CASA DIABLO GEOTHERMAL DEVELOPMENT PROJECT:

DEER MIGRATION STUDY, SUMMER-FALL 1987

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and marked into 20 sections each 0.1 miles long except Section 1, which was 0.2 miles long. In adition, the dirt road leading from Hot Springs Road to well SF 35-32 was included in the surveys.

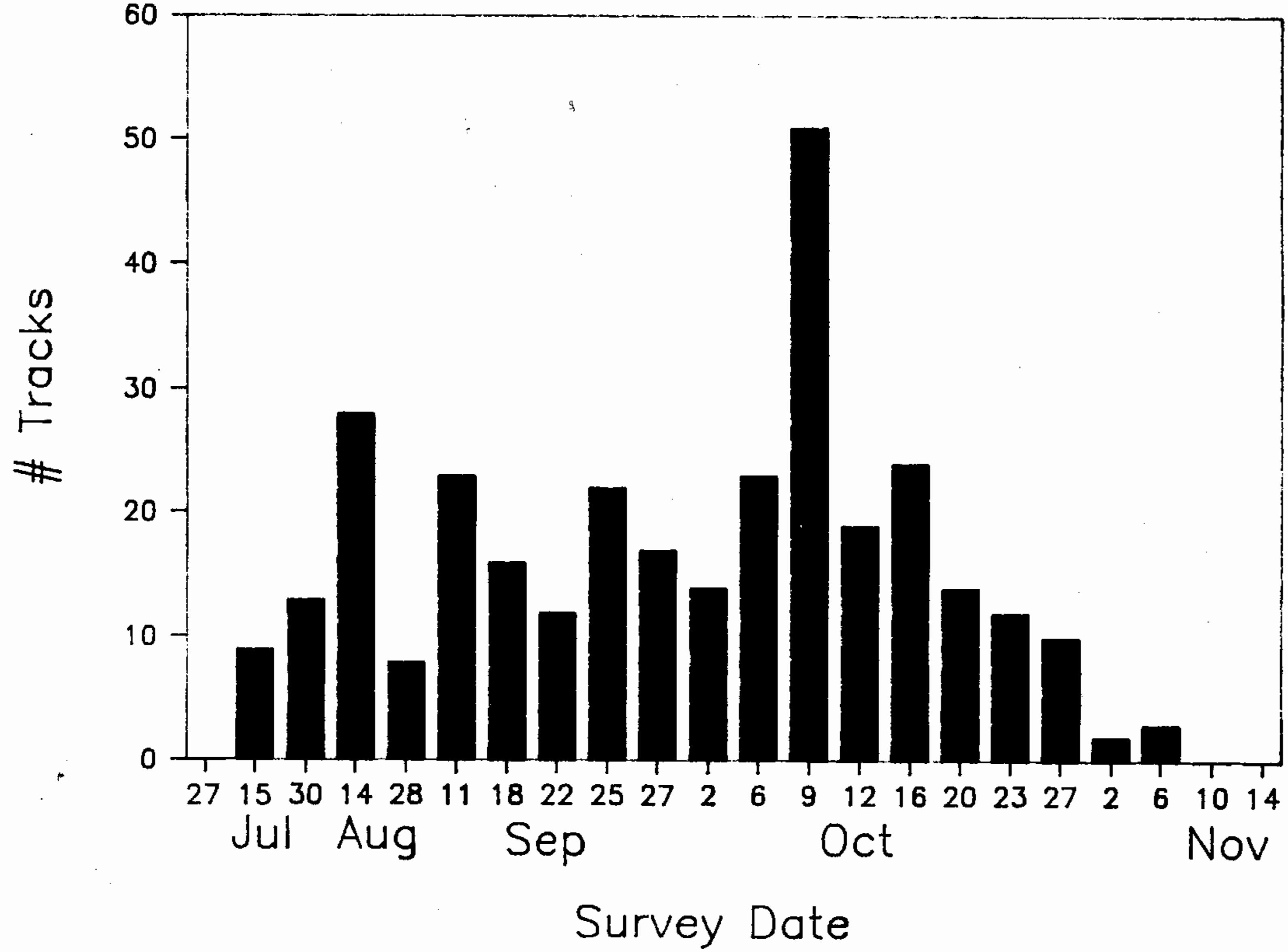
Beginning on 26 June 1987, the entire route was cleared of tracks and a tracking substrate prepared by dragging the route with a "sled" of automobile tires pulled by a vehicle. This was done in late afternoon, and the following morning, the route was walked or driven and all deer tracks observed on the road were counted, both by survey section and by direction of travel. Data recorded were the number of individual deer making the observed tracks and their direction of travel. Because the route was dragged each evening before a survey to obliterate all tracks, the tracks counted on the surveys were made by animals within approximately the previous 12-18 hours. Recording tracks by survey section was designed to give a quantitative picture of the local pattern of deer movement in the Study Area. Recording tracks by direction of movement was designed to allow separation of back-and-forth or very localized movements from migrational movements.

RESULTS

1. Timing of deer activity

Figure 3 shows the total number of tracks made by individual deer throughout the period of study, presented without regard to direction of movement or location. Use was relatively constant except for the first and last surveys, and the survey on 9 October. The low counts on the early surveys may have have reflected restricted activity during fawning. The relatively high 9 October total was no doubt due to migrating animals, and the low counts late in the period reflected the fact that most

Figure 3. Total deer tracks counted on surveys in the PLES geothermal site, Summer—Fall 1987



animals had migrated by mid-November. No major fall storm occurred to trigger a large migration, and this is reflected in the pattern of tracks.

Figure 4 shows the breakdown of tracks counted on the surveys by direction of movement. Movements to the south and east are generally in the direction of the fall migration; those to the north and west are opposite. Subtracting the north and west-moving tracks from the south and east-moving ones, respectively, can potentially yield a crude estimate of the net number of deer moving through between the the dragging of the route and the survey. This is shown in Figure 5, in which the number of tracks heading north was subtracted from those heading south and the number of tracks heading west was subtracted from those heading east, on each survey. An examination of Figure 5, however, yields no straightforward interpretation. The period of summer residency, July through September, shows a predominantly positive net number of tracks, a period during which, if movements were predominantly local, one would expect a balance of approximately zero or below.

2. Locations of deer movements

Figure 6 presents the total number of deer tracks by survey section counted during the summer and fall of 1987. The large number of tracks indicated for Section 1 is somewhat misleading, because that section is twice as long as the others. With this in mind, the distribution of tracks in the survey sections is still more heavily weighted toward the first 10 sections, although deer activity is present in all.

This deer activity between June and November can be divided

Figure 4. Deer tracks by direction of movement in the PLES geothermal site, Summer-Fall 1987

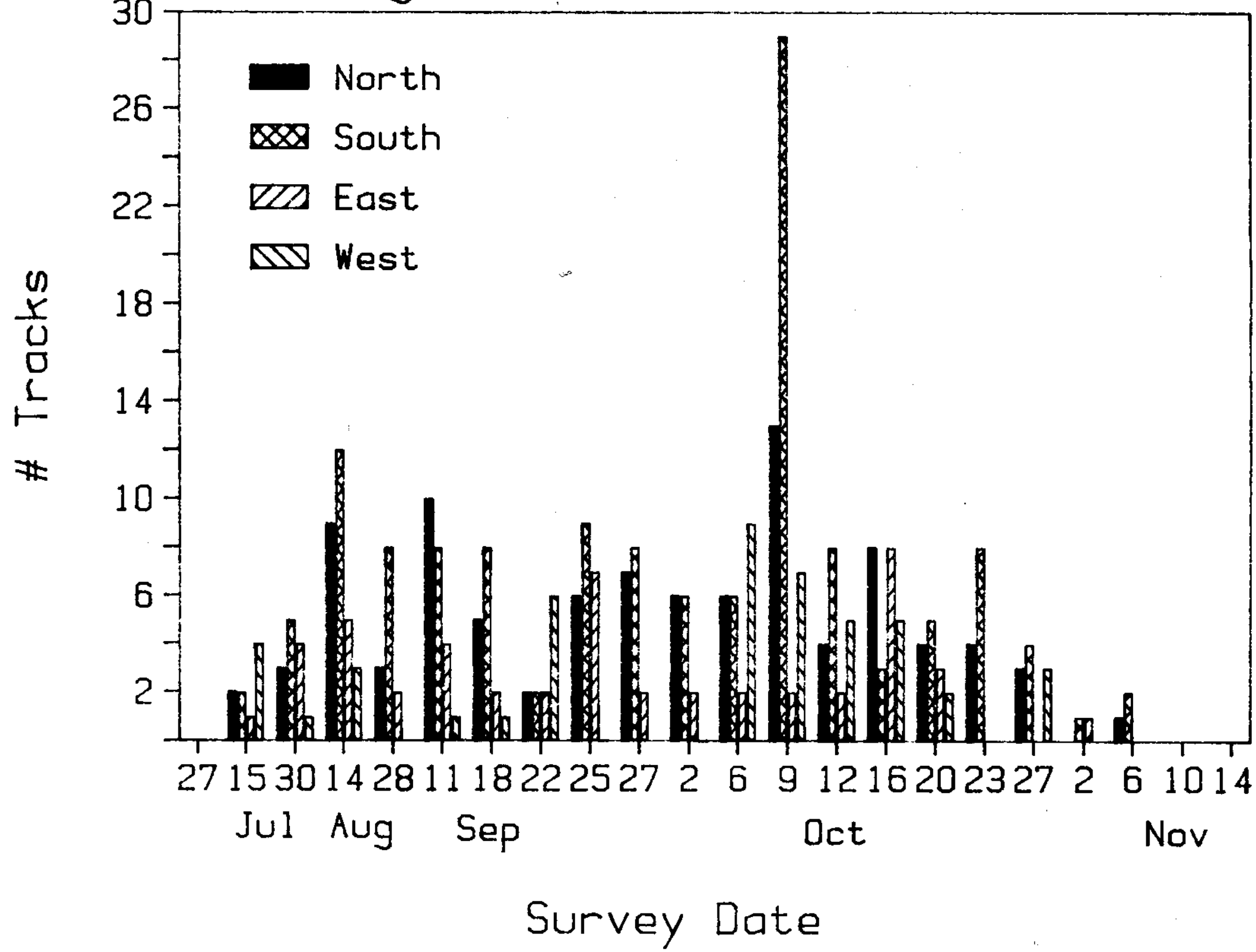


Figure 5. Net numbers of tracks by direction of movement in the PLES geothermal site, Summer-Fall 1987

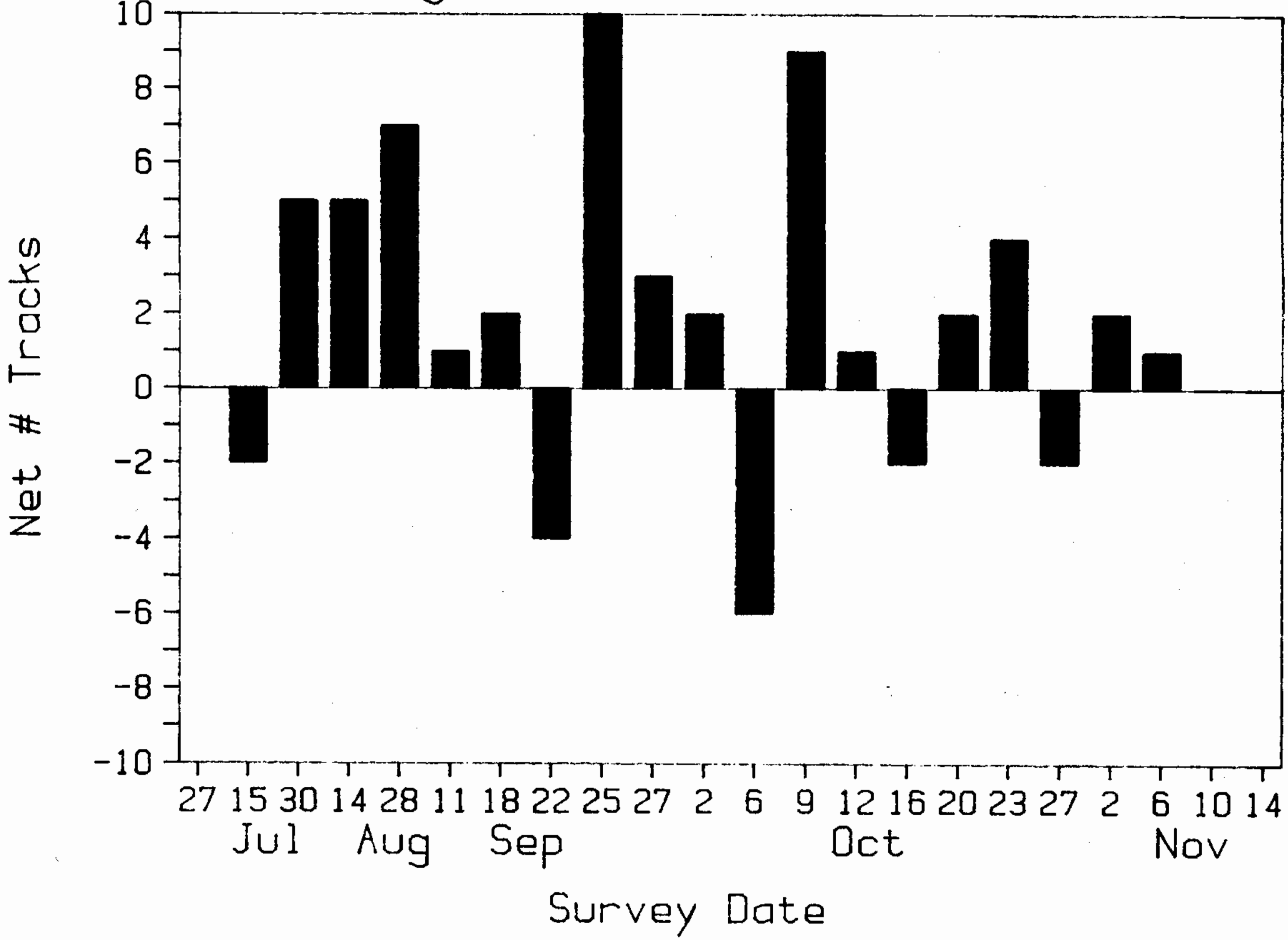
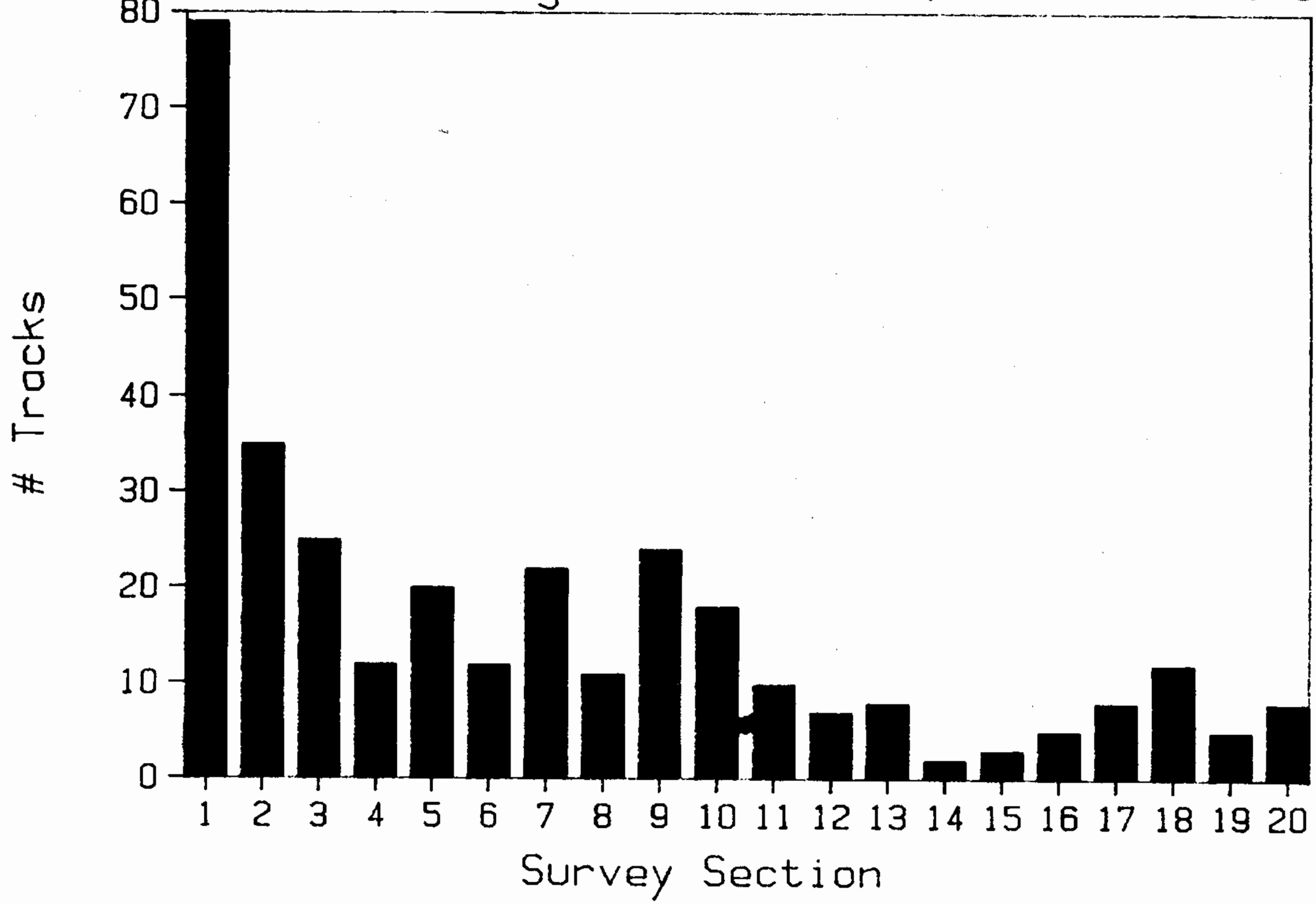


Figure 6. Total numbers of tracks counted by survey section in the PLES geothermal site, Summer-Fall 1987



into the period of summer residency and fall migration. Because there was no major fall storm to elicit one major wave of migration, the fall migration period will somewhat arbitrarily be defined as starting with the 9 October survey. This date is supported by other observations in the vicinity of the study area. Figure 7 shows the tracks by survey section divided into summer and migration periods. These comprise 12 and 10 surveys, respectively. No consistent patterns are obvious, except that more tracks were counted in Section 1 during migration than during summer. Total tracks were 168 in summer and 158 in fall.

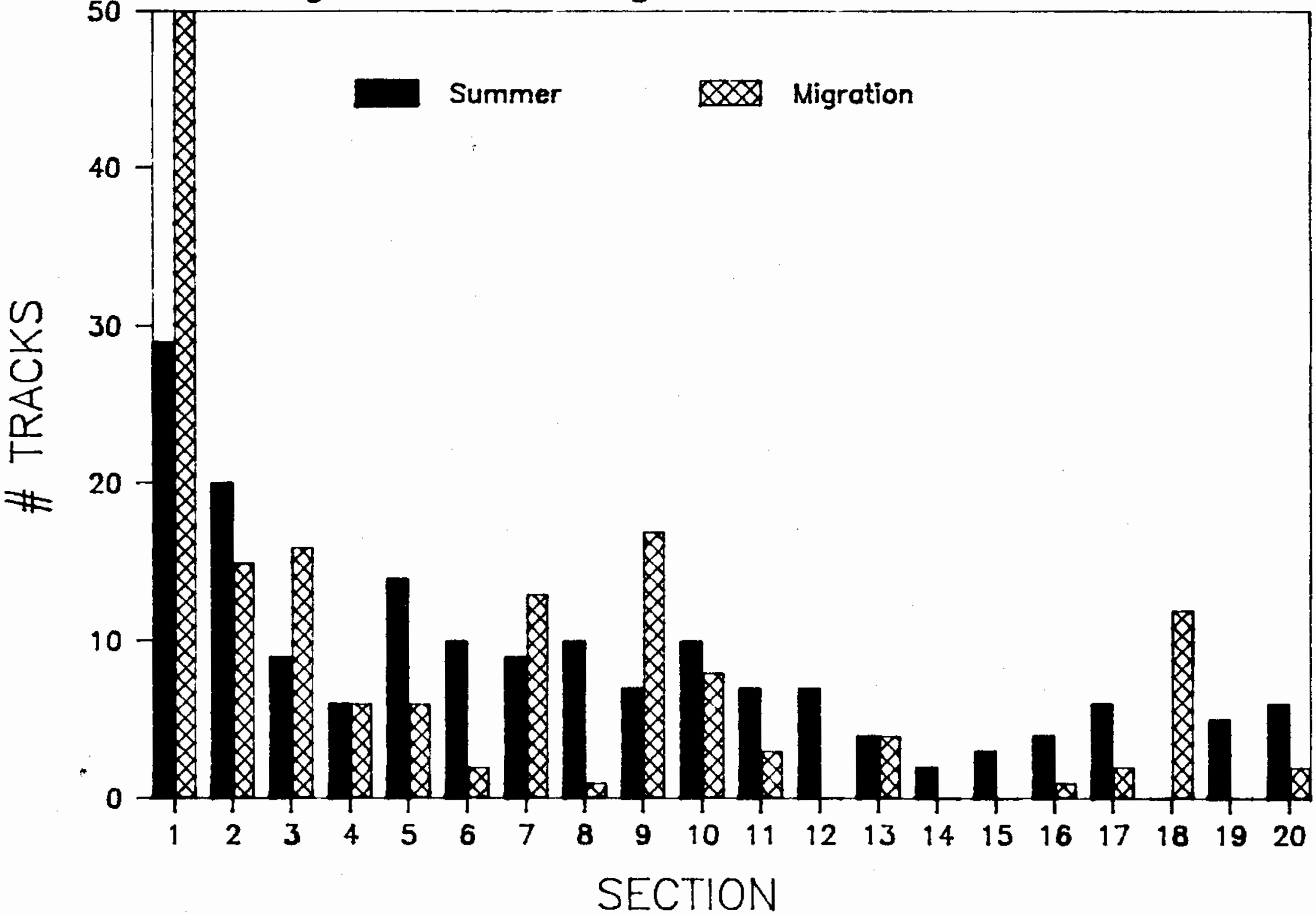
On the road to well SF 35-32, no tracks were observed on any survey during the summer or fall. Throughout the survey period, deer were observed visually on only two occasions, both in the afternoons when dragging the survey route. On 8 October, 5 adult females, 5 fawns and 1 yearling male were seen between Sections 9 and 12. On 26 October, 4 adult females and 1 fawn were seen in Section 10. As in the spring, no specific areas of deer movement or well-defined concentration areas were apparent from covering the area on foot.

DISCUSSION

Results of the summer and fall 1987 track surveys, like those of the spring, indicate a generally somewhat dispersed pattern of deer activity in and movement through the Study Area. Activity was recorded throughout the summer and fall periods. As in the spring, no well-defined migration trails were observed, and the track counts indicated deer activity in all sections.

During the summer, the number of tracks counted on the various surveys varied from 0 to 29, indicating a moderate amount

Figure 7. Total deer tracks by summer and fall migration, PLES geothermal site, 1987



of summering activity. There is no way to determine absolute numbers of animals from these track counts, but 6-10 might be a reasonable guess. Fawns were produced in the area; the first fawn tracks were observed on 14 August.

Attempting to estimate even crudely the number of animals passing through on fall migration, given the unpredictably pulsed pattern of the fall 1987 migration in addition to the problems of estimation discussed in the spring report, is not meaningful. Deer movement through the area was apparent, and, as in the spring, the precise number is not important; what matters is the estimate of magnitude. There certainly are not hundreds or thousands of animals using the area, as is the case in other local areas, but likely there are dozens. This movement does not appear to be concentrated in any localized portion of the Study Area, but is dispersed throughout it, which may not be surprising given its relatively small area and lack of extreme topography. It is likely that deer from three designated "herds" are involved: the Buttermilk, Sherwin Grade, and the Casa Diablo herds. Radioed or otherwise marked deer from all three herds have been observed in the vicinity of the Study Area.

Recent radio-telemetry information indicates that, in general, most of the Buttermilk and Sherwin Grade deer which migrate north do so along the base of the mountains west of Highway 395. Likewise, most Casa Diablo deer move along the base of the Glass Mountains northeast of the Study Area. A portion of each herd, however, does move near or right through the Study Area. The specific areas used as migration corridors are probably dictated as such by both local topography and tradition.

Impacts of geothermal development on these summering and migrating deer are difficult to predict precisely, but in a general sense are a function both of the location, amount and kinds of changes associated with the development, and of the availability of potential alternate travel routes. It was the case that deer activity was rather dispersed throughout the area. The locations of the proposed power plant sites are shown in Figure 8. These occur most closely to Survey Sections 1 and 15-17 (Figure 2). Additional facilities likely will include a number of wells, pipelines, and a transmission line, as well as the power plants. Section 1 had relatively high deer use, and Sections 15-17 relatively low (Figures 6 and 7). Assuming a "worst case" scenario, one in which deer completely avoid the proposed facilities and associated human disturbance, it is difficult to see how making several dozen deer move several hundred yards around the facilities would constitute a great hardship. Given the existing terrain, such an avoidance would likely have a trivial impact on migrating deer. Of course, certain facilities, e.g., fences, pipelines, etc., could be designed to minimize any impacts to deer and to facilitate their passage. Summer use by deer could be restricted by the developments and human activity, with a consequent lowering of carrying capacity and decreased fawn production.

From the standpoint of deer migration and summer use, the locations of the presently proposed facilities (Figure 8) are less preferable than the initially proposed site (Figure 9 in Kucera 1987). The present proposal has would have the new power plants across Hot Springs Road from the existing plant, thus

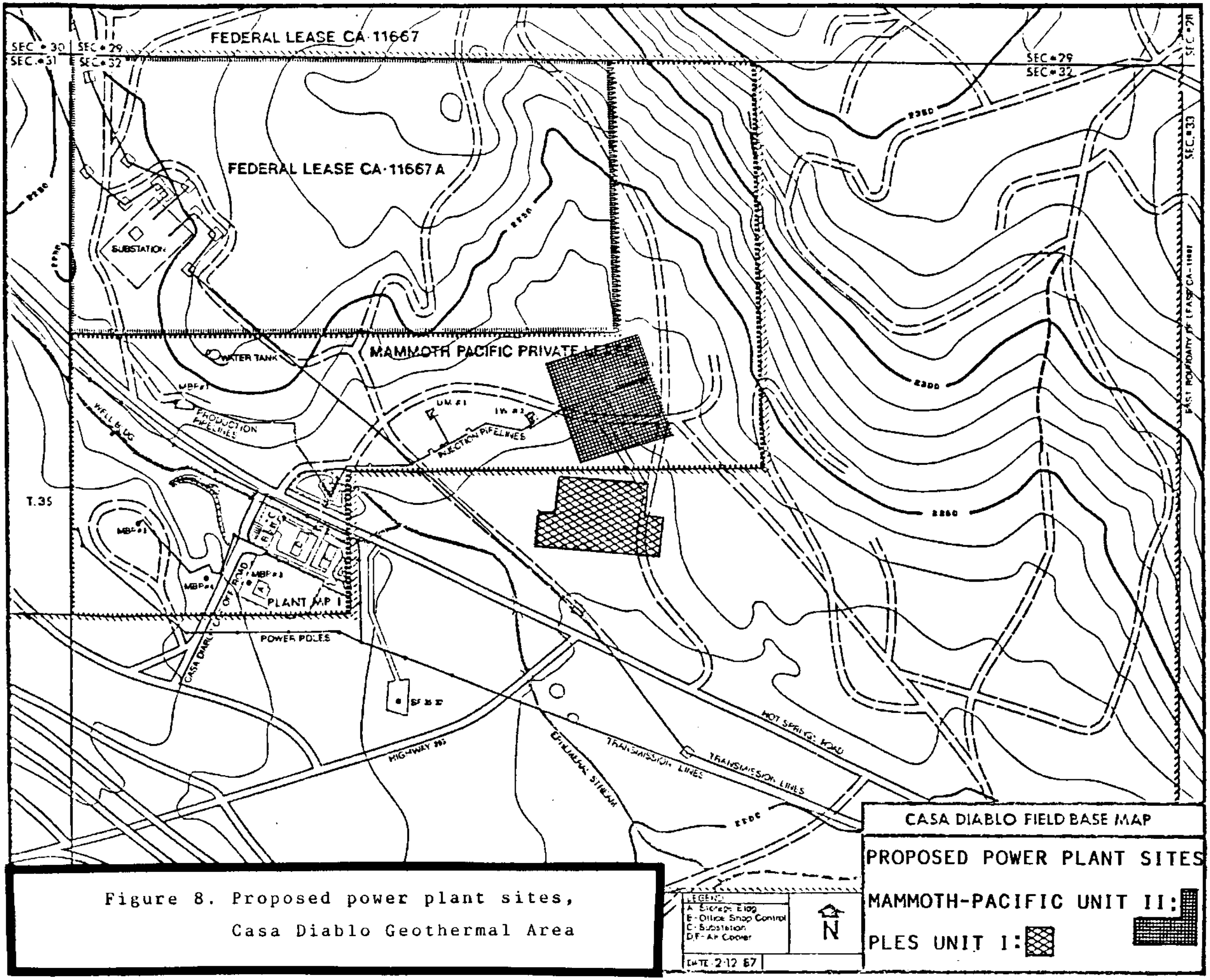


Figure 8. Proposed power plant sites, Casa Diablo Geothermal Area

effectively increasing the area impacted by the project. In general, the more concentrated an area of disturbance, the less will be its deleterious impact. The present configuration, however, apparently is preferable from the standpoint of minimizing visual impacts of the project.

At present, alternate routes for migration exist, giving deer an opportunity to avoid the project area if developed. However, there are proposals for additional developments in the region, e.g., the Mammoth/Chance geothermal project, the Doe Ridge project, the Sherwin Bowl Ski Area, the Snowcreek development, Juniper Ridge, etc. Although it is impossible to discuss thoroughly the impacts of a project without reference to the context in which that project occurs, a regional summary and analysis taking such additional projects into account are not within the scope of the present work. No doubt the consequences of some of these proposed projects, because of their nature, size, and/or geographical location, are potentially much greater than those to be anticipated from Casa Diablo. Others may be more benign. The present study was not designed to evaluate cumulative impacts outside of the Study Area.

The present investigation and discussion indicate that the Casa Diablo Geothermal Project exhibits a light to moderate amount of deer activity in summer and during the fall migration. Considered by itself, it will likely not have a major impact upon the summer residents or on fall migration. It is likely that the earlier proposed site location, adjacent to the existing power plant, would have less of an impact both to resident and migratory deer than the alternatives, across Hot Springs Road.

There will be some loss of summer habitat causing some reduction in local carrying capacity and fawn production. Regarding migration, in the worst and unlikely case that deer avoid the project entirely, there are at present alternate routes available to allow migrating deer to reach their summer ranges. Thus, the Casa Diablo Geothermal Project by itself will likely have minimal negative impact.