitterbrush.

MORTALITIES

Five of the original 23 radio-collared deer (22%) marked during January-March 1986 on the Casa Diablo winter range were killed by mountain lions (Figure 8, Appendix Figure 6). The first, from Truman Meadows, was killed on HA-1 on 26 April 1986. Her carcass was found buried under about 5 cm of dirt and litter in a large opening of Great Basin sagebrush. Two does were killed by mountain lions on 29 January 1987 on pinyon-juniper transition range in the Banner Ridge area. Both carcasses, which were found approximately 8 km apart, were mostly consumed and buried at the base of pinyon trees. One doe was killed by a mountain lion on 20 March 1987 on the Blind Spring Hills wintering area. Her carcass, which was buried in a sandy draw, was found to be almost entirely eaten. A fifth doe was killed by a mountain lion while

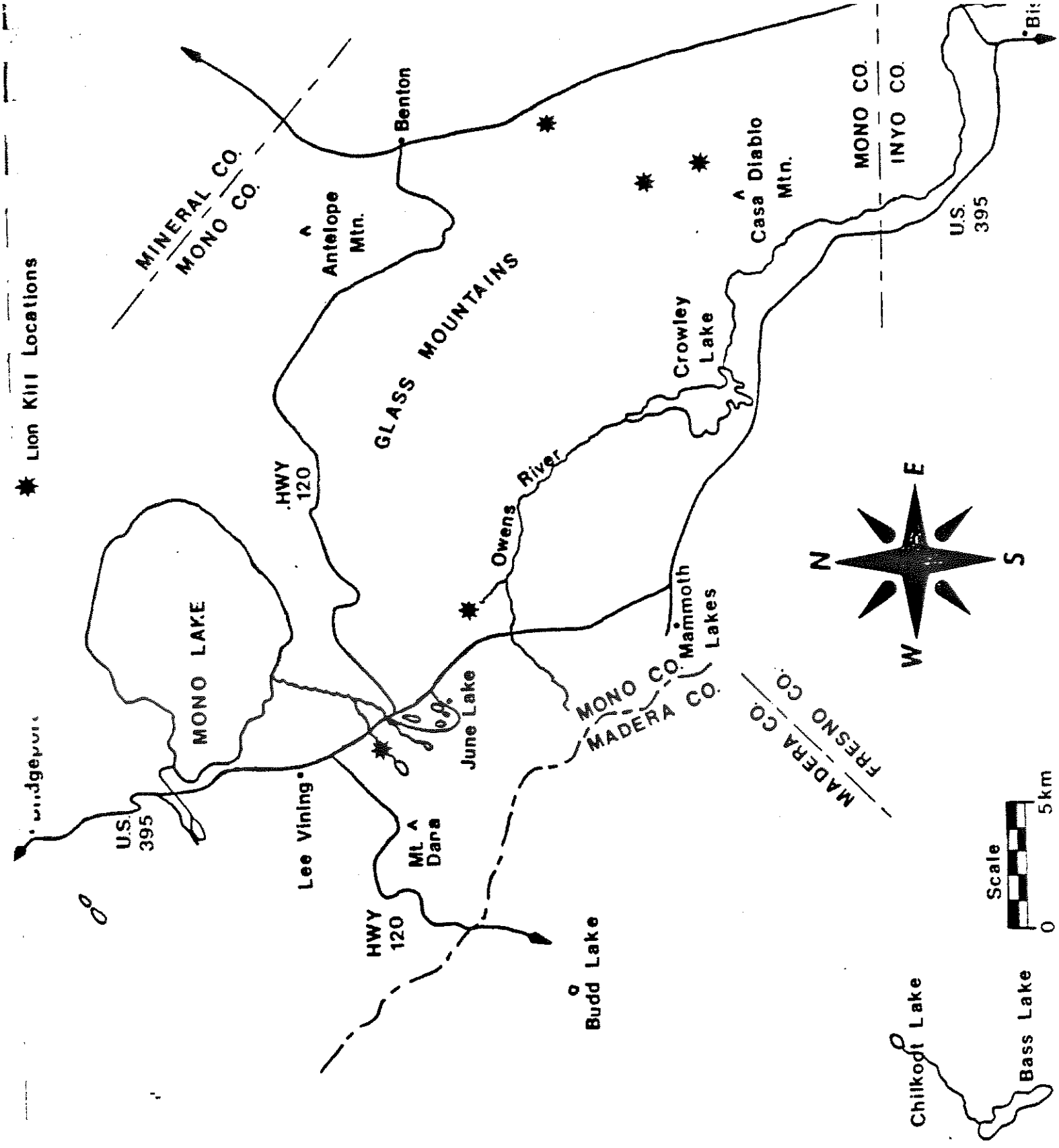

Figure 8. Locations of five radio-collared does killed by mountain lions.

on her summer range sometime during October 1987. Her carcass was found buried in willows on Parker Creek. Two additional does died while on their summer ranges; the cause of death was undetermined.

DEER HERD COMPOSITION COUNTS

Post season composition counts have been conducted over the last eight years on the Casa Diablo winter range. Fawn:doe ratios have averaged 49:100 and buck:doe ratios 9:100 (Table 2). During this study, post season composition counts were conducted on 7 January 1986, 6 January 1987, and 8 January 1988. In 1988, fawn:doe ratios were the lowest ever recorded (36:100).

Spring composition counts were conducted on the Casa Diablo winter range from the ground in April of 1986 and 1987. In 1986, fawn:doe ratios were 21:100 and 39:100 in 1987.

Deer herd size has been estimated at approximately 1,500 animals over the last several years using a ratio estimation method (Anderson et al. 1974), a technique utilizing annual buck harvest figures and herd composition data.

TABLE 2. Results of Casa Diablo Deer Herd Spring and Fall Composition Counts per 100 Does, 1980-1988

YR	Fall		Fall Sample	Spring	Spring Sample
	Bucks	Fawns		Fawns	
1980-81	13	58	---	47	---
1981-82	10	54	353	50	---
1982-83	7	41	403	28	---
1983-84	8	37	526	46	---
1984-85	7	43	366	42	191
1985-86	15	61	444	21	153
1986-87	6	60	293	39	602
1987-88	6	36	940	--	---

DISCUSSION

MIGRATION CORRIDORS

The Glass Mountains, which extend in a westerly direction from the center of the Casa Diablo winter range, provide a source of orientation

for deer as they migrate to and from wintering areas. Two major migration corridors, one along the north slope and one along the south slope of the the Glass Mountains were identified. Twenty-one of 27 radio-collared deer, representing all six subwintering areas, utilized the corridor on the south slope of the Glass Mountains during the spring and fall migrations of 1986 and 1987. It is believed that this corridor is used to such an extent because of its southerly aspect. South aspects typically are the first places to become snowfree in late winter (Garrott et al. 1987). Thus, snow does not appear to form an impediment to migration or to retard spring growth as it often does on the north slope of the Glass Mountains. In addition, this corridor was the shortest and the easiest way for most radio-collared deer to travel to and from wintering areas.

Two radio-collared does, both from the Truman Meadows wintering area, utilized different migration corridors during consecutive spring periods. In 1986, both does migrated along the south slope of the Glass Mountains, but in 1987 both used the north slope. Although the south slope is not the shortest route between winter and summer ranges for deer from Truman Meadows, it is the easiest route offering the most suitable conditions in years of above average snowfall (eg., 1986). In early April of 1986, due to snow free conditions, plant phenology was found to be much in advance and forage availability much greater along the south slope of the Glass Mountains than the north slope. Thus, in 1986 both does took advantage of these conditions by migrating along the south slope. In the dry year of 1987, snow cover on the north slope of the Glass Mountains was much lighter than normal in April, resulting in an earlier thaw and greater forage availability than in 1986. Hence, both does migrated along the north slope where they were able to take advantage of abundant forage while at the same time migrating a shorter distance to their summer ranges.

The fact that both radio-collared does have learned to utilize two migration corridors may be a form of opportunism (Geist 1982). In both cases, these animals were able to take advantage of abundant food sources brought about by ecological and climatic factors.

By traveling along the north slope of the Glass Mountains during the spring of 1987, these does were able to minimize expenditures of energy and nutrients on maintenance by migrating a shorter distance

while at the same time maximizing resources for reproduction (Geist 1982).

Radio-collared deer utilized two major migration corridors after departing HA-I. One of these extends to the west around the south slope of White Wing Mountain and over San Joaquin Ridge (Figure 3). Deer crossed San Joaquin Ridge using several passes with the majority of movement confined to Deadman Pass. These passes, located at elevations between 2,960-3,195 m, can be considered as the link between east and west side Sierra seasonal ranges. Assuming that the radioed sample of deer is representative of the entire population, about 200 deer from the Casa Diablo herd cross San Joaquin Ridge to gain access to west side summer ranges. Several hundred deer from another eastern Sierra herd (the Sherwin Grade herd) which winter in Round Valley about 14 km north of Bishop, are also known to cross San Joaquin Ridge to gain access to their west side summer ranges (Kucera, Unpubl.).

Migration between winter and summer ranges of individual radio-collared deer were quite variable. Deer summering west of the Sierra crest were found to migrate as far as 120 km between winter and summer ranges. Those deer summering in the White Mountains had up slope migrations between winter and summer ranges of 1-3 km.

HOLDING AREAS

Deer from the Casa Diablo herd utilized three major holding areas during the spring and fall migrations of 1986 and 1987. Elevational, topographical, and vegetative features of these holding areas are quite similar. All three holding areas are located at approximately the same elevation, between 2,134-2,439 m, and all generally are situated at the base of south and east facing slopes. Vegetative composition on all these holding areas consists of a mixture of Jeffrey pine and Great Basin sagebrush habitat types.

Deer generally occupied holding areas for a longer period during the spring than in the fall. Fourteen deer utilized both HA-I and HA-II in the spring of 1986, and one monitored doe was found to occupy all three holding areas.

Much of the land in which holding areas are located is administered by the United States Forest Service. Therefore, these

lands are managed for a variety of different uses including recreation, grazing, and logging. About 15% (4 km^2) of land in HA-I is in private ownership, most of which includes meadow areas along the Owens River that are used primarily for cattle grazing. A small portion of land at the northern corner of HA-III is also in private ownership where a small subdivision exists.

Winter logging of Jeffrey pine has been conducted over the last several years throughout the south and west portion of HA-I. Logging practices typically have included pre-and post-commercial thinning of trees < 20 cm DBH with an average spacing of 5 m between trees. Thus, many dense pockets of Jeffrey pine which provide the best hiding and escape cover for deer have been eliminated throughout this holding area. Several studies have identified the importance of dense hiding and escape cover for deer, especially during hunting season (Dasmann and Taber 1956, Sweeney et al. 1971). On fall holding areas of the North Kings herd, dense cover is a necessary and major component during hunting season (Bertram and Rempel 1977).

Conversely, thinning of dense stands of Jeffrey pine most likely has increased forage production within thinned areas. According to Ffolliott and Clary (1972), this is an acceptable generalization for most forest types. Other research has also indicated that use by deer commonly increases after logging (Wallmo et al. 1976).

No formal evaluation has been conducted concerning the effects of timber management practices on deer use within east side Sierra Jeffrey pine habitats. Therefore, it is difficult to postulate whether these practices have actually been of benefit to deer. According to Dasmann (1981), there can be too much cover as well as too little. HA-I already contains one large meadow area and vast open areas of Great Basin sagebrush habitat both of which typically provide an abundance of forage. Thus, since forage availability does not appear to be a limiting factor, perhaps it may be of greater benefit to deer if areas of dense Jeffrey pine are maintained.

Throughout most of the Jeffrey pine forest, roads, created primarily for timber harvest have reduced much of the effectiveness of hiding and escape cover by providing easy access to the public. Logging roads have been a major factor contributing to human disturbance on holding areas of the North Kings deer herd (Bertram 1984). Since

logging of harvestable timber is conducted only during the winter months, it does not directly conflict with deer use of Jeffrey pine bitats. However, public fuel wood gathering of logging slash and thinned trees are activities which normally coincide with the timing of fall and spring migrations.

SPRING MIGRATION

During the two spring periods studied, little overall variation was found in the overall timing of migration to the summer range (Figure 4). This is despite great extremes in total amounts of snowfall received during the winters of 1985-86 and 1986-87. Garrott et al. (1987) found that the timing of spring migration for deer in Colorado varied annually by as much as 1 month and was related to severity of winter, with deer migrating later after more severe winters. Bertram and Rempel (1977) found migration from the winter range in deer from the North Kings herd to be approximately two weeks earlier following dry winters than winters of normal to above normal precipitation.

In this study, I hypothesize that the consistency in the timing of migration between the two spring periods studied was related to the extreme difference in the severity of winters. Following the wet winter of 1985-86, a heavier than normal snowpack retarded spring growth along the south slope of the Glass Mountains, thus delaying spring migration until early April. After the very dry winter of 1986-87, spring green-up on the winter range did not occur until mid-March due to a lack of mid and late winter precipitation. This was reflected in the movements of 16 deer which moved during March from high elevation transition range to low lying wintering areas where the availability of spring forage was greatest. Deer remained on the winter range until early April when spring green-up at higher elevations along the migration corridor began to occur.

FALL MIGRATION

According to telemetry data, migration to the winter range in fall 1987 was in response to snow storms and the consequent accumulation of snow on the summer range. Snow was also found to be a cause of

migration to the winter range in other studies (Dixon 1932, Leopold et al. 1951, Gilbert et al. 1970, Moen 1973, Bertram 1984). Loveless (1964) stated that snow depth appeared to be the major reason for deer moving to lower elevations earlier in some years than others.

Because of near drought conditions in 1987, forage on the summer range became of poor quality by mid-July. As a result, deer did not appear to show a strong affinity to summer range areas once fall snow storms began to occur. Instead, deer migrated to mid-elevational transition range along migration corridors where snow accumulation was less and forage quality greater.

In fall of 1986, migration to the winter range was found not to be correlated with inclement weather simply because only one minor fall storm occurred on 24 September. Accordingly, migration was found to be very gradual occurring over approximately a three month period (24 September 1986-3 January 1987. Ultimately, migration to the winter range in 1986 for deer from the Casa Diablo herd probably was caused by declining forage conditions on the summer range. For deer in Colorado, fall movements were also attributed to declining forage quality on the summer range as well as the availability of higher quality forage on the winter range (Garrott et al. 1987). Because 1986 was a very wet year, forage quality on the summer range remained high for a longer period then it would during normal years. Thus, deer showed a greater affinity for summer range areas, as illustrated by the gradual dispersal of radio-collared deer from the summer range.

WINTER RANGE

During the winter of 1986-87, 20 of 23 radio-collared deer returned to the same locations where they were marked on the winter range. However, three radio-collared does never returned to the Casa Diablo Mountain wintering area where they were marked in January of 1986. Two of these does occupied pinyon-juniper transition range between 8-12 km northwest of the Casa Diablo Mountain throughout the entire winter. A third wintered near Sagehen Peak, located on the north side of the Glass Mountains approximately 33 km northwest of Casa Diablo Mountain.

To my knowledge, very little data has been published which documents a lack of fidelity in migratory deer to specific wintering or summering areas. Robinette (1966) cited two instances of belled deer which were

found to occupy different summer home ranges during consecutive years. The observed behavior of these three Casa Diablo deer may best be explained by elevational, topographical, and vegetational similarities between the Casa Diablo Mountain wintering area and pinyon-juniper transition range. Why should deer expend extra energy by migrating a further distance to an area that offers similar or perhaps less forage quality and availability? This may be interpreted as another form of opportunism as throughout the winter of 1986-87 deer on transition range were found to feed extensively on an abundant crop of pinyon pine nuts which were made readily available because of below normal snow accumulations. Thus, deer were able to minimize energy expenditures on maintenance by remaining on transition range where resources were of higher density and quality (Geist 1981). As a result deer were able to maintain a high level of nutrition throughout the winter months. This in turn culminated in better animal condition, and thus higher pregnancy and fetal rates among adult does collected on transition ranges (Taylor, Unpubl.).

Throughout much of the Casa Diablo winter range, water appears to be a major factor limiting deer distribution during winter months when succulent forage or snow is unavailable. When available, succulent forage and snow can provide enough water to meet metabolic needs, but free water is required during other times (Wallmo 1981, Dasmann 1981). Portions of the Casa Diablo winter range having limited water availability, such as Chidago Flat and Black Rock, where found to have large areas of seemingly suitable habitat which where virtually devoid of deer.

Water and forage appear to be the primary factors governing the size of winter home ranges. Deer occupying pinyon-juniper transition range had home ranges 2 times larger than deer which utilized other habitat types on low lying wintering areas. On transition range free water was readily available from numerous streams and seeps and, therefore, provided increased opportunity for selective foraging. Thus, deer were able to forage throughout larger areas in search of pinyon nuts and other more desirable plant species. On the North Kings winter range deer occupying Foothill-Woodland types were found to have a slightly larger home range than deer in more diverse habitat types. However, this difference was attributed to cover distribution and its

relation to forage and water (Bertram 1984). Throughout most of the lower winter range, such as Marble Creek, water distribution is more limited during certain periods and appears to directly influence the size of winter home ranges. This is especially true during October and November when the majority of deer use appears to be concentrated within 1.2 km of water.

The 1987, post-season composition counts conducted on the winter range in January, 1988 revealed the lowest fawn:doe ratios ever recorded for the Casa Diablo herd (36:100). This likely is related to the indirect effects of precipitation on forage quality and quantity on the summer range (Connolly 1981). Because 1987 was one of the driest years on record in the eastern Sierra, the quality and availability of preferred forages on the summer range probably declined much earlier than in years of normal precipitation. As a result, fawns were in relatively poor condition when they arrived on the winter range. This was determined subjectively by examining femur bone marrow of 11 road killed fawns (Cheatum 1949). Deer typically accumulate body fat during summer and fall after productive functions generally have been satisfied. If deer cannot obtain high levels of quality foods on summer and intermediate ranges during early fall, production of body fat will be diminished. Therefore, deer with limited fat reserves, such as fawns and adult deer from poor quality summer range, will succumb more readily while on the winter range once sufficient energy no longer is present for maintaining bodily functions (Short 1981).

A total of 5 radio-collared deer, 22% of the original radioed sample, were killed by mountain lions between 22 April 1986 and 26 March 1987. Lion predation may under certain conditions act to limit prey populations (Hornocker 1976). Because no objective data exists concerning lion-deer relationships on range occupied by the Casa Diablo herd, one can only speculate as to the effects of lion predation on this population.

SUMMER RANGE

Provided the telemetered sample of deer is representative of the entire population and that herd size estimations are fairly accurate, 75% of the Casa Diablo herd summers on the east slope of the Sierra Nevada. Thus, about 1,100 animals occupy summer range east of the Sierra crest throughout south and west-central Mono County, between Mammoth Lakes and Bridgeport.

Telemetry data also indicate that nearly 70% of the Casa Diablo deer herd, some 1,000 animals, summer north of the original administrative boundaries established for the herd by DFG. Therefore, since most all bucks are harvested on the summer range, it is likely that buck kill totals compiled each year for the Casa Diablo herd do not represent the actual number of bucks harvested from the herd. This is supported by the fact that four ear tagged bucks were killed by hunters within the administrative boundaries of the Mono Lake herd. Had these deer not been marked, they would have been included as part of the total kill for the Mono Lake herd. Since the Casa Diablo and Mono Lake herds are thought to share summer range together, it virtually is impossible to determine the true buck harvest for each herd. Consequently, herd size estimations based in part on buck harvest figures become questionable.

Recent changes in buck harvest management strategies in Mono County by DFG has resulted in the split of hunting zone X-9 into zones X-9a and X-9b. Prior to this split, three and possibly four herds in Mono County occupied summer range within the boundaries designated for zone X-9. From telemetry data, it was possible to delineate distinct summer range boundaries for the Casa Diablo herd which were recognizable from those of the Sherwin herd to the south and the East Walker herd to the north. These delineations were used for the purpose of demarcating new zone boundaries which now allow DFG to manage the Casa Diablo and Mono Lake herds as one in zone X-9a.

Radio-collared deer exhibited strong fidelity to individual summer ranges. All occupied the same summer home range in 1987 as in 1986. Others, (Ashcraft 1961, Gruell and Papez 1963, Robinette 1963, Schneegas and Franklin 1972, Bertram 1984, Loft et al. 1984, Garrott et al. 1987), have also reported that deer consistently use the same specific summer range, winter range, and migration routes.

One radio-collared doe was found to shift home ranges after her original one was subjected to heavy use by domestic sheep. The summer home range of this particular doe originally was centered on a small riparian strip near the lower north end of Parker Bench. She arrived on this summer range on 1 May 1987 and was observed several times there until sheep entered the area on 2 July. She immediately abandoned this home range and moved approximately one mile west to an adjacent riparian strip where she remained for the rest of the summer. Similar shifts of home

range resulting from destruction of food and cover have also been documented by Robinette (1966).

One other monitored doe which summered in Jeffrey pine habitat was found to shift her home range during early August for two consecutive years. She moved from her original summer home range, which was located in Jeffrey pine forest, to an area devoid of trees that consisted mainly of 1-1.5 m high bitterbrush and sagebrush. This dispersal was apparently done in order to establish a new home range with closer proximity to water and perhaps more adequate fawn hiding cover (Robinette (1966).

Deer occupying summer range in Jeffrey pine habitat had home ranges slightly larger than deer in other habitats. Again, this may be related to water and its proximity to forage and cover. Pumice soils associated with Jeffrey pine forest on the east side of the Sierra generally hold very little water. This is especially true of areas immediately south and east of Mono Lake, where two monitored does summered. These deer were observed to travel several km on a daily basis between feeding and resting, and watering locations.

Water is very likely a factor limiting deer distribution and numbers throughout much of the Jeffrey pine habitat type, especially after spring growth has desiccated. It also may influence fawn survivability since fawns, which have a greater relative metabolic rate, probably are more sensitive to water deprivation and consequently succumb more quickly to this form of stress than do adult deer (Short 1981).

Undoubtedly, the major reason for deer from the Casa Diablo herd showing such affinity for the east slope of the Sierra Nevada is that it offers the best suitable habitat and conditions for fawning.
Aspen-riparian habitat was the type most often utilized by radio-collared does summering on the east slope of the Sierra. This type is preferred because dense understory vegetation provides important thermal and hiding cover, especially for fawns (Reynolds 1969, Loft et al. 1987). It also is preferred because of its close proximity to water and the succulent forage which it provides (Kauffman and Krueger 1984, Loft et al. 1986).

It is estimated that riparian habitats encompass approximately 14,974 ha or 2% of all lands on the Inyo National Forest. Seventy percent of these riparian habitats (10,522 ha) are comprised of wet meadows above 2,440 m (USDA 1987). The fact that 93% of all radio-collared deer summering on the east slope of the Sierra utilized this habitat type, one

which comprises a relatively small portion of the total summer range, may indicate that this type is actively selected for by deer.

Livestock grazing occurs on an annual basis throughout most state and federal lands on the east side of the Sierra. Sheep grazing is particularly prevalent throughout most east side summer range habitats occupied by the Casa Diablo deer herd. This is especially true of lands owned by the Los Angeles Department of Water and Power, which mostly are comprised of meadow and aspen-riparian habitats. Direct conflicts in the timing of sheep and deer use occur during both spring and summer periods in many aspen-riparian areas, especially on HA-II and other lands located on the east slope of the Sierra. In those aspen-riparian habitats that have received heavy sheep use on an annual basis, much of the understory vegetation has been severely reduced from grazing and trampling. This, in turn, has affected regeneration and survival of young trees (Loft et al. 1987).

RECOMMENDATIONS

Since seasonal habitats and migration routes utilized by the Casa Diablo deer herd have now been delineated, it is important to maintain and enhance, if possible, the quality of these areas in order to achieve herd management objectives outlined in the Casa Diablo Herd Management Plan (Thomas 1984). Therefore, to assist wildlife and habitat managers in this endeavor some general recommendations regarding habitat maintenance and manipulation of critical use areas are in order.

Holding areas are utilized for up to 6 weeks during both spring and fall migration and therefore efforts should be made to attain adequate high quality forage and cover during these times. Livestock grazing occurs on on all holding areas identified and the location and use periods of some allotments suggest the probability of conflict with deer, especially during spring migration. Thus, the timing and intensity of livestock grazing should be evaluated and provisions made which minimize competition for available forage.

Timber harvest and thinning can have beneficial effects on deer forage production by opening the canopy and stimulating herbaceous growth and browse production. However, thinning of Jeffrey pine forest has eliminated valuable hiding and escape cover, which appear to be of

particular importance during the fall. Therefore, it is essential that dense stands of Jeffrey pine be maintained especially on fall holding areas where deer are dependent on this habitat type for cover.

A dense network of logging roads throughout most of the Jeffrey pine forest has reduced much of the effectiveness of this habitat type as hiding and escape cover by increasing accessibility and disturbance to deer. Thus, a program of road closure and rehabilitation is needed to improve habitat conditions and reduce human disturbance throughout areas impacted by past timber harvests.

Water is scarce and poorly distributed throughout much of the Casa Diablo winter range and portions of the summer range, especially in Jeffrey pine and Great Basin sagebrush habitats to the south and east of Mono Lake. As a result, deer use generally is restricted to favorable habitats near permanent water sources. In order to increase deer densities on a herd wide basis, a major management objective of the Casa Diablo herd, it is essential that permanent water sources be developed in unwatered areas. This can be achieved by improving existing water sources and establishing windmills and rainwater collectors, or "guzzlers" (Appendix Figures 7a, 7b, and 8).

Three radio-collared deer occupied summer range on the west side of the Sierra Nevada. These animals were provided access to their west side summer ranges by a migration corridor extending around the south slope of White-Wing Mountain and over San Joaquin Ridge. White Wing Mountain and San Joaquin Ridge have been proposed for nordic ski development in phases IV and V of the Mammoth-June Mountain Ski Area Development Plan. It is essential, if ski development is allowed to occur, that development be intelligently planned when considering the placement of proposed facilities within this migration corridor. Thus, it will be necessary to design studies that would gather more site-specific information regarding deer migration and summer use within areas of proposed ski development. It also is imperative that mitigation be designed that will limit human disturbances associated with such developments during migration periods. For example, this may entail reduction or complete cessation of ski area construction and maintenance activities until migration has been completed. It may also include stringent laws that help to prevent free roaming dogs, a typical problem associated with such developments, from harassing migrating deer.

Other areas of the Casa Diablo deer herd range are the subject of land use proposals which may impact deer habitat. A major geothermal power plant has been proposed near the Inyo Craters. One such plant exists and several others are proposed for the Casa Diablo Hot Springs area. In addition, there is a proposal for a major resort complex on Doe Ridge near the Mammoth-June Lake Airport. Several hydropower projects exist or are proposed on drainages between June Lake and Bridgeport, some in critical deer habitat. This study has revealed that deer from the Casa Diablo herd use these areas as migration and summer habitats. The effects of these or other projects will depend on the number developed, and where and how they are developed. Therefore, in order to insure the welfare of the Casa Diablo herd it is imperative to evaluate the effects of land use projects on an individual and a cumulative basis.

Since the Casa Diablo and Mono Lake herds essentially have overlapping summer ranges, it may be biologically and administratively sound to designate these herds as one, e.g., the Mono Lake herd. Future telemetry research of the Mono Lake herd will further clarify this issue.

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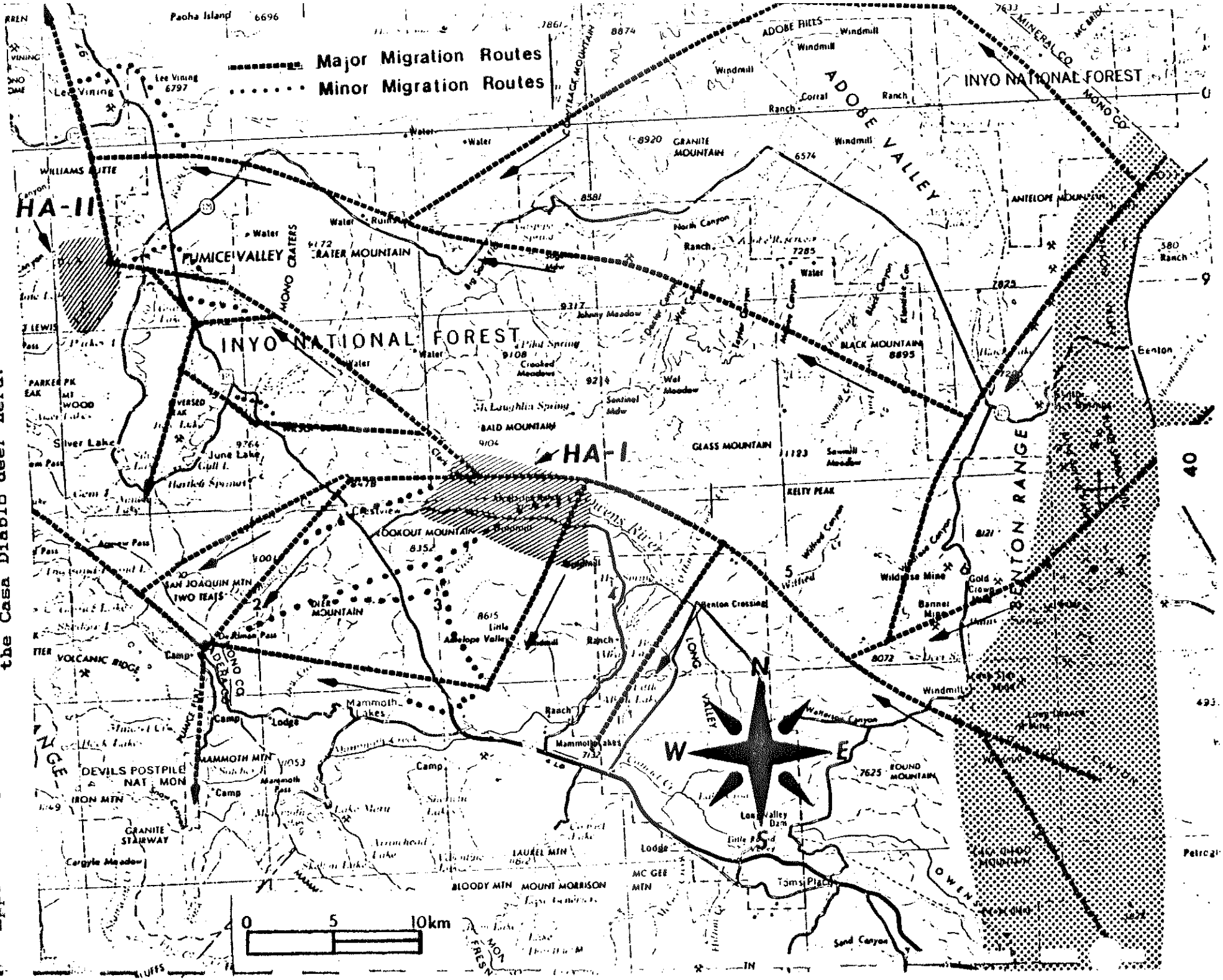
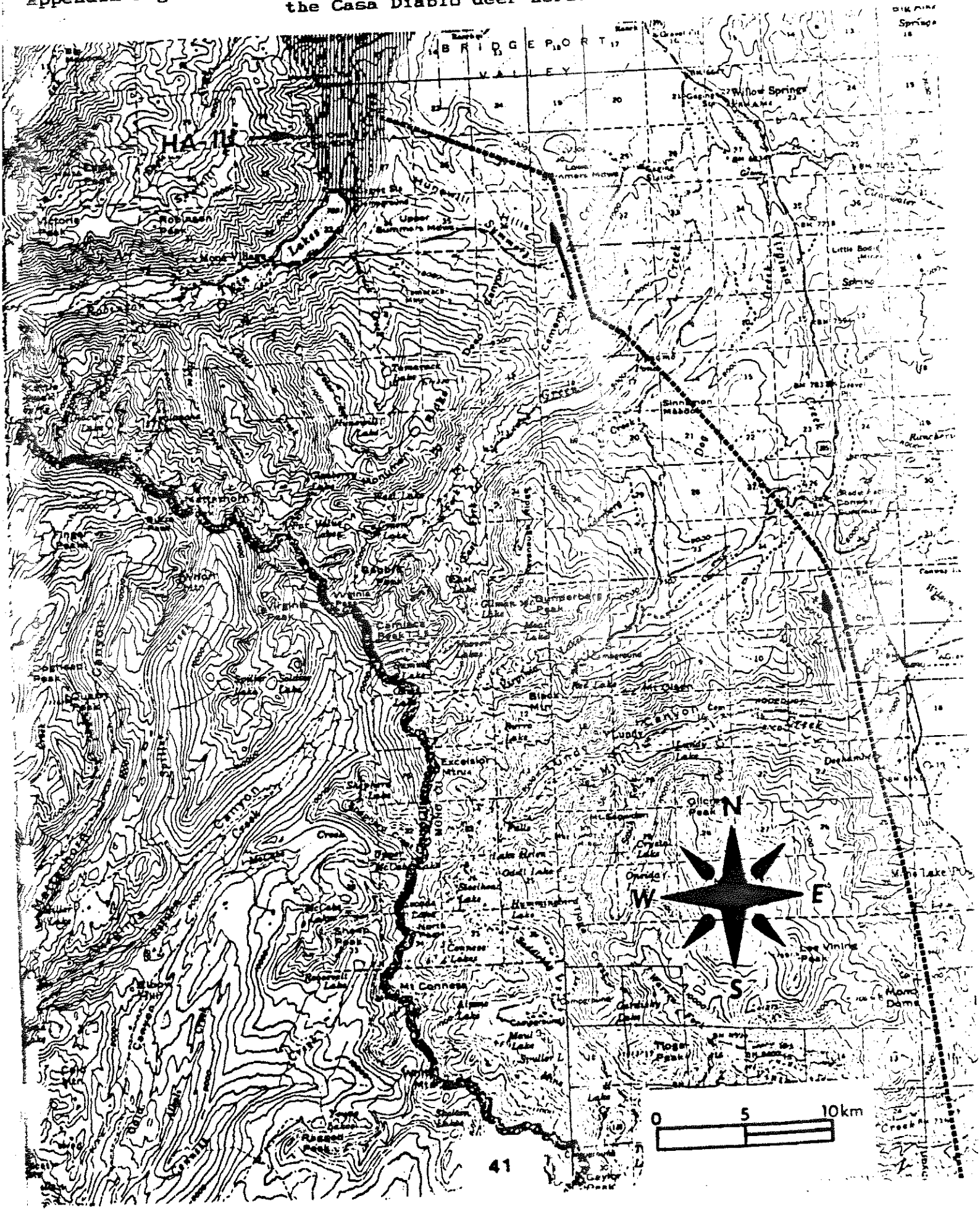
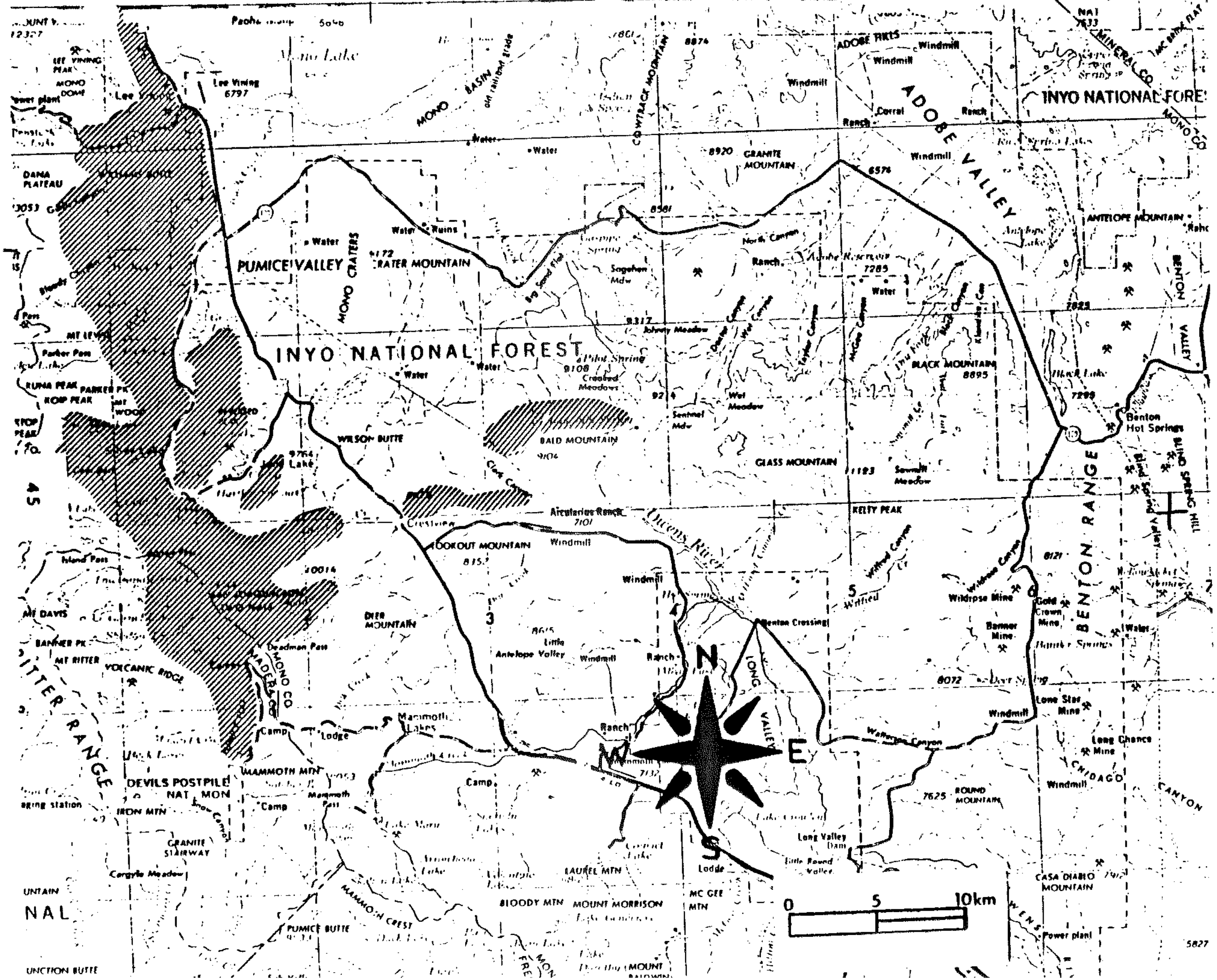


Appendix Figure 1a Locations of migration routes of the Casa Diablo deer herd.

Appendix Figure 1b Locations of migration routes [illegible] the Casa Diablo deer herd.




INYO NATIONAL FOREST
ADOBE VALLEY
BENTON RANGE
BENTON VALLEY
BLIND SPRING HILL
Blind Spring Valley
Benton Hot Springs
PUMICE VALLEY
MONO CRATERS
CRATER MOUNTAIN
MONO BASIN
COWTRACK MOUNTAIN
GRANITE MOUNTAIN
ANTELOPE MOUNTAIN
BLACK MOUNTAIN
8895
GLASS MOUNTAIN
BALD MOUNTAIN
WILSON BUTTE
KELTY PEAK
LOOKOUT MOUNTAIN
DEER MOUNTAIN
Little Antelope Valley
LONG VALLEY
Long Valley Dam
Benton Crossing
Alcularius Ranch
7101
Crestview
Wildrose Mine
Banner Mine
Gold Crown Mine
Lone Star Mine
Long Chance Mine
CHICAGO CANYON
ROUND MOUNTAIN
7625
CASA DIABLO MOUNTAIN
Power plant
Mammoth Lakes
MAMMOTH MTN
Mammoth Pass
Deadman Pass
MONO CO
MADERA CO
DEVILS POSTPILE NAT MON
VOLCANIC RIDGE
MT RITTER
BANNER PK
MT DAVIS
RITTER RANGE
IRON MTN
GRANITE STAIRWAY
MAMMOTH CREST
PUMICE BUTTE
LAUREL MTN
BLOODY MTN
MOUNT MORRISON
MC GEE MTN
Lee Vining
6797
LEE VINING PEAK
MONO DOME
DANA PLATEAU
MT LEWIS
PARKER PK
KUNA PEAK
KOIP PEAK
Mono Lake
Water
Windmill
Ranch
Corral
MINERAL CO
ADOBE FLATS
Wet Meadow
Sentinel Mdw
Johnny Meadow
Sagehen Mdw
Crooked Meadows
Sawmill Meadow
North Canyon
Big Sand Flat
Queens River
Wilfred Canyon
Wildrose Canyon
Watterson Canyon
Camp
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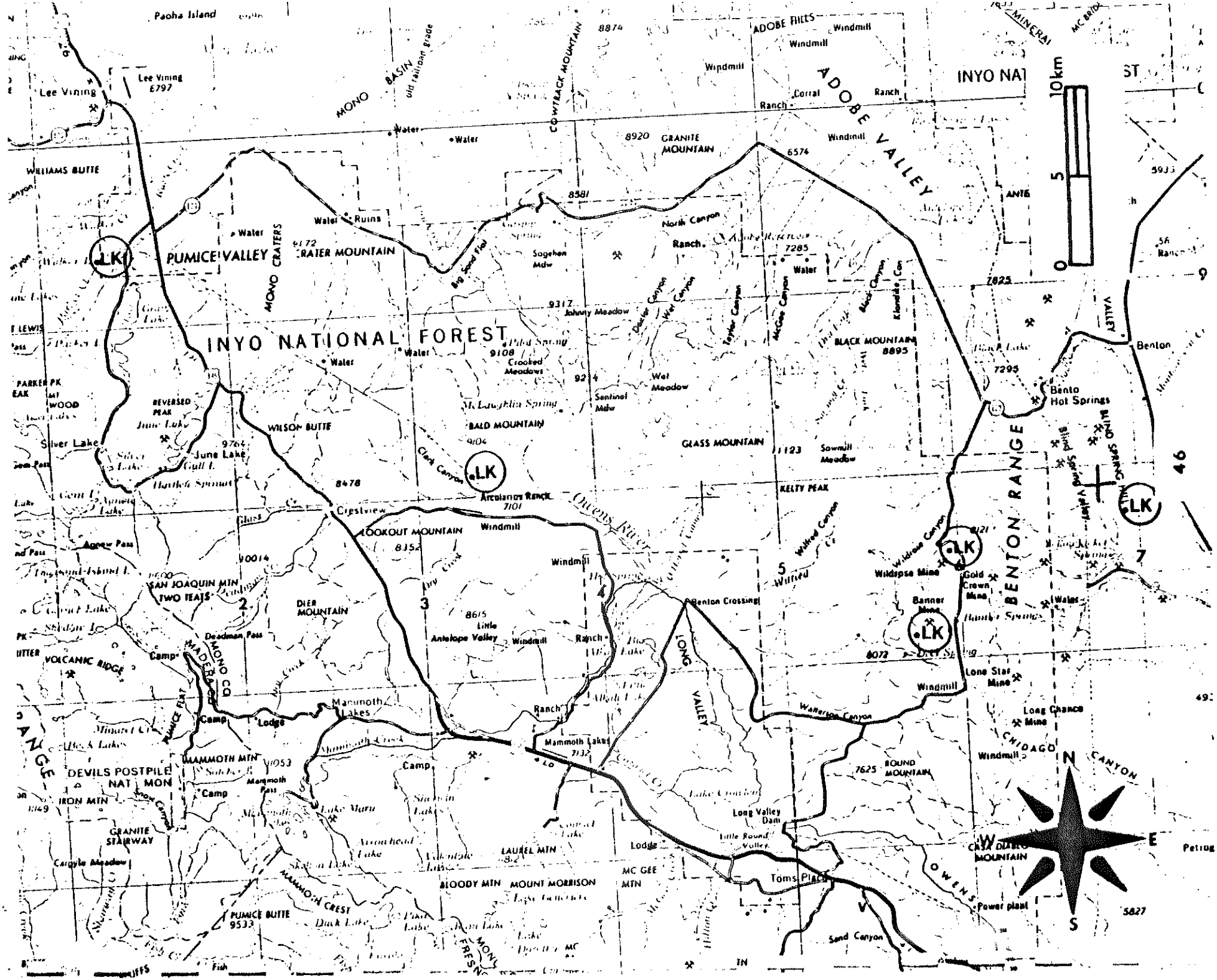
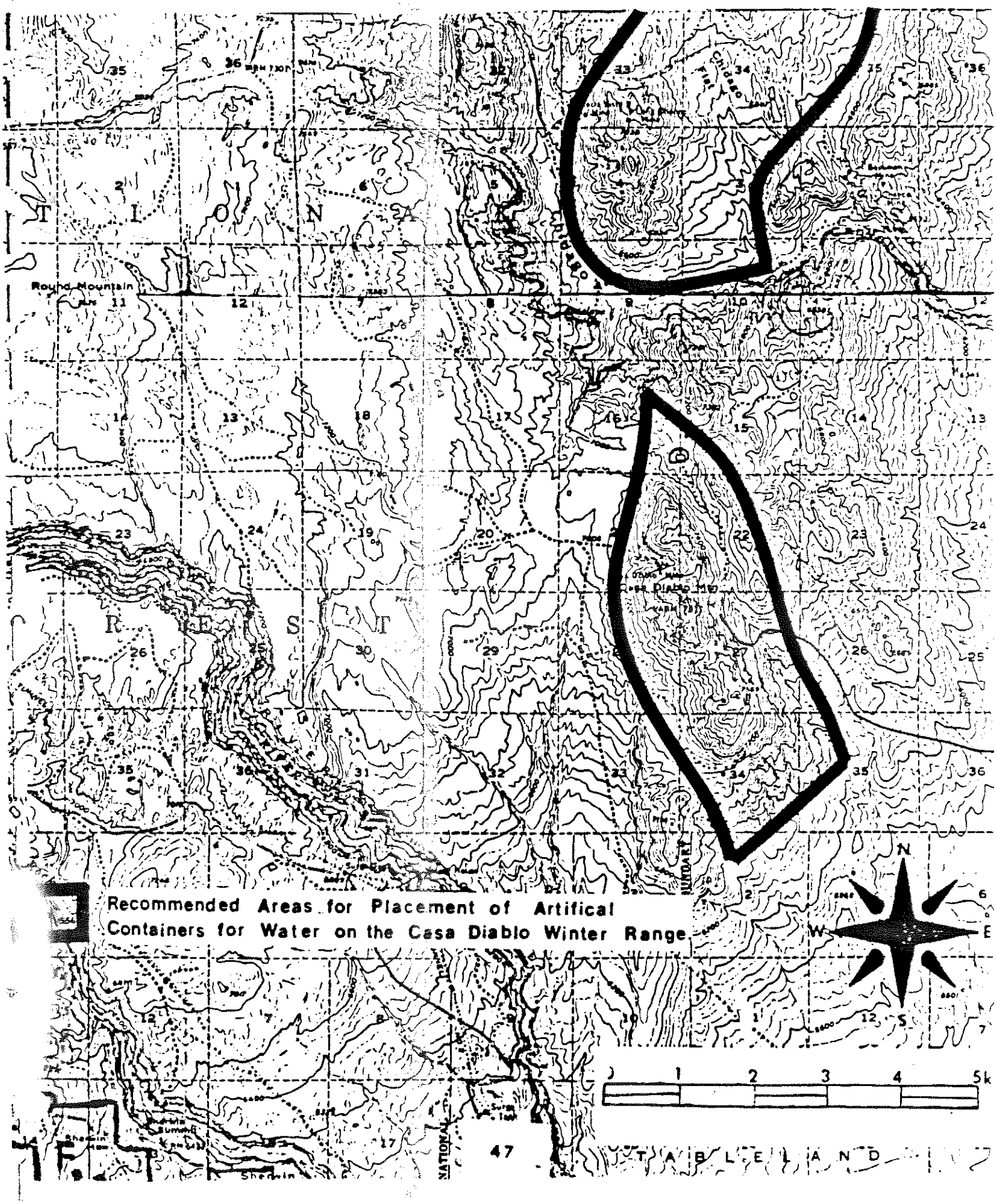
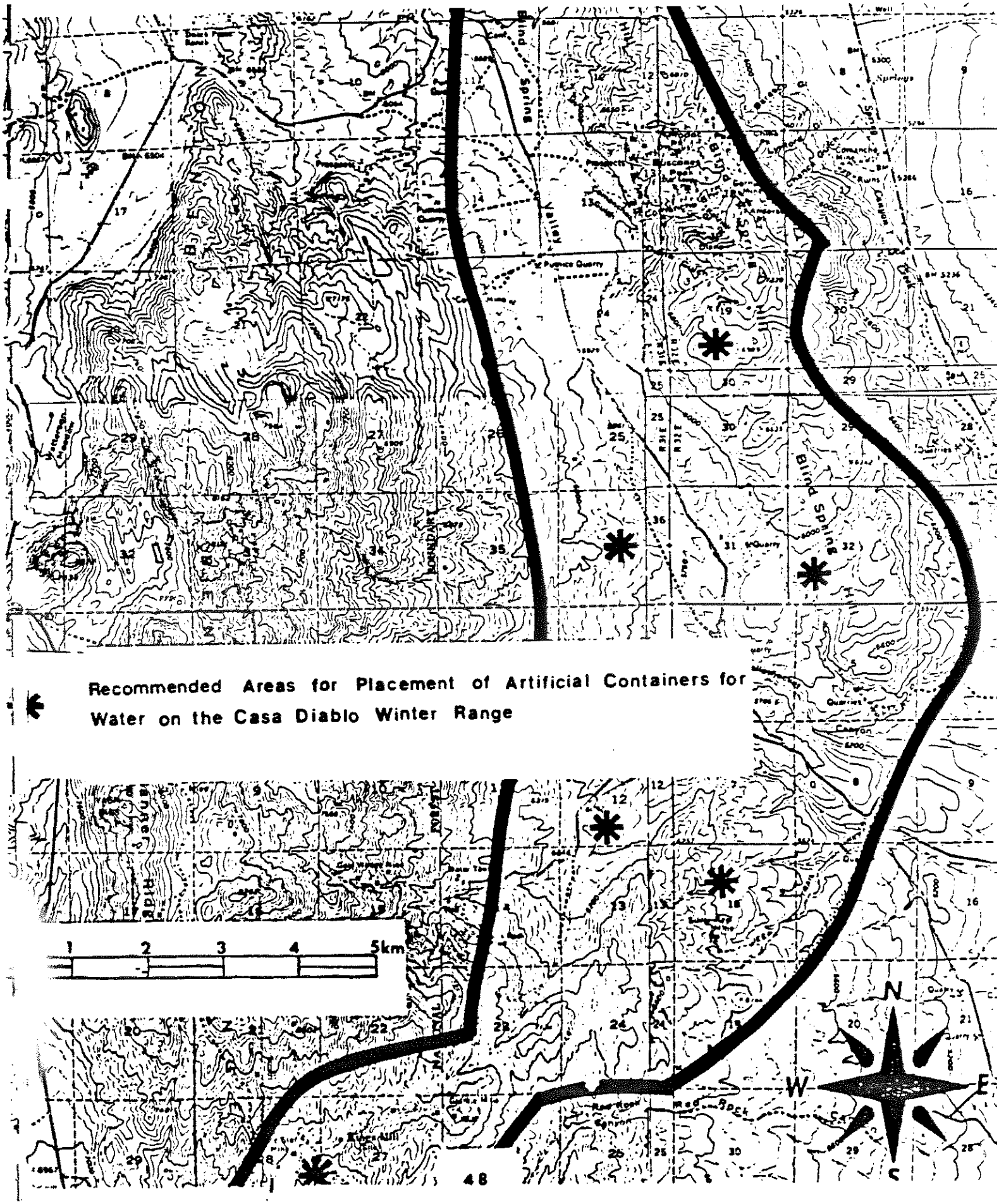


llons, Casa Diablo deer herd.

necessary for providing permanent water.

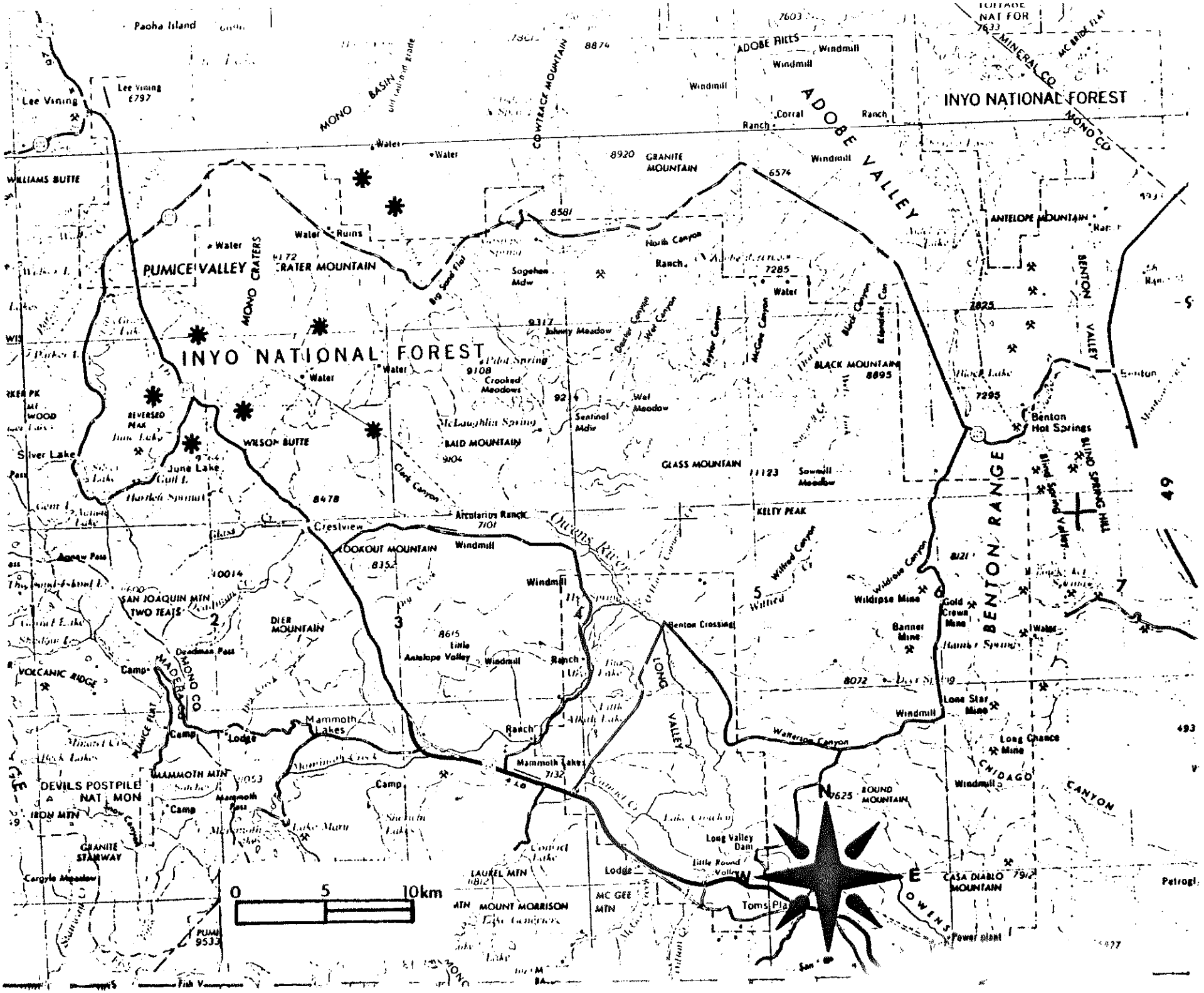


necessary for providing permanent water.



* Recommended Areas for Placement of Artificial Containers for Water on the Casa Diablo Winter Range

necessary for providing permanent water.



EAST WALKER/MONO LAKE DEER STUDY

FIRST INTERIM REPORT
SEPTEMBER 1988

Timothy Taylor
P.O. Box 191
June Lake, CA 93529

TABLE OF CONTENTS

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INTRODUCTION

The Rocky Mountain mule deer (Odocoileus hemionus) is the most adaptive and widespread western ungulate (Poole 1976). However, a decline of mule deer in the west has been a major concern of many state conservation agencies (Julander and Low 1976). A general statewide decline in California's deer herds has been occurring since the 1950's (Bertram and Rempel 1977, Dasmann 1981). This is particularly evident in migratory mule deer herds of the Sierra Nevada Mountains (Bertram 1984). According to Bertram and Rempel (1977) and Longhurst et al. (1976) the decline is related to a number of different factors which working in combination have ultimately eliminated deer and reduced productivity and fawn survival. Some of these factors include: habitat problems resulting from overgrazing; changes in logging methods and reforestation techniques; elimination of range by roads; recreational developments such as campgrounds; sub-divisions; construction of reservoirs; and predation.

The long term decline in deer numbers prompted the California Department of Fish and Game (DFG) in 1975 to formulate a general plan to restore and maintain healthy deer herds at levels compatible with their habitat, to increase the quantity and quality of deer habitat, and to provide for diversified recreational use of deer (Thomas 1985a). In 1975, DFG was mandated by the legislature to develop management plans for each geographically distinct unit of deer range. As a result, separate and unique herd management plans were completed in 1985 for the East Walker and Mono Lake deer herds; the two eastern Sierra migratory mule deer herds which are the subject of this investigation.

The East Walker and Mono Lake herds, which each consist of approximately 3,000 animals, occupy adjacent winter ranges in Mineral and Lyon Counties, Nevada and share summer range primarily on the east slope of the Sierra Nevada Mountains in northwestern Mono County, California. Since much of the herd range is largely public lands, high demands for multiple commercial, residential and recreational uses exist. Therefore several major concerns relating to the management of the East Walker and Mono Lake deer herds have been identified in management plans. Some of

these concerns include: the high demand for multiple resource use of the range especially for recreation, grazing, and housing; and increasing demands for hydropower development (Thomas 1985a, Thomas 1985b). These concerns have prompted DFG to begin this investigation of the East Walker and Mono Lake herds so that all critical habitats used by these herds, which may be subject to alteration, be delineated. To effectively manage migratory deer in the Sierra it is crucial that migration routes and all seasonal habitats be delineated (Bertram and Rempel 1977).

The major objectives of this investigation, which was initiated in January 1988, are those outlined in the East Walker and Mono Lake deer herd management plans. These objectives are (i) to delineate all critical habitats used by the East Walker and Mono Lake deer herds; (ii) to analyze the quality and quantity of all critical habitats defined; (iii) to access the impacts of land uses, existing and proposed, on critical habitats; (iv) to identify habitat factors limiting the herd; and (v) to formulate recommendations to reduce the impacts of these factors.

ACKNOWLEDGEMENTS

I gratefully acknowledge the help of the following individuals in this study: J. Davis, T. Russi, A. Lapp, T. Blankinship, D. Jessup, R. Thomas, V. Bleich, C. Mortimore, pilot L. Goehring. This project is being funded through the California Deer Herd Management Plan Implementation Program under Contract FG-7027, The Bureau of Land Management., and the Mono County Fines Committee.

STUDY AREA

The East Walker deer herd occupies approximately 600 km^2 in Mono and Tuolumne counties, California and Mineral and Lyon Counties Nevada. The herd winter range, which encompasses approximately 140 km^2 is located on the Toiyabe National Forest (TNF) in Mineral and Lyon Counties, Nevada (Figure 1). The most major geographical feature on the winter range is the East Walker river which flows north from the Bridgeport Valley. Winter range vegetation is Great Basin sagebrush type, consisting mainly of big sagebrush (Artemisia tridentata), bitterbrush (Purshia tridentata),

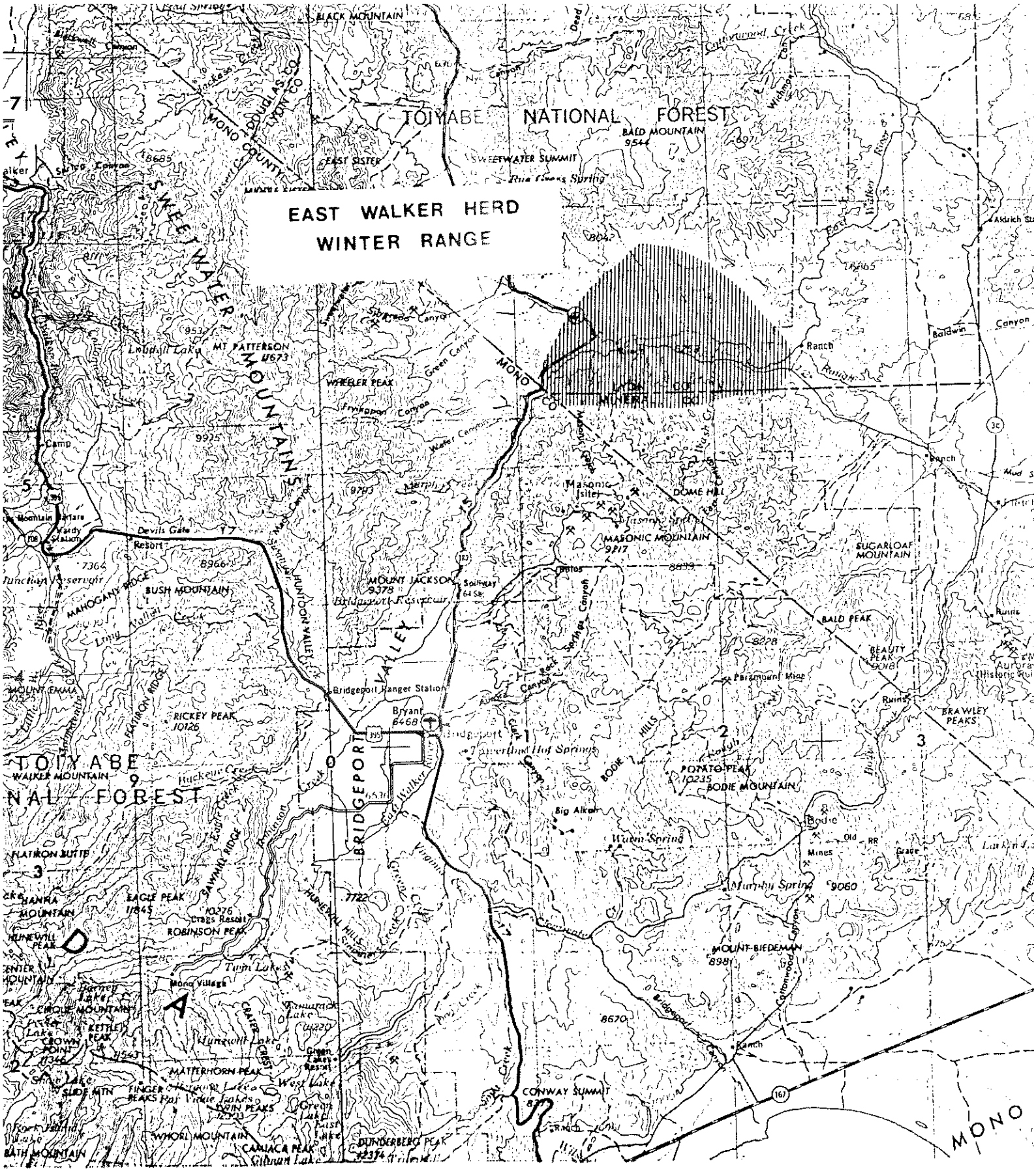

Figure 1. Location of East Walker deer herd winter range in Mineral and Lyon Counties, Nevada

and rabbitbrush (Chrysothamnus spp.). Singleleaf pinyon pine (Pinus monophylla)-western juniper (Juniperus occidentalis) woodland dominates vegetation between 1,950-2,450 m. Various grasses and forbs which occur on the winter range include needlegrass (Stipa spp.), bluegrass (Poa spp.), cheatgrass (Bromus tectorum) and forbs including storksbill filaree (Erodium cicutarium). Terrain is moderately sloping with highly erodible soils that are shallow to moderately deep (25-100 cm) and generally have a sandy loam texture (Thomas 1985a).

The Mono Lake deer herd occupies approximately 2000 km^2 in Mono and Tuolumne Counties in California and Mineral County, Nevada. The herd winter range encompasses some 200 km^2 on the TNF and is located between 12 and 35 km south of Hawthorn, Nevada in the Wassuk and Excelsior mountain ranges (Figure 2). Winter range vegetation is Great Basin sagebrush type, consisting of big sagebrush, bitterbrush, and rabbitbrush. Pinyon-juniper woodland dominates vegetation above approximately 2,070 m. Terrain is moderately sloping with soils consisting of an admixture of sandy loams which are generally shallow and rocky (Thomas 1985b).

Deer from the East Walker and Mono Lake herds share approximately 2,000 km^2 of summer range on the TNF, primarily along the east slope of the Sierra Nevada. Portions of the Stanislaw National Forest (SNF) in Tuolumne County on the west side of the Sierra Nevada are also used to a limited extent by summering deer. Nine major habitat types, varying in elevation between 2,130-2,950m have been identified in areas used by radio-collared deer (USDA 1981).

Great Basin Sagebrush.----This type generally occurs on the dry slopes and plains east of the Sierra crest, primarily in the Bodie Hills, the Hunewill Hills, the Conway Summit area, and the west side of the Sweetwater mountain range. Big sagebrush is dominate with bitterbrush often occurring as a codominate. This type is often found in association with Jeffrey pine (Pinus jeffreyi) forest and pinyon-juniper woodland.

Singleleaf Pinyon Pine-Western Juniper.----This type occurs mainly on dry south and east facing slopes of the Sierra Nevada, the Sweetwater mountain range, and the Bodie Hills. Where this type occurs single-leaf pinyon pine is the dominate conifer species between approximately 2,070-2,600 m, with curlleaf mountain mahogany (Cercocarpus ledifolius), big sagebrush, and bitterbrush occurring as

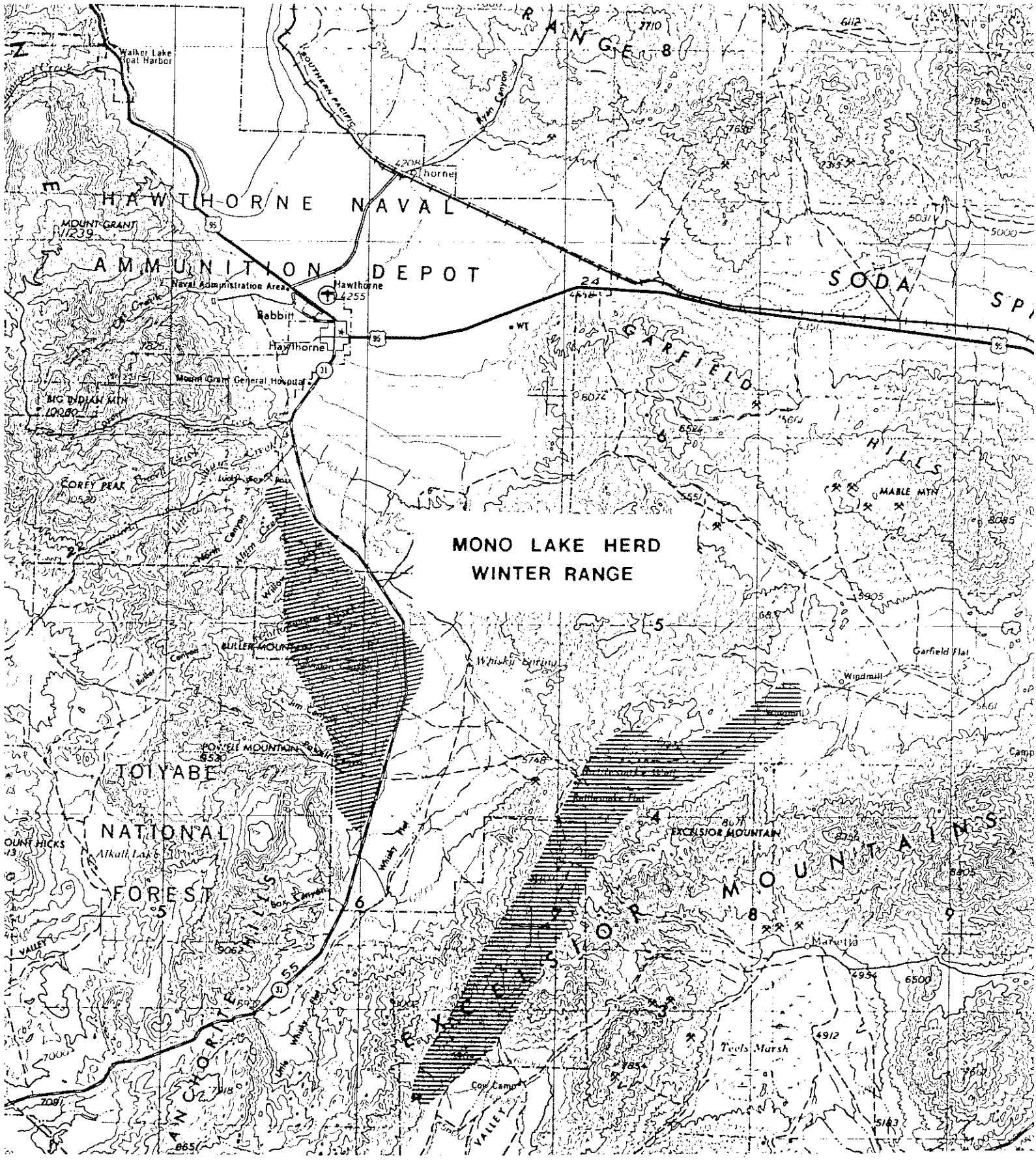

Figure 2. Location of Mono Lake deer herd winter range in Mineral County, Nevada

associated understory species.

Jeffrey Pine.----This type is open Jeffrey pine forest which occurs in scattered stands between elevations of approximately 2,200-2,450 m. This habitat type is most prevalent in the Twin Lakes and Buckeye Creek drainages, on Sawmill Ridge and Ricky Peak, and the Sonora Pass area. Associated understory species include big sagebrush, bitterbrush, gooseberry (Ribes spp.), mountain snowberry (Symphoricarpos vaccinioides).

Quaking Aspen Riparian.----This dense cover type occurs within a few meters of most stream channels on the east slope of the Sierra Nevada, in the Bodie Hills, and in the Sweetwater mountain range. Quaking aspen (Populus tremuloides) and willow (Salix spp.) dominate vegetation, with wild rose (Rosa woodsii), gooseberry, and snowberry occurring as understory species. Groves of quaking aspen, which provide critical fawning and fawn rearing habitat, are indicators of moist conditions and are located mainly near high elevation meadows.

Mixed Conifer.----The codominates of this vegetation type occurring on the east slope of the Sierra Nevada between 2,400-2,600 m, include Jeffrey pine, white fir (Abies concolor), lodgepole pine (Pinus contorta), and western white pine (Pinus monticola). At higher elevations of the Mixed Conifer type, red fir (Abies magnifica) is an occasional associated species with white fir often occurring in pure stands at lower elevations.

Lodgepole Pine Forest.----This forest type is found above the Mixed Conifer type primarily on the east slope of the Sierra at elevations between approximately 2,600-3,000 m. It is composed of lodgepole pine which often occurs in large, dense, homogeneous stands. Within the lodgepole pine forest perennial grasses and forbs (needle-and-thread grass (Stipa comata), bluegrass (Poa pratensis), bromegrass (Bromus tectorum), lupine (Lupinus spp.), and pussy paws (Calyptridium caudiciferum)), dominate openings of poorly developed, dryer soils.

Montane Chaparral.----This type occurs on open flats and rocky ridges from 2,135-3,050 m in the Sweetwater mountain range and lower foothills of the Sierra Nevada mountains. Greenleaf manzanita (Arctostaphylos patula), mountain whitethorn (Ceanothus cordulatus), Chinquapin (Castanopsis sempervirens), and tobacco brush (Ceanothus velutinus), occur as codominates. This type is often found in association with

Great Basin sagebrush.

Montane Meadow.----This meadow type is found mainly at mid and upper elevations on the east slope of the Sierra and throughout the Bodie Hills and is composed primarily of sedges (Carex spp.), and rushes (Juncus spp.), and designates year long water availability. Perennial grasses, forbs, quaking aspen, and lodgepole pine are associated with these meadows.

Whitebark Pine.---- This forest type, dominated by whitebark pine (Pinus albicaulis), occurs on high windswept ridges at treeline on the east slope of the Sierra.

METHODS

Deer were captured on the East Walker and Mono Lake herd winter ranges from 1 March-4 March 1988 using linear, nylon tangle nets (2 x 90 m) and a Bell Jet Ranger III helicopter (Beasom et al. 1980). Deer were hazed slowly by helicopter into nets placed at strategic locations, usually preselected by the pilot through aerial reconnaissance. Net sites usually employed natural escape routes, such as ravines. Anywhere from 1-10 deer were captured on successive drives until desired numbers were obtained for each wintering area.

All deer were physically restrained and marked with large, plastic, consecutively numbered cattle ear tags (7.5 x 11.5 cm; Allflex Tag Systems, Harbor City, Calif.), color coded to wintering area. Thirty-four adult females were fitted with radio collars. In addition, five adult males were instrumented with a radio transmitters mounted on expandable collars to allow for neck swell during the rut.

Adult radio collars (159.150-159.470 MHz; Telonics, Inc., Mesa, Arizona), weigh 260-270 g and have an operational life of 24-36 months at 35-75 pulses/minute. All radios are equipped with mortality sensors that double the pulse rate when the animal is stationary for 3-5 hours.

The locations of all radioed animals are obtained by triangulation from the ground or from a fixed-wing aircraft. Deer were located 5-6 times weekly during the spring migration. During the summer months deer are located 2-3 times weekly. Initial ground locations are made from a vehicle equipped with a Telonics TR-2 receiver with an attached program/scanner

(TS-1) and a base loaded whip antenna. Triangulation bearings are obtained using a hand-held, 2-element antenna (RA-2A; Telonics, Inc., Mesa, Arizona). Visual sightings of radio-collared deer are made whenever possible. Radio locations and visual sightings are marked on a U.S. Geological Survey 7.5 minute series topographic map.

Fixed-wing flights were conducted once weekly, weather permitting, during spring migration and once every 2-3 weeks during the summer, usually between 0900 and 1100 hours. Flights are conducted in a Cessna 185 at air speeds of 120-180 km/hour.

Migration routes, holding areas, and summer home ranges are delineated using radio telemetry. Winter and summer home ranges (Burt 1943), are determined using the Modified Minimum Area Method (Harvey and Barbour 1965). Each home range includes a minimum of five relocation points determined from visual observations.

Holding areas are recognized as sites along migration corridors where deer remain for several days or more during migration. (Bertram and Remple 1977). All holding areas identified thus far were designated a number as to the position in which they occur along the migration corridor, e.g., HA-1.

Post season deer composition counts were conducted on both winter ranges with a Bell Jet Ranger III helicopter during January of 1988. Spring composition counts were conducted on foot and by vehicle in April and early March of 1988 on the East Walker winter range. In late April of 1988, composition counts were conducted with a helicopter on the Mono Lake winter range.

RESULTS

1. Capture and marking

Between 1 March and 3 March 1988, a total of 67 deer were captured, marked, and released on 4 different areas on the Mono Lake herd winter range. On 1 March, a total of 14 deer (12 females and 2 males) were captured in the Wassuk Mountain range at two different net sites located at the mouths of Johnston and Cottonwood Canyons. Ten of these (1 male and 9 females) were fitted with radio-collars while 4 were marked with ear tags only.

On 2 March, 31 deer (26 females and 5 males) were captured at Rattlesnake Wells in the Excelsior Mountain range. Six of these were fawns (3 males and 3 females) and 6 were yearlings (4 females and 2 males); 20 were adult females and 3 were adult males. Of the 31 deer captured in the Excelsior Mountains, 10 adult does and 1 yearling male were radio-collared; the remaining 19 were fitted with ear tags only.

On 3 March, 19 deer (17 females and 2 males) were captured in another portion of the Wassuk range near the mouth of Powell Canyon, located approximately 5 km south of Johnston Canyon. Of these 19 deer, 5 were fawns (2 male and 3 female) and 13 were adult females; only 1 yearling, a female, was captured. Two of the adult females were radio-collared while the remaining 17 were marked with ear tags only. Also on 3 March, 3 deer (2 females and 1 male) were captured with a helicopter net gun in Huntoon Valley, a remote portion of the Excelsior Mountains. All three were fitted with radio-collars before being released.

A total of 39 deer (32 females and 7 males) were captured, marked and released on the East Walker winter range on 4 and 5 March 1988. Four of these were fawns (2 males and 2 females) and 7 were yearlings (1 male and 6 females); 26 were adult females and 5 were adult males. Of these 39 deer, 12 adult females and 2 adult males were instrumented with radio-telemetry collars; the remaining 27 were fitted with ear tags only.

2. Spring migration

a) Timing of deer movements

A total of 16 radio-telemetry flights were made during the spring of

1988 to locate deer during migration. All telemetered deer from the East Walker and Mono Lake herds are migratory with distinct winter and summer ranges. The timing of deer movements from the East Walker and Mono Lake winter ranges in the spring of 1988 is shown in Figure 3.

Radioed-collared deer from the Excelsior Mountains began leaving the Mono Lake winter range approximately 10 days earlier than deer from the Wassuk Mountain wintering area, and 20 days earlier than deer from the East Walker winter range. According to radio-telemetry data, migration from the Excelsior Mountain wintering areas at Rattlesnake Wells and Huntoon Valley was completed by approximately 11 April. Migration from the East Walker winter range, which lasted about 42 days, did not begin until approximately 9 April. The timing of deer movements from the East Walker winter range is rather gradual when compared to that of deer from the Excelsior and Wassuk Mountain wintering areas, which lasted approximately 22 and 30 days respectively. Radioed-collared deer from the East Walker herd remained on the winter range approximately two weeks longer than did deer from the Mono Lake herd.

b) East Walker deer herd migration routes

During the spring of 1988, all radio-collared deer marked on the East Walker winter range migrated to summer range located in northern Mono County, California. Eleven of these deer moved south into Mono County along a migration corridor which contours along the east slope of the Sweetwater Mountains between the winter range and Hwy 395 (Figure 4). This corridor, which parallels the East Walker River drainage, extends primarily through pinyon-juniper woodland at elevations ranging between 2050-2500 m. Six deer continued south across Hwy 395 and migrated to a large area of summer range located primarily to the west of Bridgeport, California, between the Twin Lakes drainage and Hwy 108.

Five deer, instead of crossing Hwy 395, migrated north to summer range in the Sweetwater Mountains, located to the north and east of Hwy 395 and the West Walker River drainage. Two deer from the East Walker herd migrated along the north slope of the Bodie Hills, on the east side of the East Walker River drainage, to summer range located in the Bodie Hills (Figure 4).

c) Mono Lake deer herd migration routes and holding areas.

During the spring of 1988, all radio-collared deer from the Mono

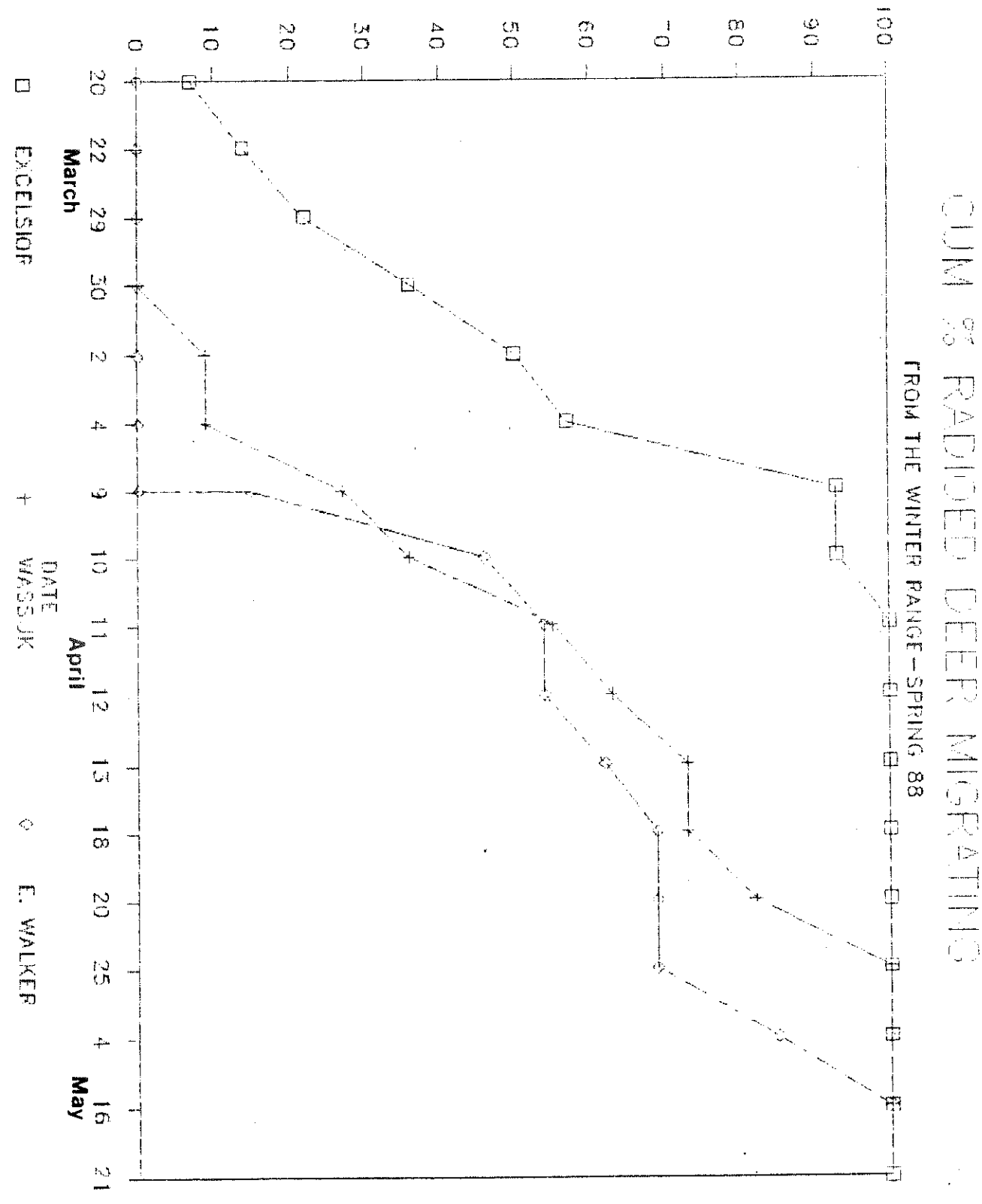

Figure 3. Cumulative percent of radio-collared deer migrating from the East Walker and Mono Lake winter ranges by date, spring 1988

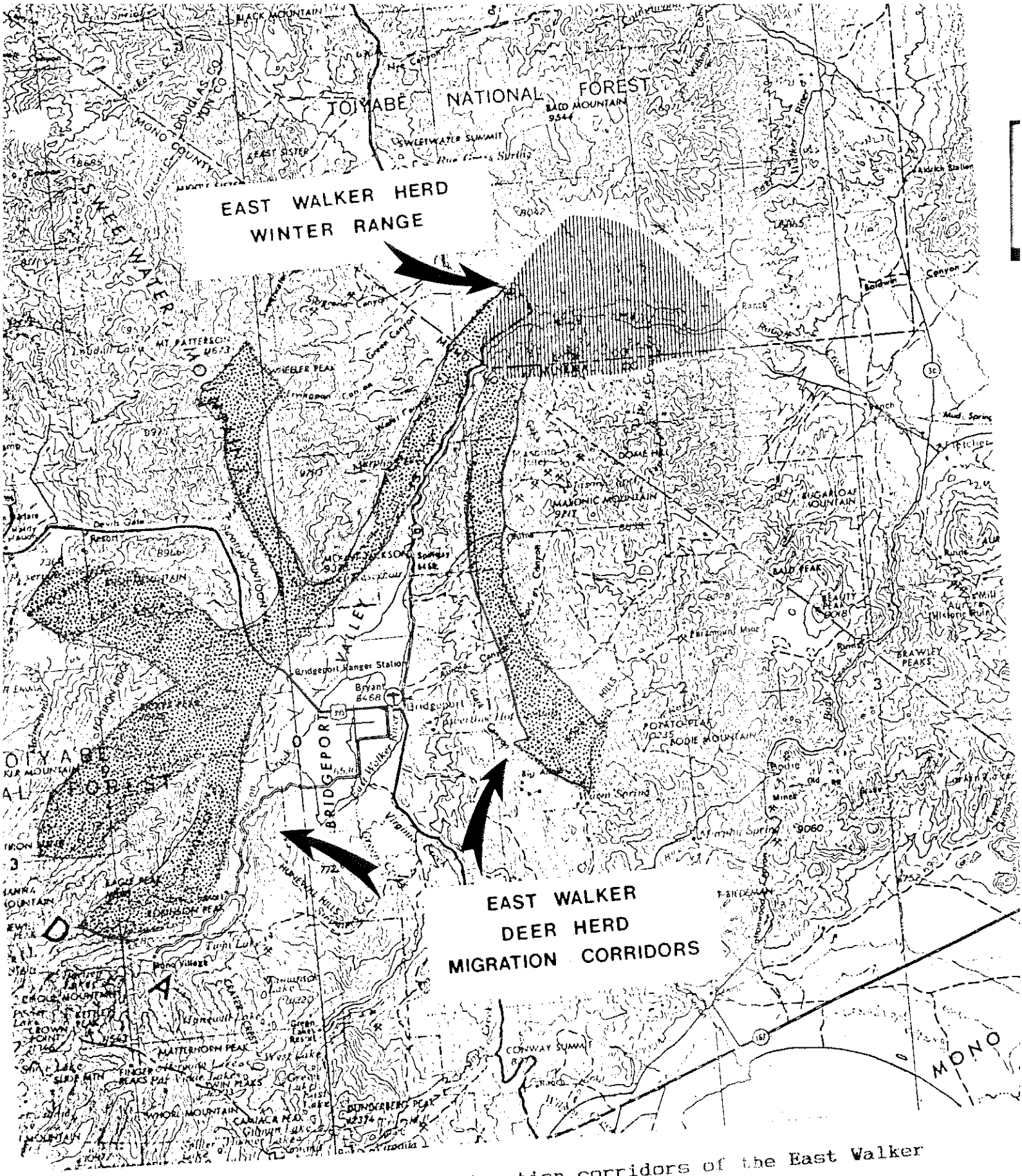

Figure 4. Locations of migration corridors of the East Walker deer herd, spring 1988

Lake herd migrated to summer range located in west-central and north-western Mono County, California. Deer from both the Wassuk Mountain and Excelsior Mountain wintering areas migrated west into Mono County along a broad migration corridor which contours around the south slope of the Bodie Hills.

During late March and early April, deer leave their respective wintering areas in the Wassuk and Excelsior Mountain ranges and move in a westerly direction along seperate migration routes toward the Bodie Hills (Figure 5a, Figure 5b). Deer from the Wassuk Mountain wintering areas at Powell, Johnston, and Cottonwood Canyons spend much of March and April on the east slope of the Wassuk range between approximately 1,830 and 2,440 m. Beginning in early April deer leave the east slope and move in a westerly direction toward higher elevations in the Wassuk range. Once deer reach an elevation of approximately 2,600 m, they move around the east and west sides of Powell Mountain and begin a southerly migration toward the Bodie Hills.

Deer from the Excelsior Mountain wintering area at Rattlesnake Flat leave the winter range in late March and migrate in a southwesterly direction along the base of the Excelsior range toward Hwy 167 and the Anchorite Hills. Deer cross Hwy 167 along a 2 km stretch between the north end of Anchorite Pass and Box Canyon. Once deer cross Hwy 167, they turn southwesterly toward the Bodie Hills and merge their migration with deer from the Wassuk Range.

The migration corridor through the Bodie Hills provides a link between winter ranges in western Nevada and summer ranges on the east slope of the Sierra Nevada. The Bodie Hills migration corridor is between approximately 8 and 16 km wide and ranges in elevation from 2,040-2,500 m. It consists of an association of several different habitat types which include Great Basin sagebrush, Pinyon-Juniper Woodland, and Aspen-Riparian. Because very little free water exists within the Bodie Hills, the amount of Aspen-Riparian habitat is severely limited. As a result, the amount of suitable summer range habitat is also extremely limited.

Once deer from the Mono Lake herd complete their migration through the Bodie Hills, they cross Hwy 395 toward spring range located throughout the Conway Summit area, the Hunewill Hills, Copper Mountain and Lundy Canyon (Figure 5b). Several major crossings of Hwy 395 were identified

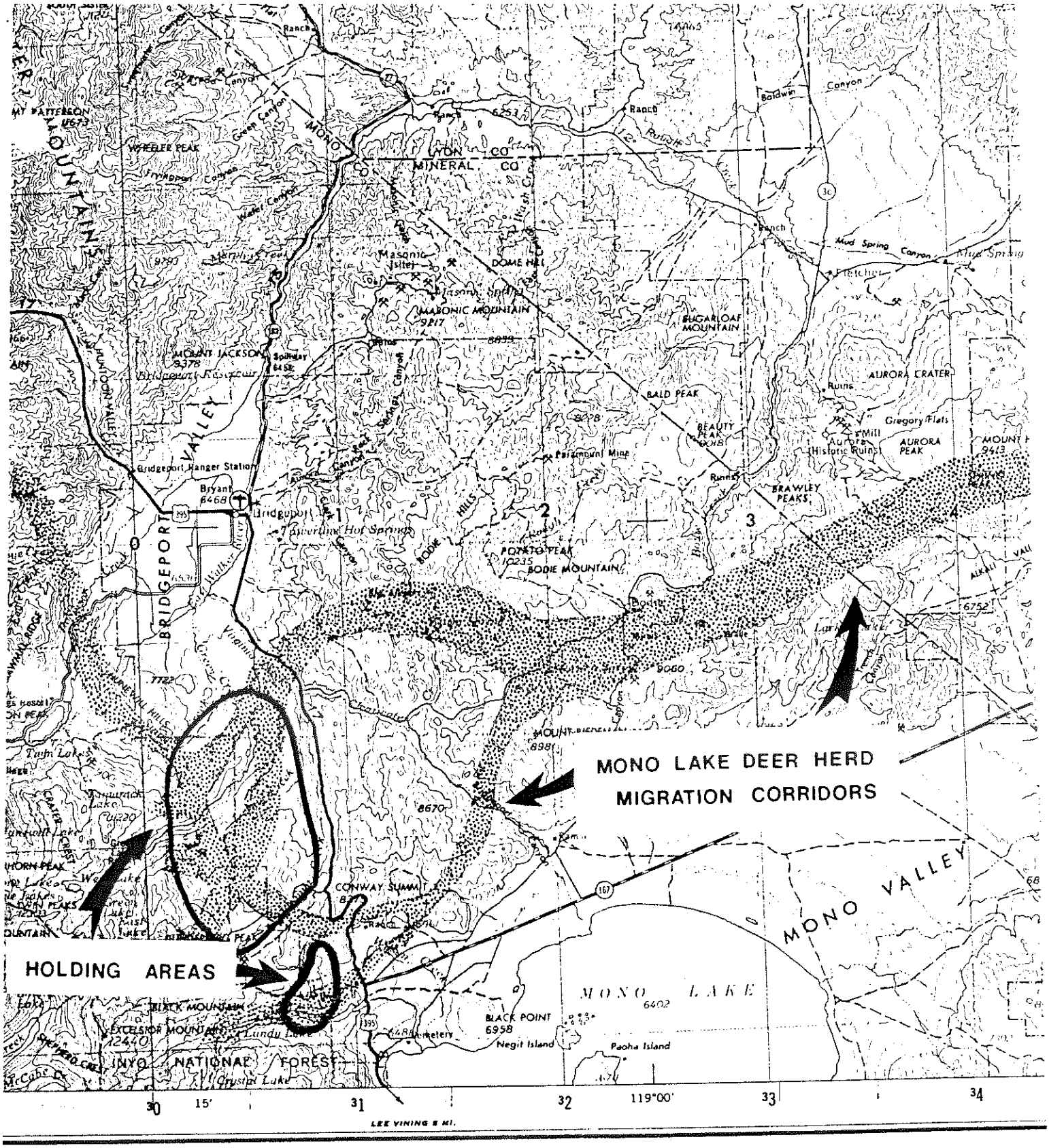

Figure 5a. Locations of migration corridors of the Mono Lake deer herd, spring 1988

the Sweetwater Mountain range (Figure 6). All five of these deer occupy Aspen-Riparian habitats located on the Swauger, Cottonwood, and Burcham Creek drainages. Two deer were found to summer to the south of the East Walker winter range in the Bodie Hills. One of these occupies a small riparian area on the west side of Potato Peak. The other, which summered on the south side of Bodie Mountain, was killed by a mountain lion (Felis concolor) on 5 July. This particular doe occupied summer range consisting primarily of Great Basin sagebrush habitat.

Deer from the Mono Lake herd occupy summer range located primarily on the east slope of the Sierra and throughout the Bodie Hills (Figure 6). The overwhelming majority (52%) of radioed deer from the Mono Lake herd summer on the east slope of the Sierra, between the Lundy Creek and Twin Lakes drainages. Seven deer (28%) from the Mono Lake herd summer to the west of the Twin Lakes drainage where they share summer range with deer from the East Walker herd. One radioed doe, from the Wassuk range, summers to the west of the Sierra crest near Baker Station, in Tuolumne County on the SNF. Four deer (16%) summer in the Bodie Hills.

Marked deer from different winter ranges have been found to occupy summer range of close proximity. Conversely, marked deer from the same winter range have been found to disperse to opposite ends of the summer range. For example, one doe from Johnston Canyon summered at the southern end of the herd range near the Green Creek drainage while another doe summered at the extreme northern end of the range near Sonora Pass.

d) Mortalities

Four (10%) of 39 radio-collared deer marked on the East Walker and Mono Lake winter ranges have been killed by mountain lions (Figure 7). The first, an adult buck from the East Walker, was killed on the winter range on 28 March. The second, a doe from the Wassuk range, was killed on 1 June on Copper Mountain during spring migration. Her carcass, which had been almost completely consumed, was found partially buried under about 5 cm of dirt and litter in a thicket of mountain mahogany. The third, an East Walker doe, was killed on her summer range on the west side of Bodie Mountain on 8 July. Her carcass, which had been only partially consumed, was found buried in a large opening of Great Basin sagebrush. The fourth radio-collared doe to be killed by a mountain lion was found dead on her

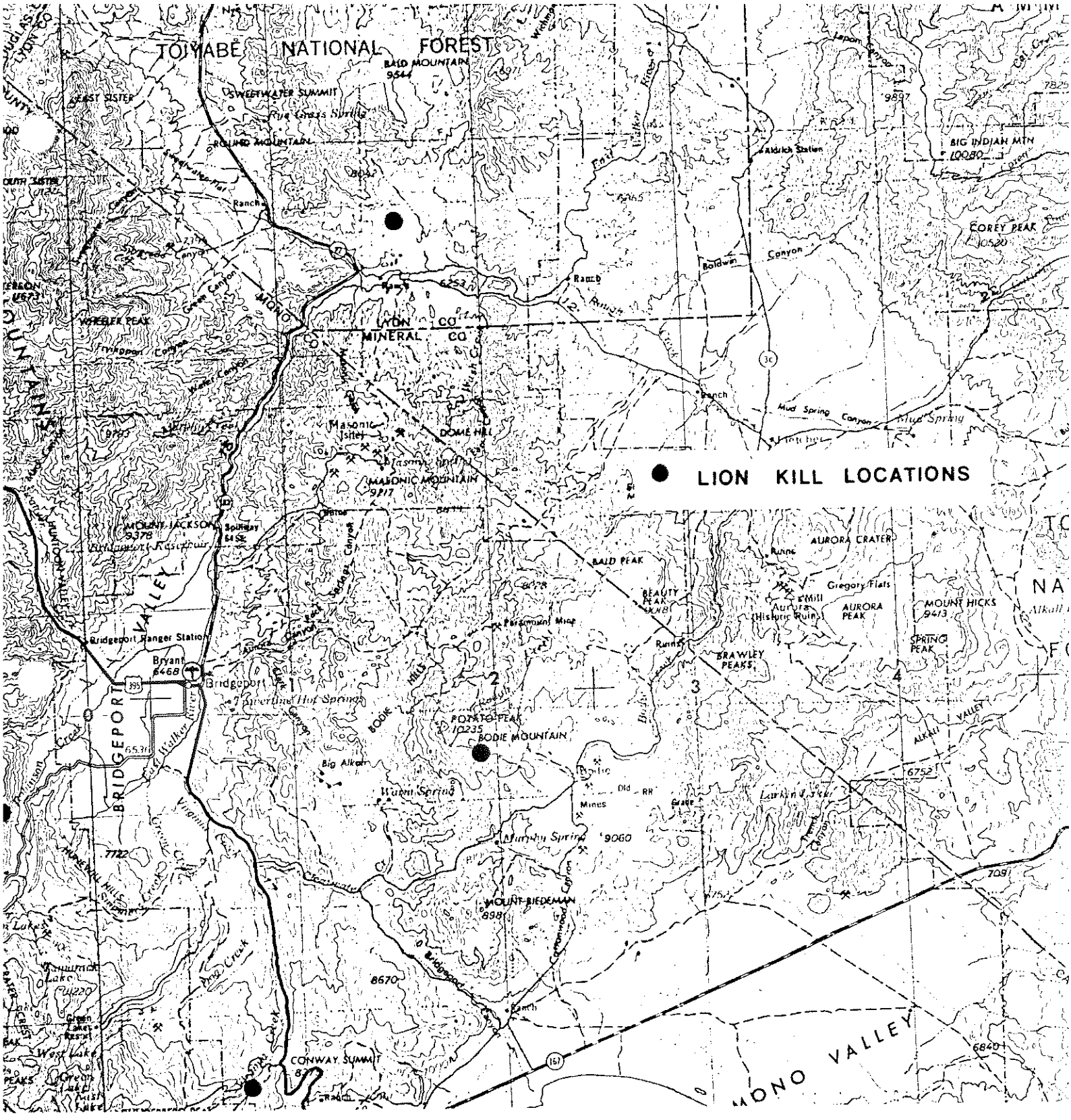

Figure 7. Kill locations of four radio-collared deer by mountain lions, East Walker and Mono Lake deer herds, 1988

summer range at Sawmill Ridge on 5 August. This doe was found buried at the base of a large Jeffrey pine tree, her carcass amost entirely consumed.

One radio-collared buck from the Mono lake herd was shot by a hunter on 11 September on its summer range located on the north side of Kavanuagh Ridge.

DISCUSSION

During the spring of 1988, deer from the Excelsior Mountain wintering areas at Rattlesnake Flat and Huntoon Valley migrated approximately 10 days earlier than deer from the Wassuk range and three weeks earlier than deer from the East Walker winter range. This variation is most likely related to the effects of weather on plant phenology on the winter range. Because of the extremely dry conditions experienced in 1988, herbaceous spring forage on the East Walker and Mono Lake winter ranges began drying up by late March. This was particularly apparent on the Mono Lake herd wintering areas in the Excelsior Mountains where deer migration to the summer range in late March and early April was stimulated by the desiccation of annual plant forage.

Much of the East Walker deer herd winter range consists of irrigated pastures which boarder the East Walker River. Therefore in 1988, spring forage availability on this habitat type was extended into late spring. For this reason, radio-collared deer from the East Walker herd remained on the winter range for a longer period despite the fact that annual spring forage on the foothills surrounding the pasture lands had desiccated In fact, it seemed as though deer from the East Walker herd were reluctant to leave the winter range as several radio-collared deer returned after making short trips to higher elevations. According to Bertram (1984), this behavior was observed in radioed deer from the North Kings herd and was attributed to effects of weather on plant phenology at higher elevations. It is suspected that deer from the East Walker herd were reluctant to leave the winter range because spring forage availability along the migration route is limited and forage quality is poor.

A number of land use activities have been proposed on spring and summer habitats used by deer from the East Walker and Mono Lake herds. Several hydropower projects exist or have been proposed on major drainages throughout spring and summer range. A hydroelectric power plant already

exists on Lundy Creek, a spring holding area used by deer from the Mono Lake herd. A hydropower project is proposed for Green Creek at the Dynamo Pond, an area identified to be within a major deer migration corridor of the Mono Lake herd. In addition, a hydropower project is proposed for the Little Walker River, an area used by deer from the East Walker herd as summer range. The effects of these or other projects on the East Walker and Mono Lake deer herds will depend primarily on where and how they are developed. Therefore, in order to insure the welfare the East Walker and Mono Lake herds it is imperative to evaluate the effects of these land use projects on an individual and cumulative basis.

The land use project which could potentially have the greatest impact on deer in this study is a proposed resort complex at the Conway Ranch. The Conway Ranch is located at the base of the southwest end of the Bodie Hills in the Mono Lake deer herd migration corridor. This area, which consists of approximately 880 acres, most of which is pastureland, has been identified as an area used by approximately 24% of the Mono Lake herd during spring migration (Taylor 1988, Appendix A).

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CONWAY RANCH RESORT DEVELOPMENT PROJECT: DEER MIGRATION AND SAGE GROUSE STUDY

SPRING 1988

Timothy J. Taylor
P.O. Box 191
June Lake, CA 93529

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INTRODUCTION

A proposal by the Conway Ranch Partnership to develop a resort complex on the Conway Ranch property in Mono County, California, has created concern among local resource managers regarding potential impacts of the proposed project on local wildlife, especially migratory mule deer (Odocoileus hemionus). In response to these recognized concerns and pursuant to the requirements of the California Environmental Quality Act (CEQA), the Environmental Impact Report process was initiated. Through the environmental consultant for the project, Triad Engineering Corp., and with the cooperation of the California Department of Fish and Game, a study plan was formulated in order to specifically address mule deer and sage grouse (Centrocercus urophasianus) use of the area. This work was designed to provide site-specific information regarding the amount, timing, and intensity of mule deer and sage grouse use of the Conway Ranch property.

Data from this report has been combined with information collected from an independent radio-telemetry study of the Mono Lake herd, the herd now recognized to use the project area. Intensive radio-telemetry research investigating the movements and seasonal habitats of most deer herds occurring in Mono County has been conducted since 1981 by the California Department of Fish and Game (DFG). However, research involving the Mono Lake herd was only recently initiated in March of 1988. Although this study is still in the early stages, valuable information regarding the movements and seasonal habitats of the Mono Lake herd has already been collected.

The Mono Lake herd, which consists of an estimated 3,000 animals, is one of the largest migratory deer herds occurring in Mono County. The herd winters in western Mineral County, Nevada, approximately 10 miles south of Hawthorn and 40 airline miles north of the project area (Figure 1). The spring migration begins in late March and early April, when deer leave the winter range and move in a westerly direction along the south slope of the Bodie Hills to spring holding areas located in the Hunewill Hills and in Lundy Canyon drainage. Holding areas are bulbous expansions of the migration corridor located at intermediate elevations where deer concentrate for 2-6 weeks in the spring. During this period they feed primarily on herbaceous spring growth and regain condition lost over the

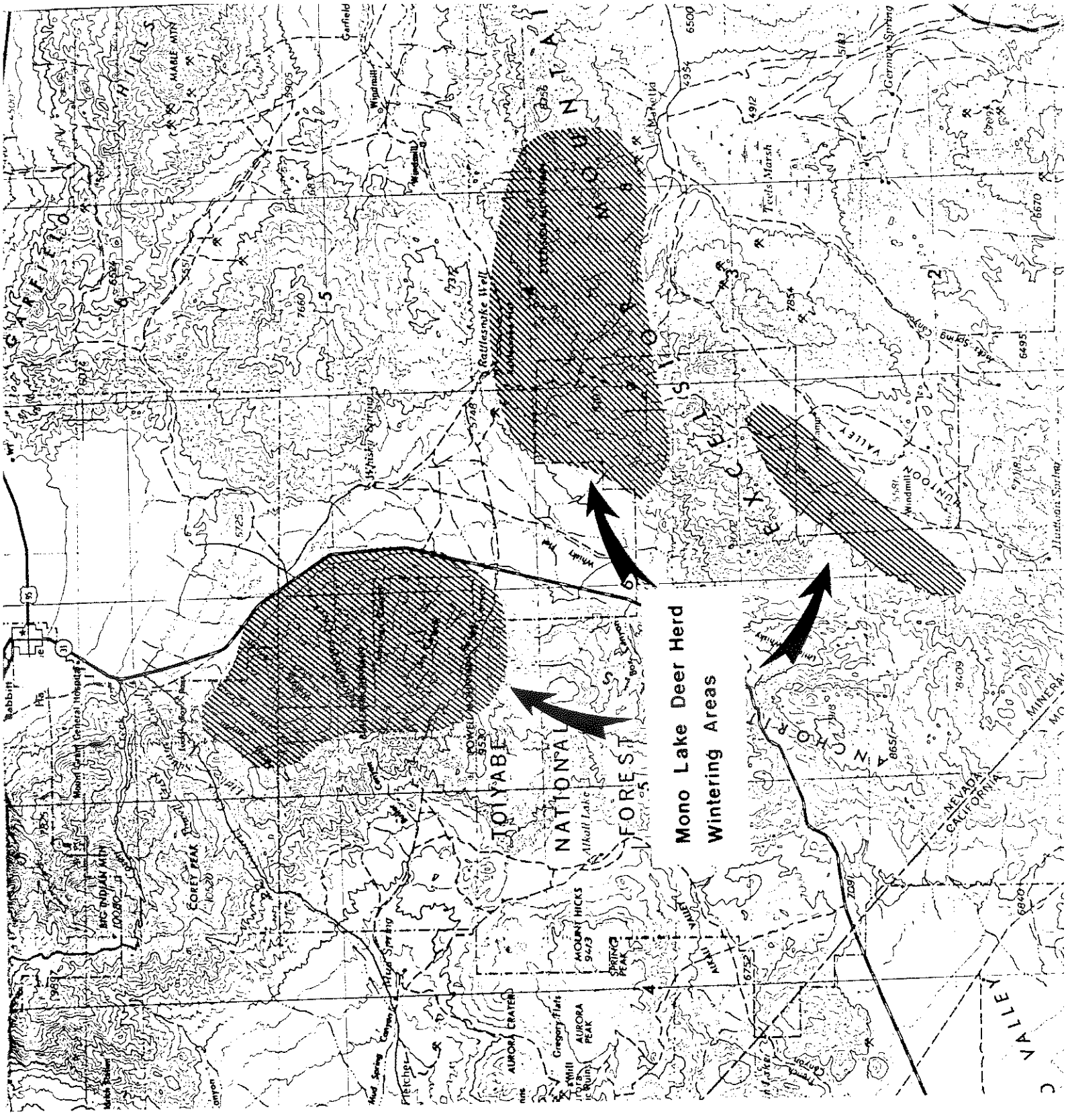


FIGURE 1 Location of the Mono Lake deer herd winter range in Mineral County, Nevada

winter, after which they move to summer ranges located on the east and west slopes of the Sierra Nevada. Deer arrive on the summer range in May and June, produce fawns in July, and typically begin their fall migration back to the winter range in October. Currently no information on fall migration exists for the Mono Lake herd. However, studies of other eastern Sierra deer herds have shown that fall migration is more rapid than that of spring and is usually triggered by the first significant fall snow storm. Studies have also shown that during the fall, deer typically use the same migration routes as in the spring when returning to the winter range.

Combining radio-telemetry information from the Mono Lake herd with data collected from this study has provided an excellent opportunity to fully access migratory mule deer use of the area. The objective of the present work is to provide the project proponents and the appropriate resource managers with baseline information regarding mule deer and sage grouse use of the area. The information in this report will be incorporated into the wildlife element of the Conway Ranch Draft Environmental Impact Report.

ACKNOWLEDGEMENTS

This investigation was conducted under a contract with the Conway Ranch Partnership, the project proponent. The study plan was designed in cooperation with the environmental consultant, Triad Engineering Corp., and with cooperation of DFG. Some of the data presented here is from an independent radio-telemetry study of the Mono Lake herd funded by DFG and the Mono County Fish and Game Fines Committee. The information presented in this report is to be used entirely for the purpose of accessing the environmental effects of the proposed Conway Ranch development project, and is not to be used by any entity other than the proponent without written consent of the author.

STUDY AREA

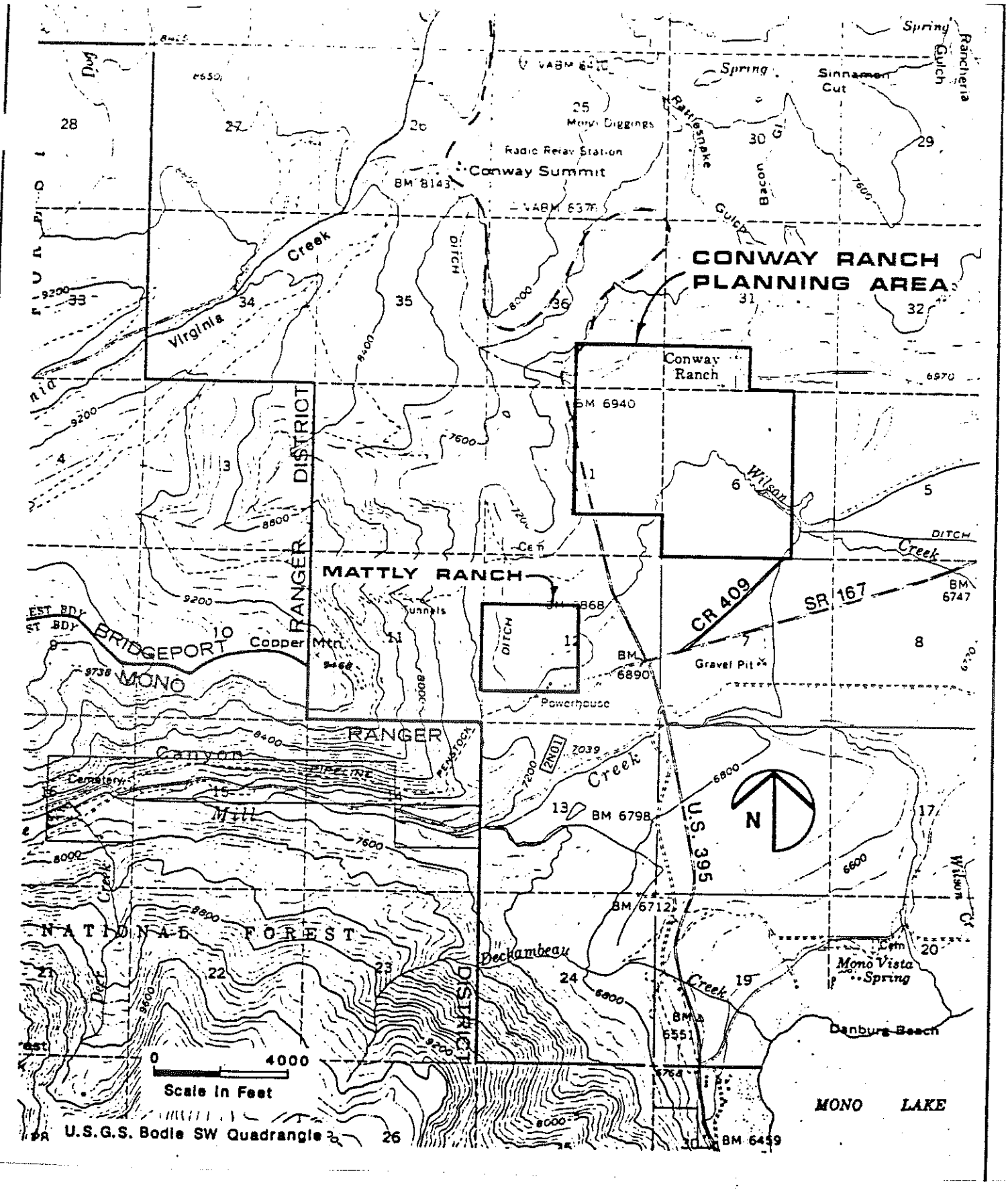
The Conway Ranch project site hereafter designated the Study Area, is located in Section 31 of T. 3 N, R. 25 E, Section 1 of T. 2 N, R. 25 E, Section 31 of T. 3 N, R. 26 E, and Section 6 of T. 2N, R. 26 E. (Figure 2). It is approximately 18 miles south of Bridgeport and seven miles south of Lee Vining. The area encompasses some 878 acres and is bordered by Highway 395 to the west and Highway 167 to the south. A complete description of the topographical and vegetative features of the area is provided in the Conway Ranch Draft Environmental Impact Report.

METHODS

1. Deer

In the spring of 1988 track count surveys were conducted from a vehicle along a fixed route in order to determine the amount, pattern, timing, and specific locations of migratory deer use of the area. This route, which consists of four separate roads (A,B,C, and D), is 3.6 miles long and divided into 18, .2 mile segments so that data could be quantified more easily (Figure 3). Road A begins at Hwy 167 and runs in a northerly direction for .8 miles, crossing a water diversion from Wilson Creek and ending at the south end of the Conway Ranch meadow. Road B, which is .4 miles long, runs in a westerly direction along a powerline between Road A and the paved road to the Conway Estates. Road C, which begins at Hwy 395 near the Virginia Creek diversion, is 1.4 miles long and runs in an easterly direction along the northern perimeter of the Conway Ranch meadow. Road D is 1.0 miles long and runs in a southerly direction between Road C and Wilson Creek where it ends.

Between 2 April and 15 June, track surveys were conducted twice weekly. In order to determine the amount of summer deer use of the area, surveys were conducted once weekly between 19 June and 10 July. Between 1600 and 1900 hours on the evening prior to each track survey, the route was dragged in order to obliterate old tracks and create a medium for new tracks. During each survey, which was conducted the following morning between 0600 and 0800 hours, the entire route was driven and the location and number of all tracks observed was recorded, as well as the direction



URE 2 Location of the Conway Ranch Study Area in Mono County, California

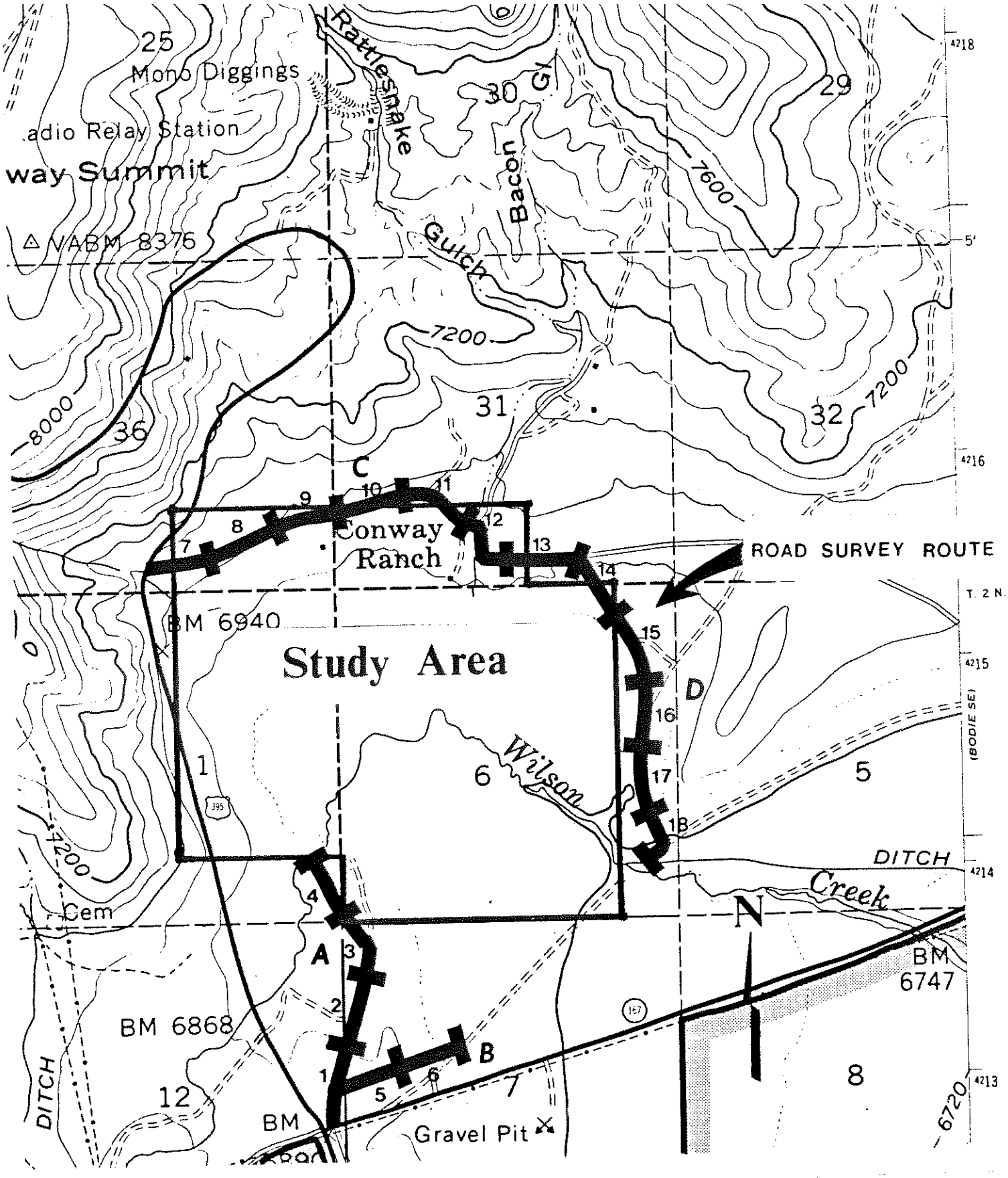


FIGURE 3 Location of the track survey route and the 18 survey segments in the Study Area

in which they were headed. Thus, all tracks counted the following day were made by animals within the time elapsed (12-13 hours) between the dragging of the road and the survey. A track was only used in the present analysis if it was completely recognizable as to its direction of travel. The direction of spring migration through the area was determined from present knowledge of major deer migration corridors and wintering areas identified in an independent study of the Mono Lake herd (Taylor, Unpubl.).

Because of the dimensions of the survey route it was necessary to separately analyze track count data collected for each road (A,B,C, and D). For example, track count data collected for Road A was analyzed independently of data collected for Roads B, C, and D. Analyzing tracks in this fashion allowed for the separation of localized back-and-forth movements from migrational movements. For the purpose of this investigation, tracks headed to the south and west are in the direction of spring migration; those to the north and east are opposite. Thus, a rough estimate of the number of deer actually migrating across each road between the dragging of the route and the survey, was obtained by subtracting all north and east-moving tracks from all south and west-moving tracks. If a particular deer was thought to have crossed two roads within the survey route in one direction, then only the track observed on the latter road was counted. A rough estimate of the total number of deer migrating through the Study Area during the entire survey period was ultimately determined by subtracting the total number of north and east-moving tracks from the total number of south and west-moving tracks.

All deer observed during the course of field work were counted and classified according to sex and age (adult, yearling, or fawn), and their locations plotted on an aerial photo. In addition, all marked deer observed during the course of field work were identified to wintering area and plotted on an aerial photo.

2. Sage Grouse

In order to determine the presence and relative abundance of sage grouse within and adjacent to the Study Area, flushing transects were conducted 1-3 times weekly with 2-3 trained hunting dogs. When grouse were flushed, the sex and age (adult or juvenile) of each individual bird

was recorded and their locations plotted on an aerial photo. During ground surveys all sage grouse sign observed in the form of droppings and tracks was recorded and plotted on an aerial photo.

RESULTS

1. Deer Migration

a) Timing of deer movements

Between 2 April and 15 June 1988, a total of 22 track count surveys were conducted along the 3.6 mile survey route within and adjacent to the Conway Ranch Study Area. Figures 4a and 4b show the total number of deer tracks which were counted during each of the 22 surveys. Figure 4a shows the total number of tracks counted on each of 11 surveys conducted in the first half of the study period, between 2 April and 7 May. Figure 4b shows the total number of tracks counted on each of 11 surveys conducted in the second half of the study period, between 10 May and 15 June.

A total of 337 tracks were observed throughout the entire study period between 2 April and 15 June. In the first-half of the study period, between 2 April and 7 May, a total of 130 (39%) tracks were observed (Figure 4a). The greatest number of deer tracks observed on any one survey during the first-half, was 47, on 25 April. The fewest observed was 2, on 5 and 21 April. During a survey conducted on 19 April, no tracks were observed. In the second half of the study period, between 10 May and 15 June, a total of 207 (61%) tracks were observed (Figure 4b). The greatest number of deer tracks observed on any one survey in the second-half was 53, on 10 May. The fewest observed was 2, on 15 June. Deer activity within the Study Area was greatest between 25 April and 10 May when 45% of all tracks were recorded.

Figures 5a and 5b show the direction of movement of the 337 tracks observed during each of the 22 surveys. It must be emphasized that these tracks reflect only those movements which occurred during a 13-14 hour period, or the time elapsed between the dragging of the route and the survey. Of these 337 tracks, 141 (42%) were headed north, 176 (52%) south, 5 (1%) east, and 15 (5%) west. Thus, subtracting 146 north and east-moving tracks from the 191 south and west-moving tracks provides an estimate of 45 deer moving through the Study Area between the dragging of

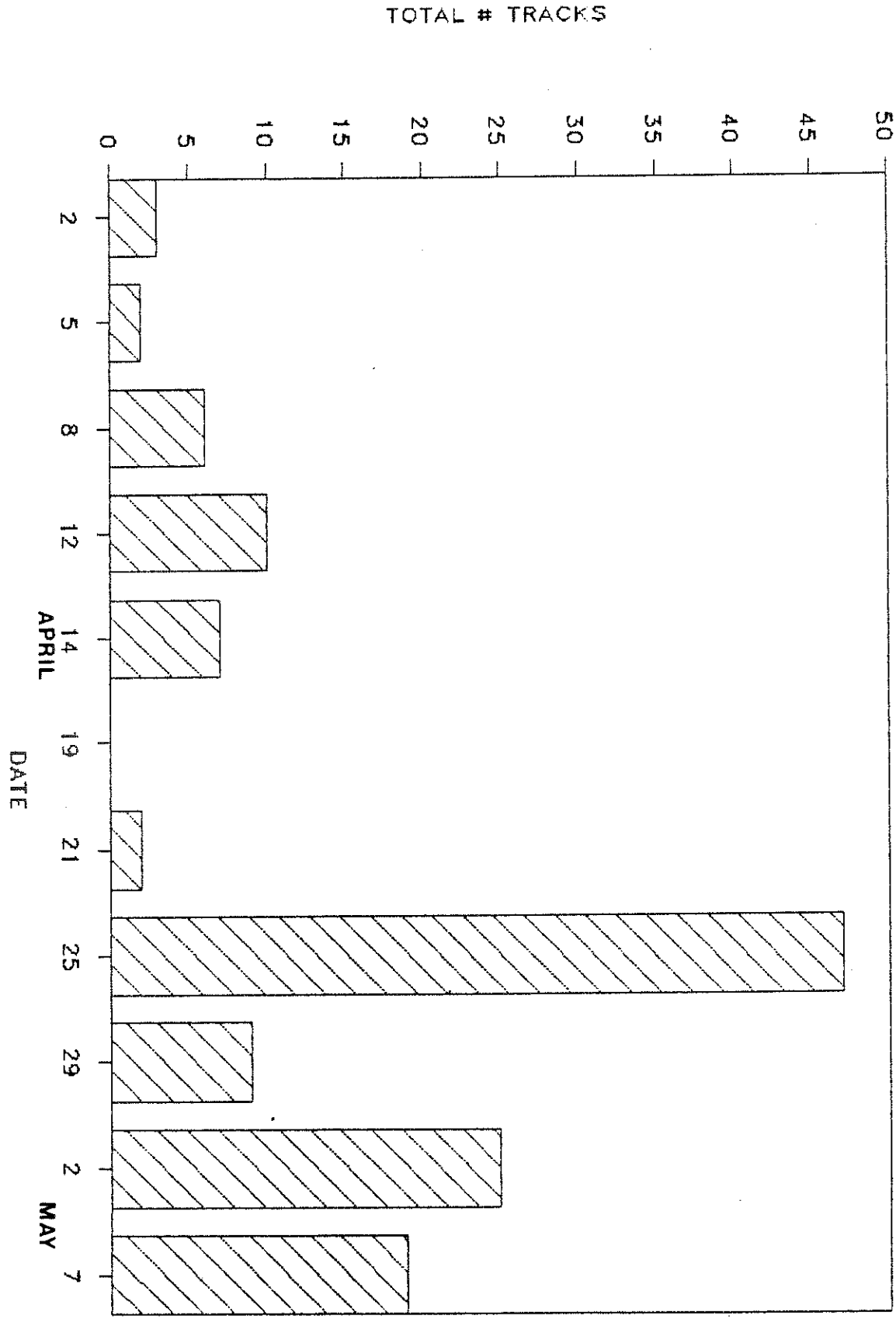


FIG. 4a TOTAL # TRACKS COUNTED

CONWAY RANCH STUDY AREA, SPRING 1988

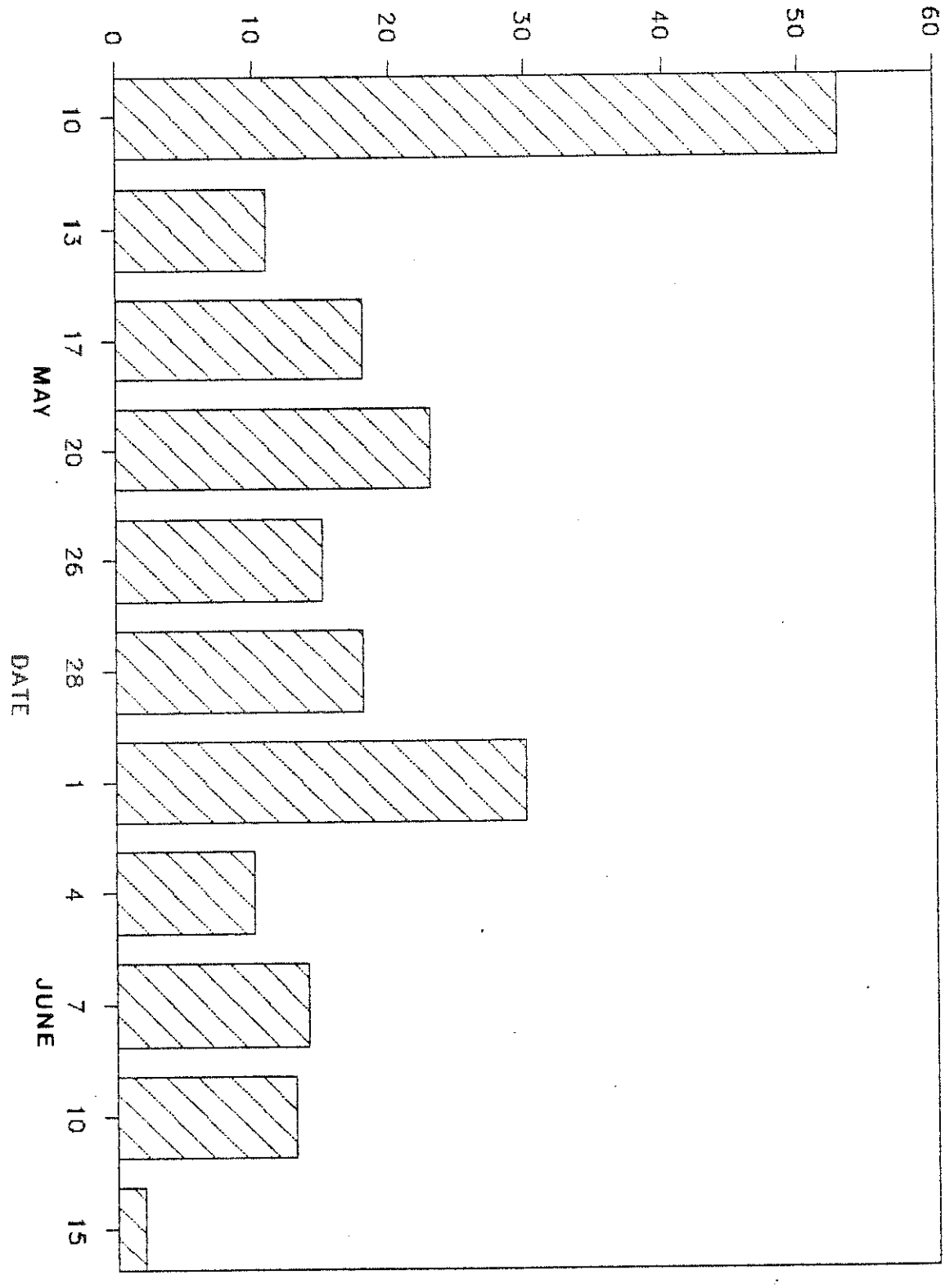


FIG. 4b TOTAL # OF TRACKS COUNTED

CONWAY RANCH STUDY AREA, SPRING 1988

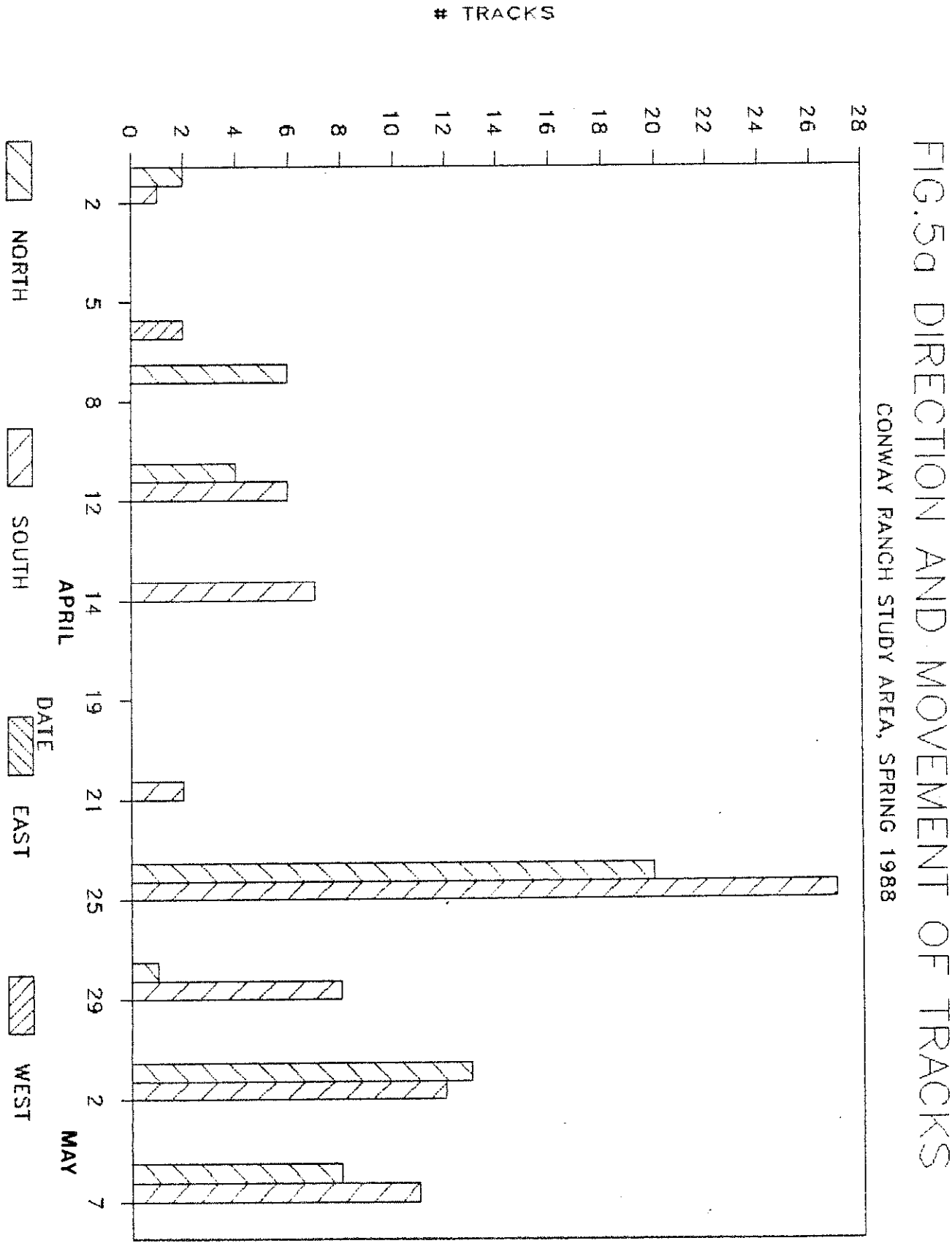
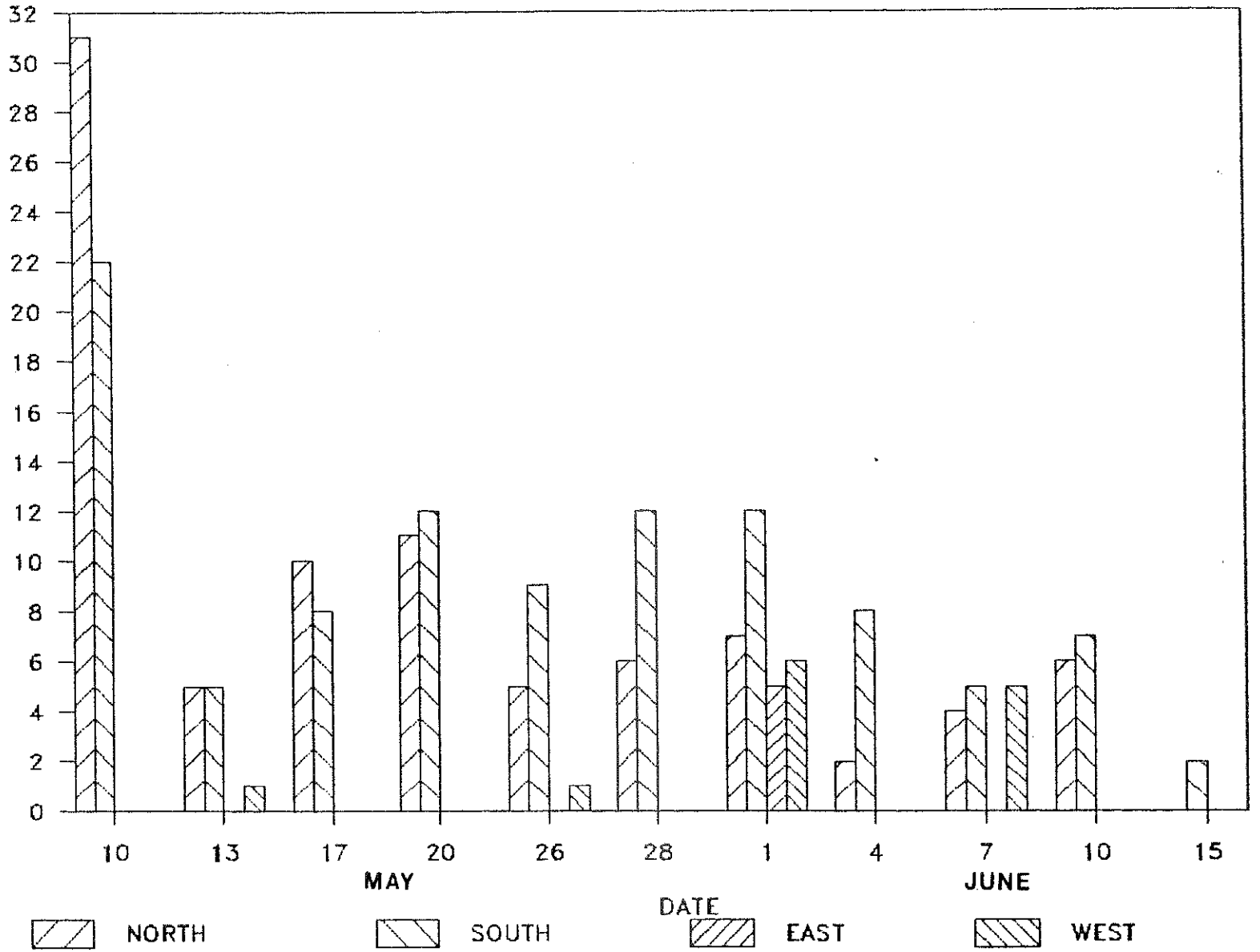


FIG.5a DIRECTION AND MOVEMENT OF TRACKS

CONWAY RANCH STUDY AREA, SPRING 1988

FIG.5b DIRECTION AND MOVEMENT OF TRACKS

CONWAY RANCH STUDY AREA, SPRING 1988



the route and the survey. This is shown in Figures 6a and 6b, in which the number of tracks headed north were subtracted from the number headed south, and the number headed east from the number headed west. Positive numbers represent those surveys when the extent of migrational movements through the Study Area were greater than localized movements. Conversely, negative numbers represent those surveys when the extent of localized movements were greater than migrational movements. The difference between negative numbers and positive numbers may be interpreted as the total number of deer (45) moving directly through the Study Area during the study period. Movements of deer directly through the area were greatest between 21 and 29 April and 26 May and 4 June.

The 45 deer estimate is again, the number of animals migrating directly through the Study Area during the 22 periods between the dragging of the route and the survey. From this number, the total number of deer ultimately moving directly through during the entire study period can be estimated. The 22 surveys conducted covered approximately 29% of the 75 day (2 April-15 June) study period. Therefore, an estimated total of 155 (45/0.29) deer moved directly through during the study period. This accounts for only those deer moving through at night. Based on the assumption that 75% of deer would migrate at night and 25% would migrate during the day (Kucera 1987), the total number of deer moving directly through during the entire study period can be estimated at 207 (155/0.75). According to radio-telemetry information collected for the Mono Lake herd, approximately 9% of the spring migration occurred before 1 April. Thus, it can be estimated that a total of 227 (207/0.91) deer moved directly through the Study Area during the spring migration of 1988.

Localized deer movements within the Study Area occurred on a daily basis mainly between Sagebrush-Scrub areas above Road C and the Conway Ranch meadow (Figure 3). These movements were performed by deer migrating to the immediate north of the Conway Ranch property. The extent of these localized, back-and-forth movements across Road C occurred at night, as deer would briefly pause during their migration west to feed and water in the meadow. A total of 286 tracks were counted crossing Road C during the 22 surveys. Of these, 135 (47%) were headed north, 145 (51%) south, 1 (0.3%) east, and 5 (1.7%) west. Therefore, a total of 150 deer (145 north and 5 west) crossed Road C into the meadow portion of the Study Area. A total of 136 (135 north and 1 east) deer crossed back again after using

FIG. 6a TOTAL # MIGRATORY TRACKS

CONWAY RANCH STUDY AREA, SPRING 1988

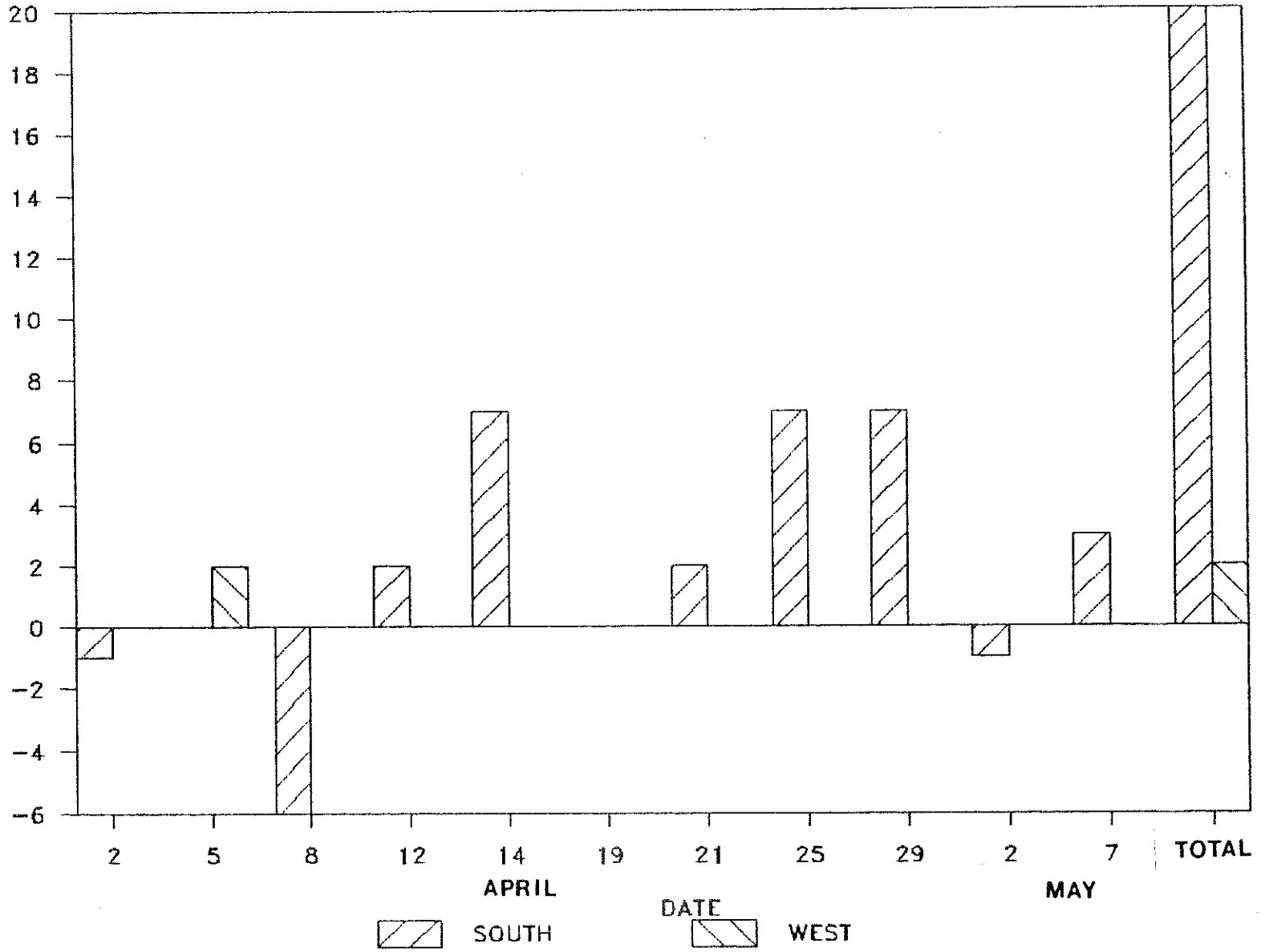
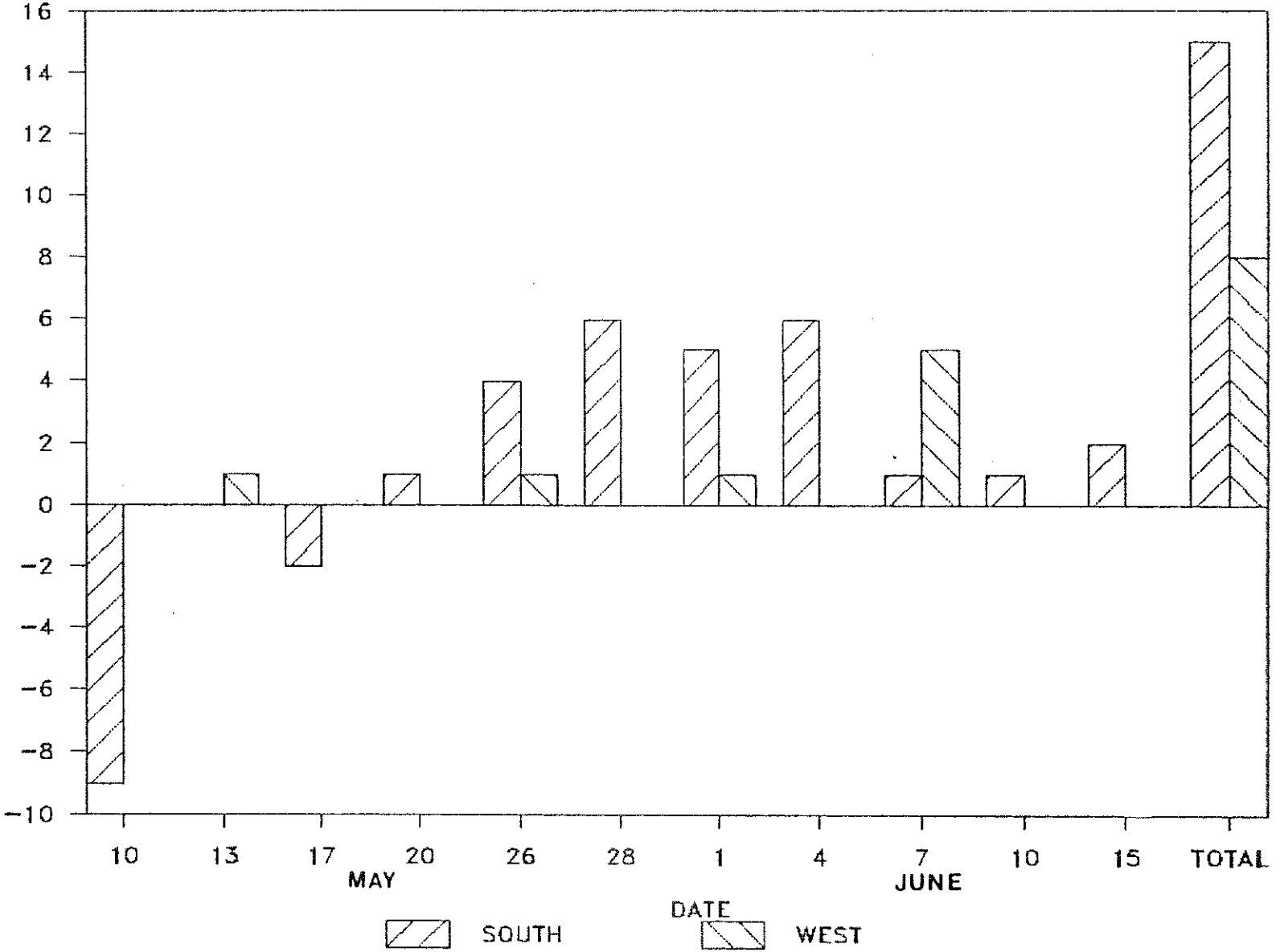


FIG.6b TOTAL # MIGRATORY TRACKS

CONWAY RANCH STUDY AREA, SPRING 1988



the meadow while 14 continued migrating to the south and west. Assuming that the majority of deer use occurred at night, it can be estimated that 467 (136/0.29) deer used the meadow portion of the Conway Ranch property during the entire study period. Since 9% of the spring migration occurred before 2 April, it can be estimated that a total of 513 (467/0.91) used the meadow during the 1988 spring migration.

There is no doubt that some deer remained in the vicinity of the Conway Ranch area for extended periods of time. However, because of a large influx of animals into and out of the area on a weekly basis, this number was difficult to determine from track counts. According to radio-telemetry information the actual number of deer staging or holding within the vicinity of the Study Area is probably fewer than 50.

b) Locations of deer movements

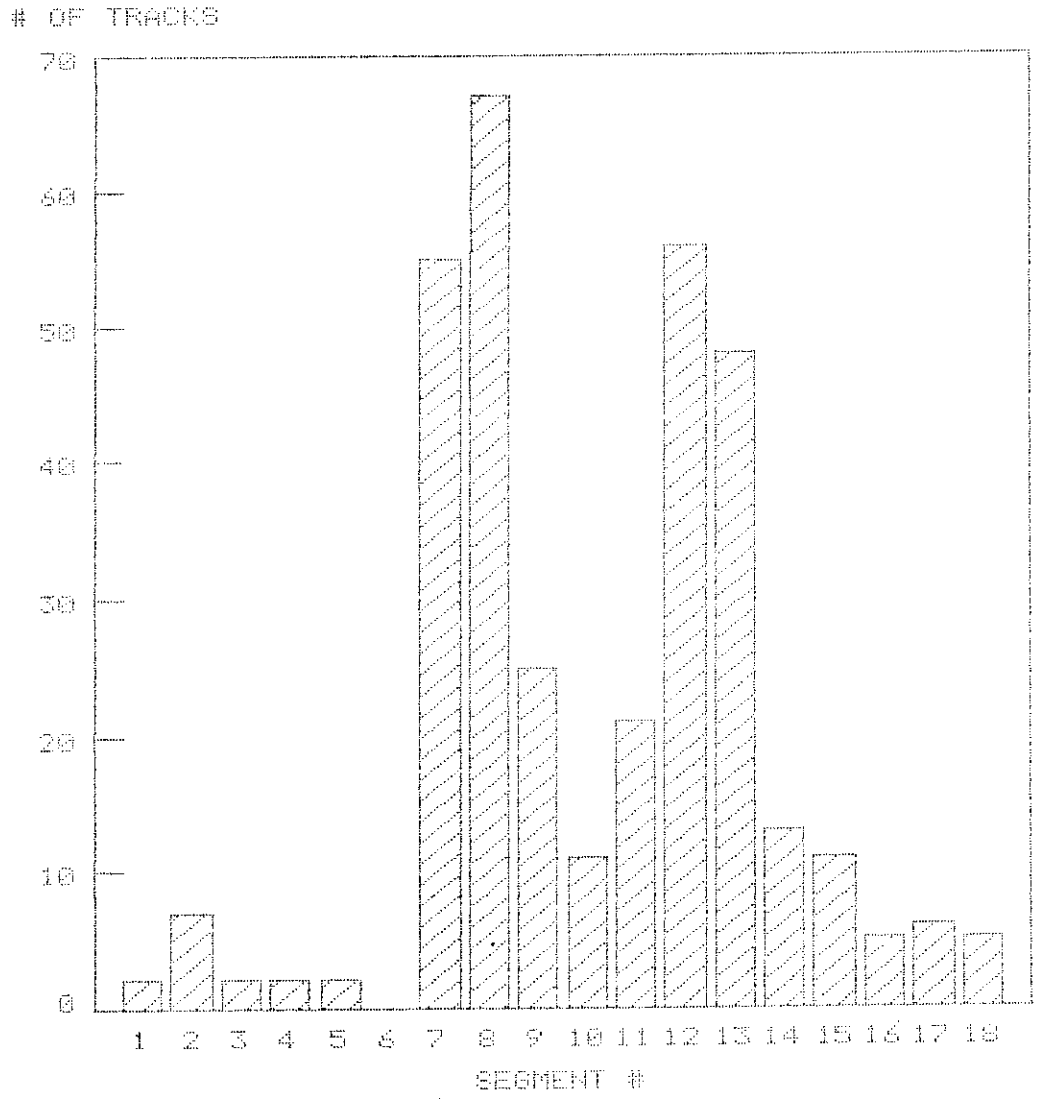
Figure 7 presents the total number of deer tracks observed in each survey segment throughout the entire study period. It can be seen that deer activity was most concentrated across Road C (segments 7-13), located in the northern portion of the Study Area. The greatest amount of activity occurred in segments 7 and 8 and 12 and 13. The least amount of deer activity occurred in the southern portion of the Study Area across Roads A and B, where a total of 15 tracks were observed.

Of the 45 tracks made by deer moving directly through the Study Area, 20, all westbound, were recorded crossing Road D (segments 14-18). A total of 14 tracks were recorded crossing Road C, while 9 and 2 tracks respectively, were made by deer crossing Roads A and B.

No well-defined migration trails were observed within the Study Area south of Road C. Those migration trails identified were found in the Sagebrush-Scrub foothills to the north of the road (Figure 8). The majority of these trails were headed in a north-south direction between the meadow and the foothills. Most westbound movement through the Sagebrush-Scrub foothills was dispersed throughout a 1.5 mile swath beginning immediately north of Road C. Movements through this area were not restricted to specific trails primarily because of the moderately sloping terrain occurring here.

Figure 8 shows the general direction of deer movement through the Study Area. The majority of movement occurred around the north, south, and east perimeters of the meadow area. Those deer migrating around the

FIG.7 # OF TRACKS PER SEGMENT CONWAY RANCH STUDY AREA, SPRING 1988



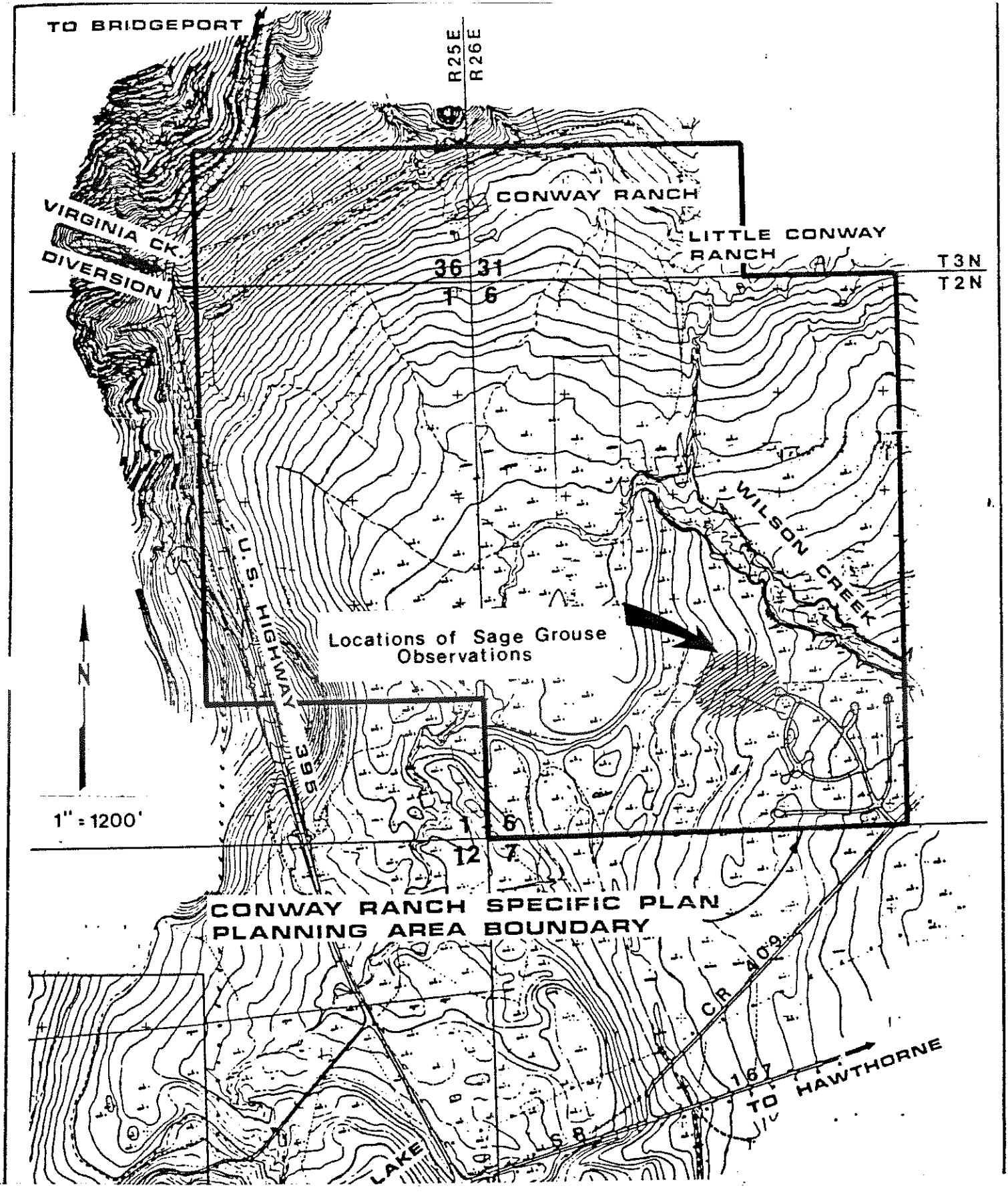


FIGURE 9 Location of sage grouse observed in the Study Area in spring 1988

were observed in Sagebrush Scrub areas within and adjacent to the project area. This would tend to confirm a report of approximately 30 sage grouse observed wintering in the vicinity of the project area in the winter of 1987-88 (DFG, pers. comm.).

DISCUSSION

According to track count surveys, an estimated 227 deer migrated through the Conway Ranch Study Area during the spring migration of 1988. Another of 513 deer were estimated to have used the northern perimeter of the meadow during migration. Thus, a total of 740 deer either migrate through the Study Area or simply use the meadow for the water and herbaceous forage in which it provides. This is remarkably consistent with radio-telemetry data collected for the Mono Lake herd which revealed that approximately 24% of the population, some 720 animals, migrate either through or immediately adjacent to the Study Area.

The estimates provided here are both approximations of the number of deer using the Study Area during spring migration. According to Kie (1987) and Wallmo (1981), track counts typically underestimate total numbers of deer moving through an area for several reasons: rain, sleet, snow, or wind may obliterate tracks; frozen ground may prevent track registration; during periods of heavier movement, some tracks may obliterate others. In this particular investigation all of the above may have had some influence on the number of tracks recorded and ultimately the number of deer estimated to use the Study Area during spring migration. In the case of radio-telemetry data, it is likely that at least one or two radio-collared deer migrated through or near the project area without being detected. In fact, the possibility of this is quite high since the overwhelming majority of animals migrate at night. It is important to emphasize that the estimates provided here are minimum approximations of the number of deer using the Study Area during the spring migration of 1988. Without doubt, the most important relationship brought forward by data presented here is that those deer which use the project area during migration comprise approximately 24% of the Mono Lake herd. This is definitely a significant percentage of the population, regardless of actual numbers of deer involved.

Although track counts do not provide a precise estimate of the number of deer using the area, they do supply accurate information concerning the timing, pattern, and intensity of migration. They also provide important information regarding specific locations of deer use within a particular area. The height of deer activity within the Study Area was between 25 April and 1 June when 80% of all tracks were recorded. The greatest number of tracks were observed on 10 May, with a gradual, uneven decrease in deer activity through mid-June. Deer activity was most concentrated at the northern end of the Study Area in segments 7,8,11, and 12. All deer which migrated through the Study Area entered from the north and east across Roads C and D. Deer exited the Study Area at the western boundary along Hwy 395, where they crossed within approximately a two mile stretch between Wilson Creek and the junction of Hwy 395 and Hwy 167.

The migration corridor used by the Mono Lake herd follows the south slope of the Bodie Hills and provides the link between the winter range in western Nevada and the summer range on the east slope of the Sierra. This migration corridor also includes the Conway Ranch Study Area and the outlying foothills to the north. Recent radio-telemetry information obtained from the many studies in California and the western United States (Ashcraft 1961, Gruell and Papez 1963, Robinette 1963, Schneegas and Franklin 1972, Bertram 1984, Loft et al. 1984, Garrott et al 1987, Taylor 1988), have revealed that deer consistently use the same specific wintering and summering locations on an annual basis. They also consistently use the same specific migration routes and holding areas which connect winter and summer ranges. Therefore, it can be assumed that in future spring migrations the same proportion of the Mono Lake herd will attempt to use the Study Area. It can also be assumed that deer which migrated through the Study Area in the spring will generally migrate back through in the fall.

It is difficult to predict the precise impacts of the proposed Conway Ranch development on migrating deer. This is largely dictated by the number, locations, and size of facilities developed and the availability and suitability of alternate migration routes. Since terrain within the entire Study Area is relatively flat, deer migrating through are not restricted in their movements due to topography. However, because little security cover exists in the meadow, deer tend to migrate around its perimeter. Figure 10 shows the Conway Ranch development concept plan for

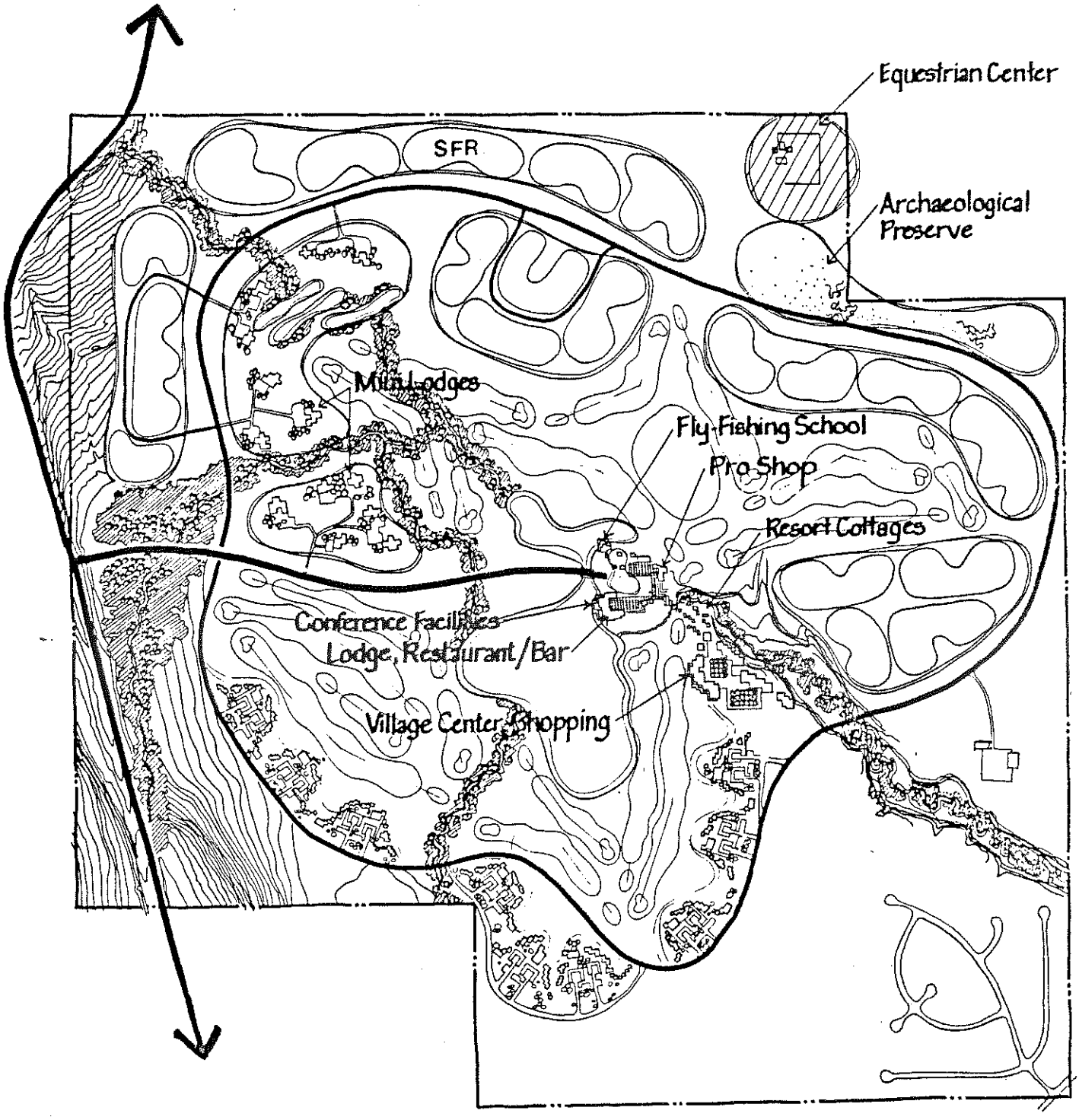


Figure 10

DEVELOPMENT CONCEPT PLAN

the area. Deer moving around the south and east end of the development will have to avoid the townhouse clusters and resort cottages proposed there. In order to do this they will be forced to seek alternate routes to the south and east. This could result in deer moving entirely around all development by migrating to the east of the Conway Ranch Estates toward Hwy 167. This may expose animals to additional highway crossing risks. In addition, the effects of being forced out of traditional pathways will undoubtedly be somewhat stressful to deer, especially pregnant does carrying late term fawns.

Water is very limited in that portion of the Mono Lake herd migration corridor which extends through the Bodie Hills between the winter range and the project area. Hence, the water and herbaceous forage found along the northern perimeter of the meadow is particularly vital to animals using this corridor. Meadow edges are especially important for does in their third trimester of pregnancy which depend heavily on herbaceous spring growth in order to gain weight back lost over the winter and to produce and successfully rear fawns. Therefore, it would be extremely beneficial if the northern meadow edge were maintained and even enhanced for deer. Elimination of deer use of this meadow edge through development could indirectly impact fawn survival on a herd wide basis by lowering the overall reproductive condition of adult does.

Sage grouse were found only in flood irrigated pastureland in the southeast corner of the project area. Because 3.5 young per adult hen were found here, it is obviously an area containing high quality brooding habitat. Loss of this specific habitat type to development would unavoidably eliminate grouse use of the area.

RECOMMENDATIONS

Because the meadow serves as such a powerful attractant for the water and herbaceous forage in which it provides, deer will probably continue to use its northern perimeter at night if it remains undeveloped. Therefore, it is recommended as partial mitigation that the single family residences proposed for the northern perimeter of the meadow be moved elsewhere in order to maintain use of the meadow edge for deer. This could possibly be achieved by interchanging the locations of the single family residences

with a portion of the golf course. Moving a portion of the golf course to where the single family residences are proposed would serve to create a buffer between any structural development and the migration corridor. If this were the case, deer could possibly become a nuisance on the golf course. However, this could be somewhat alleviated by using the meadow edge as a buffer between the golf course and the migration corridor. This "deer pasture" would be particularly effective if it were irrigated in the spring and summer months with Virginia Creek diversion water.

Due to the current constraints of the migration corridor on the south side of the meadow, it is difficult to see how the effects of proposed development in this area can be mitigated. Likewise, the effects of developing the irrigated pastureland at the southeast corner of the project area where sage grouse are found cannot be mitigated.

Track surveys indicate that deer use of the meadow area is greatest between approximately mid-April and early June. Therefore, it is recommended that as partial mitigation construction activities be modified during this period in order to reduce disturbance to migrating deer. This will also be necessary during the fall migration. However, since work accessing the fall migration has not been conducted it is difficult to speculate as to the timing of deer movements through the Study Area and consequently when to modify construction activities.

A typical problem associated with most development in the eastern Sierra is dogs harassing migrating deer. Therefore, it is recommended as partial mitigation that leash laws be strictly enforced within the project area.

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To : Ken Mayer

From : Ron Thomas, Mono Unit Mgr. Date : 10/17/90

Subject : Inyo Forest Plan appeal and deer herd plan revisions

Enclosed you will find our latest draft responses to two FS responses on issues affecting mule deer. As you will see, the Forest is attempting to mandate deer plan revision in an effort to justify non-planning for deer on the federal lands. It is most important that DFG not submit to this tactic; I believe that no push for plan revision of any kind should by directed by our Dept. until resolution of our LRMP appeal.

Additionally, we are now forced to ignore many critical duties relating to habitat preservation, development projects, etc. which will cause severe permanent impacts to deer and other species. We simply don't have time to tackle additional jobs such as herd plan revisions without causing additional inattention to important activities.

Ron Thomas

Mono Unit

cc: Vern Bleich
Larry Sitton

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Issue #7 : Mule Deer Management

Issue 7a: The forest's response to our stated concern is merely an obvious attempt to avoid the central issues of compliance with California's Deer Herd Management Plans and the lack of suitable LMP emphasis on the valued mule deer resource. The response indicates that the Forest would prefer to modify or weaken the goals of the State's legislatively-mandated plans rather than to pursue a good faith effort to manage for deer on federal lands pursuant to the existing signatory commitment.

While we do not disagree with the USFS listing of their own agency's plans "Incorporated With Direction To Update", the existing Deer Herd Plans are in no need of substantive revision, and the eleventh hour suggestion by the Forest to revise is patently inappropriate, since the Forest has no authority to dictate such revision of these State documents. The Forest's response on this issue is unacceptable; the LMP was and is faulty by its' failure to honor the Forest Service signatory committment to the direction and goals of the Deer Herd Plans.

Issue 7b: We recognize that the difference between the DFG and FS WFUD estimates is only about 6%. However, the refusal by the Forest to utilize the DFG figures (which are based on solid data including deer tag sales, harvest and success rates, field surveys, and questionaires) is indicative of the continued resistance to modifying and improving the LMP when improved data is made available. Though the difference is relatively small, the Forest's understatement reveals the tendency to reduce emphasis on valuable wildlife resources.

Issue 7c: The FS repsonse to our request for analysis of the economic contribution of fish and wildlife resources is again evasive, lacking substance, and inadequate. The EIS pages cited in the Forest's response contain no specifics regarding the dollar values of such wildlife dependent outdoor recreation as hunting, fishing, photography, and other uses. Current information reveals that the "Willingness To Pay" values used in the Appendix E economic analysis are questionable (eg. deer hunting in California is now valued at $184 million per year; deer viewing, $69 million)(Loomis, 1989). Further, nowhere in the Plan do we find adequate economic analysees encorporationg specific dollar figures on the values of wildlife resources on the Forest or the specific effects of the alternatives on those values.

Issue 7d: We oppose the Forest's continued attempt to minimize the importance of the deer resource by refusing to use the best available imformation on populations on the forest. We view this refusal to encorporate solid DFG data as further evidence of the FS's demonstrated inflexibility throughout the planning and appeal processes. However, since deer numbers are dynamic and have declined recently due to the severe ongoing drought coupled with the effects of grazing and other competing land uses, we will withdraw this issue in an effort to facilitate the appeal process.

Issue 7e: This critically important issue centers on the need to include the vital trans-Sierra mule deer migration routes within the Mule Deer Prescription #4. The Forest remains inflexible on this issue, continuing to assert that protection of these habitats is assurred under Forestwide standards and guidelines which would "allow for some alteration of their habitat consistent with deer herd management objectives". This wording is not acceptable in reference to the identified migration corridors, since even minor alterations can have drastic consequences and since the Forest is admitting to an effort to

alter DFG's deer management objectives (Issue 7a).

Nor do standards and guidelines for other resource uses provide any assurance for beneficial deer herd management, since the LMP states that "Crucial trans-Sierra migration routes are scheduled for management under "Potential Alpine Ski Area" and "Range Emphasis" prescription". The deer herds are obviously in jeopardy under LMP direction, since the Plan lacks any S&G's for ski area development and the "Range Emphasis" contains no provision for or mention of deer migration routes.

As stated in our letter of 9/11/89, we submitted to the Forest in 1987 a map of our research findings on key deer habitats. We have subsequently provided updated mapping generated through the Geographic Information System (GIS) service provided by the BLM's Bishop office. Despite our diligent efforts in providing all latest and pertinent research results, the Forest has continued to refuse to consider altering Rx area boundaries for the benefit of the deer resource. In a February 23, 1990 letter to Regional Foresters, FS Chief F. Dale Robertson stated that, while imperfect, Forest plans employ "the use of improved data" to provide the best-ever basis for Forest action. Yet our best and most current information on deer numbers, WFUD's, and key migratory habitats (based on extensive and costly research) have been repeatedly refuted or ignored in the planning and appeal processes. We are certain that the Inyo Forest Plan is decidedly imperfect due to the Forest's refusal to employ the improved data provided by our Department. It is our firm position that adequate planning provision for deer herds will not be realized without inclusion of key migration corridors in the deer Rx.

Other important issues raised and reiterated during our participation in the appeal process have recieved no recognition or response in the responsive statement from the Regional Forester dated 9/4/90. These issues are as follows:

1) The confusion created by the contradictory language in the planning documents regarding the deer herd plans has been exacerbated by the new effort by the Forest to dictate revision of the California deer herd plans. We question whether the Forest is still committed to "insure compliance" with the plans it would revise and what such revisions would encompass. The LMP projects a 2% decline in deer habitat: the Forest's response has failed to address our recommendation for "substantive revisions of the LMP to include planning direction aimed at increasing habitat capability and deer numbers".

2) The response lacks any mention of our queries regarding specific information on LMP-directed deer habitat improvements.

3) No reply is provided regarding our comments on the need for inventory of wildlife/riparian habitat conditions and our concern regarding FEIS wording which appears to presuppose increased livestock impacts to riparian habitats.

4) We recommended meaningful and specific language for the Mule Deer Rx (and the "facilities" and "timber" sections) to help insure the future of the resource. These recommendations recieved no response.

Literature cited:

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Issue #11 : Early Seral Stage Non-Timber Species

The response provided does not adequately address our stated concerns. As written, the proposed language addition to prescriptions 9 and 10 provides no assurance of habitat benefits for deer or other browse/shrub dependent species. We continue to maintain that the Plan should provide firm planning direction for this important habitat component by incorporating such specific standard and guideline wording as that adopted in the Sequoia NF Plan: " Retain summer forage for deer where preferred browse species occupy a timber site after harvest" We believe such direction could also create benefits for blue grouse, an increasingly important harvest species on the Forest, as well as other shrubland species which require mixed habitat types. Incorporation of the above language would likely reduce the Plan's projected loss of early seral stage brush and would fully satisfy our concerns on this issue.

We find it unacceptable that the Forest proposes to address deficiencies in the LMP by modifying the existing deer herd management plans. This and other responses suggest that, contrary to the multiple use principle, the Forest would diminish the emphasis on mule deer in order to accomodate intensive land uses and commodity outputs while there exists substantial unsatisfied demand for hunting and other uses of deer. The deer plans were formulated with the recognition of conflicts between deer and other land uses. The legislative intent was to guide land management decisions to benefit California's deer resource, to prevent serious impacts of conflicting uses, and to prevent severe declines in deer herds which could result from unsound or shortsighted management decisions.

This Department recognizes no need for such modifications, which we interpret as suggesting a relaxing of herd goals to accomodate the LMP's commodity emphasis. The subject plans are mandated to provide deer management direction for a ten-year period, and as such, were signed by the Forest Service and other agencies. The Inyo Forest has no authority to dictate or direct the revision of California's legislatively mandated deer management plans.

CASA DIABLO DEER HERD PLAN UPDATE

1994-95

I. Update of biological data

A. Composition counts

Year	Post-season bucks/100doe	Post-season fawns/100doe	Spring fawns	Fall sample	Spring sample
1986-87	15	61	21	444	153
1987-88	6	60	39	293	602
1988-89	6	36	18	940	406
1989-90	12	18	15	159	349
1990-91	9	22	26	174	628
1991-92	17	38	29	206	507
1992-93	13	49	21	512	577
1993-94	27^	26	22	325	321
1994-95	16	36	35	640	270

^ A newly-surveyed winter habitat located this year (through telemetry research data) had higher buck numbers than areas surveyed in the past, substantially raising the buck ratio. It is not to be assumed that the buck ratio actually doubled in this one-year period.

B. Buck kill

Year:	1985	1986	1987	1988	1989	1990	1991	1992
	141	100	140	175	201	175	165	195
	1993	1995						
	149	189						

II. Update of habitat improvement projects for 1994.

None

III. Other changes to the herd plan

The 1995 X-9A hunting season quota will remain at 650, unchanged from 1994.

The effects of unlimited numbers of archers hunting this population was addressed last year through implementation of an archery quota of 500 tags in zone X-9A (new zone A-16) to control intense hunting pressure which has been increasing rapidly, especially with reduced rifle quotas. It is hoped that it will now be possible to effect herd buck ratio increases through positive control of total buck harvest.

It is anticipated that the 1998 increase in fawn ratios may result in an increase in total deer numbers in the zone. Currently, feed, water, and cover conditions are excellent throughout the herd's range. Weather patterns and precipation totals will again be crucial to future herd performance.

The recent denial of all points of the HFQ appeal of the Inyo Forest Plan can be expected to have substantial negative impacts on the future of this herd and all herds on the Inyo Forest due to deemphasis of deer habitat management. Additionally, the Inyo Forest Plan Amendment removing the State Deer Herd Plans from the Forest Planning document, and further weakening language for deer will now provide clearance for approval of the Snowcreek Ski Area and other projects damaging to key deer habitats on the Inyo.

WHITE MOUNTAIN DEER HERD PLAN UPDATE

1993-94

I. Update of biological data

A. Composition Counts

year	Post-season bucks/100dd	Post-season fawns/100dd	Spring fawns	[illegible]	Spring sample
1986-87	16	62	--	[illegible]	--
1987-88	no counts				
1988-89	26	27	--	[illegible]	--
1989-90	no counts				
1990-91	no counts				
1991-92	19	14	--	[illegible]	--
1992-93	no counts				
1993-94	no counts				
1994-95	no counts				

Due to the inaccessibility of the range, the lack of deer concentrations, and the need for substantial snow cover for efficient helicopter surveys, fall counts have been conducted infrequently and no spring counts have been attempted.

A substantial number (up to 500 or more) of deer winter in the Fish Creek Mountains on the north-west end of the White Mtn. range. Telemetry data has revealed that this wintering population is composed of a mix of White Mtn. deer and Casa Diablo herd deer from the Sierra. Lacking other, more specific and adequate data, composition counts of this group are reported to provide an indication of performance of the White Mtn. population.

year	Post-season bucks/100dd	Post-season fawns/100dd	Spring fawns	[illegible]	Spring sample
1986-87	12	65	--	[illegible]	--
1987-88	18	30	--	[illegible]	--
1988-89	no counts				
1989-90	19	25	23	[illegible]	161
1990-91	10	35	--	[illegible]	--
1991-92	10	29	30	[illegible]	247
1992-93	16	50	no cc.	[illegible]	--
1993-94	no animals found this survey		13/100 adults		42
1994-95	no survey, insufficient helo time				

B. Buck Kill

Year:	1965	1966	1967	1968	1969	1990	1991	1992
	51	56	37	36	34	38	35	32

1993	1994
33	39

? (possibly an incomplete tag count)

II. Update of habitat improvements

None during the report period

III. Other changes to the herd plan

None