SAGE GROUSE TELEMETRY PROJECT

2003 PROGRESS REPORT

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I. Introduction

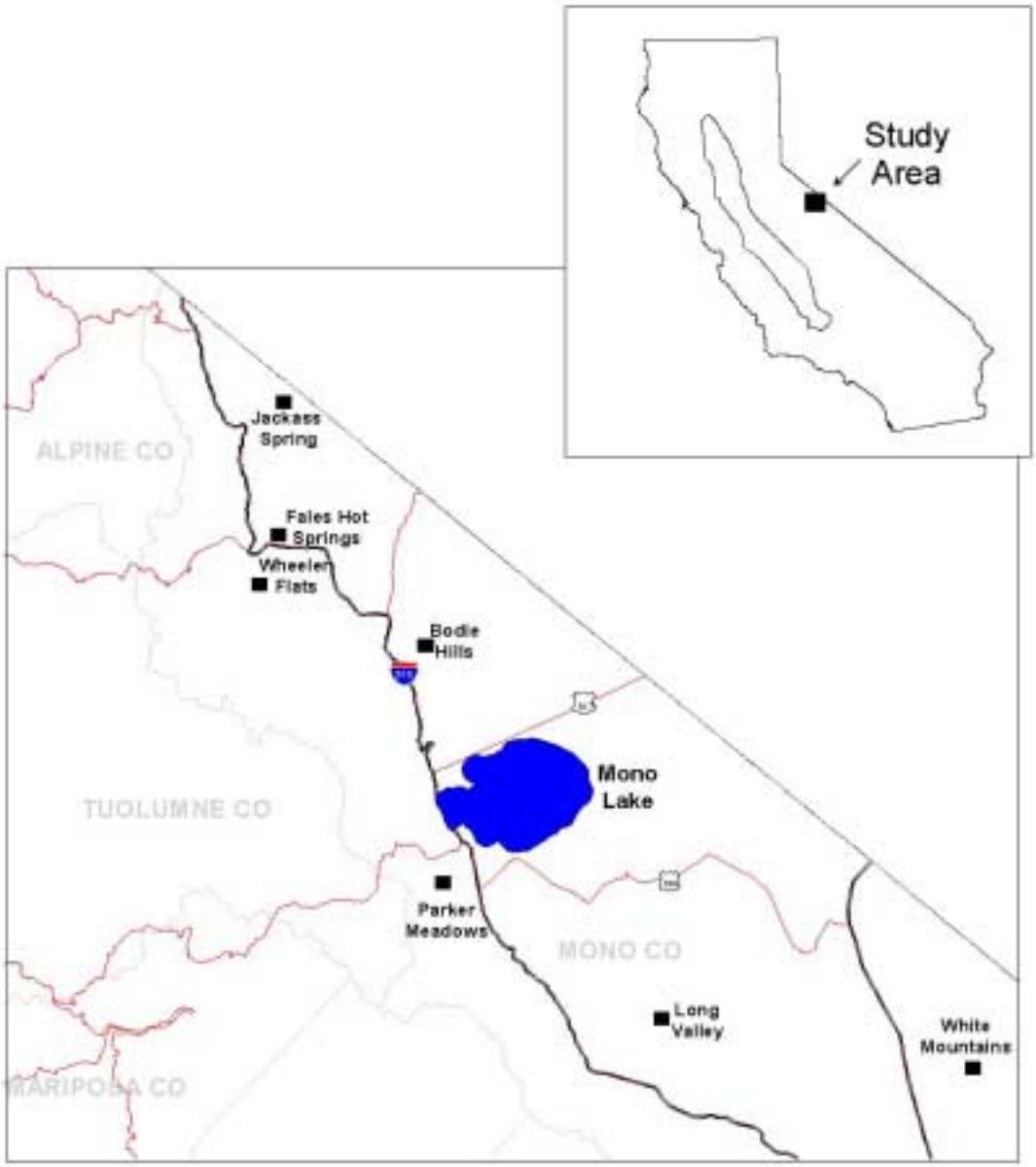
The greater sage grouse (*Centrocercus urophasianus*) is found in sagebrush (*Artemisia spp.)* dominated habitats across western North America. Sage grouse populations have declined dramatically throughout their range and most populations face problems that will likely affect the long-term viability of this species (Schroeder et al. 1999, Braun 1998, Connelly & Braun 1997). Much of this species' habitat has been lost to cultivation, burning and overgrazing (Schroeder et al. 1999). Six petitions to list sage grouse under the Endangered Species Act in various portions of their range have been filed in recent years, including a petition to emergency list the Mono Basin area sage grouse as a distinct population segment (Webb 2001).

Several local populations of sage grouse have been previously identified in Mono County, including the Jackass Spring area, the Fales/Wheeler area, Parker Meadows, Long Valley, the Mono Basin, the White Mountains, and the Bodie Hills (Figure 1).

The basis for defining a local population for purposes of this progress report, are known concentrations of birds occupying local areas which are not known to interchange regularly with sage grouse in other local concentration areas. Complexes of lek sites (breeding display sites – strutting grounds) have been monitored for many years in the Long Valley and Bodie Hills, with additional leks identified in the Fales/Wheeler area and Parker Meadows. Sage grouse are known to occur in the Jackass Spring area and the White Mountains, but currently used lek sites had not been identified. There are records of historic lek sites in the White Mountains (CDFG unpublished data). These populations have been defined primarily on known lek sites and brood rearing areas. However, movements between these areas are not well known and wintering areas have not been sufficiently studied.

Sage grouse face a variety of risks to their continued viability in each of these areas. Leks in the Fales/Wheeler Flat area are found on a combination of private and United States Forest Service (USFS) lands. Private lands in this area are facing increased pressure from housing development. Habitat and populations on adjacent USFS lands could also be affected by development on private lands. Until recently, leks in the Parker

Figure 1. Study location in Mono County, California showing the major study areas investigated beginning the winter of 2002.



area had not been identified and little is known about the movement patterns of this local population. Sage grouse in the area of Jackass Spring near the Nevada border on the northern end of Mono County have not been studied, with very little existing information on this local population and no documented lek sites. A recent proposal to expand the Mammoth-Yosemite airport to accommodate large commercial jet aircraft could have tremendous growth-inducing impacts to the region and may negatively impact the Long Valley sage grouse population. Proposed developments associated with the airport expansion include residential zones, commercial retail, and a hotel. These developments, located on property owned by the Town of Mammoth Lakes, could have significant impacts on sage grouse found on adjacent Bureau of Land Management (BLM) and City of Los Angeles-owned lands within Long Valley. Additional private land in Long Valley contains key sage grouse use areas. Similarly, development of private parcels and mining proposals on public (BLM) lands may impact the sage grouse population in the Bodie Hills.

Much of the existing sage grouse literature focuses on maintenance of habitat on public lands (Wisdom et al. 2002, Connelly et al. 2000) while very little information is available regarding maintenance of habitat on private lands under threat of development. Because so many different agencies are involved in the development process, it is difficult to devise mitigation measures likely to result in the conservation of sage grouse. Projects are reviewed on a case-by-case basis and mitigation measures that are piecemealed may not be adequate on a larger regional scale.

An effort to develop a comprehensive conservation plan inclusive of sage grouse in Mono County is currently underway via the Nevada Sage Grouse Conservation Strategy (2001). Such a plan is needed to address overall pressures to sage grouse populations and habitat from various land and recreational uses now and in the future. To effectively complete such a plan, a comprehensive understanding of sage grouse populations is required. Identification of lek sites, nesting areas, brood rearing areas, wintering areas, and seasonal movements between these areas are not currently well known. A more complete understanding of the ecological consequences of alterations in the quantity, quality, and juxtaposition of these habitats to the population dynamics is required to recommend strategies for conserving sage grouse throughout the landscape.

Local strategies will also be required to recommend key pieces of property for protection, and to suggest appropriate mitigation measures for proposed development.

A wealth of information is already available to begin building the conservations plan from previous monitoring and research. However, information gaps exist for sage grouse in Mono County, including information on migratory patterns, habitat use, and factors affecting survival and recruitment. This research is designed to identify and gather critical information to develop a more comprehensive and effective conservation plan throughout the county.

Sage grouse ecology has been documented and summarized in several recent publications (Connelly et al. 2000, Schroeder et al. 1999). Numerous telemetry studies have documented the existence of different migration strategies for sage grouse including populations that have; 1) distinct winter, breeding and summer areas; 2) distinct summer areas and integrated winter and breeding areas; 3) distinct winter areas and integrated summer and breeding areas; and 4) non-migratory populations (Connelly et al. 2000). The migration strategies for Mono County sage grouse are not well known. Habitat management guidelines for sage grouse have been developed for winter, summer and breeding habitats (Connelly et al. 2000). Knowledge of movement patterns are needed to identify habitat use areas within Mono County and evaluate future management strategies based on sage grouse habitat requirements. The compilation of existing data on sage grouse populations in Mono County, combined with additional research conducted on local populations which have been little studied, will contribute significantly to a comprehensive sage grouse conservation plan for Mono County.

II. Research Methods

Telemetry

Sage grouse were captured using spotlighting techniques (Wakkinen et al. 1992, Giesen et al. 1982) beginning in March of 2003, with a goal to maintain about 30 female and 15 male radio-marked grouse during the study. We attempted to mark a total of at least 10 yearling male grouse at $\geq$ 3 different leks in order to optimize our chances for identifying new lek sites within the study areas. Juvenile male birds tend to be more mobile and will be more likely to lead us to new lek sites (Apa 2003, pers. comm.). Birds were captured

on roosts surrounding lek sites in the spring and near water sources and roost sites in the fall. Captured birds were aged, weighed, sexed (Beck et al. 1975), banded, measured including total tarsus, culmen, wing chord and primary 1,9,10, and fitted with a necklace-mounted radio transmitter with an activity sensor (Riley and Fistler 1992, Sveum et al. 1998). The birds were then released at the point of capture and the location marked using a Global Positioning System (GPS). All bird locations were recorded in Universal Transversal Mercator (UTM) units. Tracking in the Bodie Hills and Long Valley was coordinated and augmented with BLM personnel. USGS has maintained a Microsoft Access database of all morphological, telemetry, and vegetation information collected within the study area. Data is collected in the field using personal digital assistants (PDA's).

Seasonal Movements: Each radio-marked grouse will be relocated at least twice each week to determine seasonal movements and habitat use throughout the year. Birds were monitored more frequently during the breeding season than other seasons using a combination of aerial, truck and hand-held telemetry techniques. Aerial telemetry has been used to locate missing birds and to identify bird locations when ground conditions prohibit vehicle or hand-held telemetry observations (e.g. heavy snow). [sg1]

Home range and Movement Analysis

Annual and seasonal home ranges were calculated using the Animal Movement extension version 2.0 in ArcView 3.2 (Environmental Systems Research Institute, Redlands, California, USA). Home ranges for birds with >30 telemetry locations and >10 winter locations were estimated using the minimum convex polygon (MCP) method. The fixed kernel method is also available with the Animal Movement extension, but due to erratic winter movements and a paucity of locations for several birds the estimated seasonal home ranges were not sufficiently precise to be useful. Additional data collected after January 1st will likely ameliorate this condition and allow kernel methods to be used in seasonal home range calculation. Seasonal home ranges were calculated during three time periods: spring (March 1st to June 31st), summer (July 1st to September 31st) and winter (November 1st to February 28th).

Nesting

Nests locations were identified by radio marked females that remained in localized areas during the spring. To minimize the probability of abandonment, nests were not visited until 2 weeks from the estimated initiation date. Location, number of eggs, vegetation characteristics and placement information were recorded. Nests were revisited following movement by female, success or failure of the nest was determined, hatch rate estimated, cause of failure investigated, and detailed vegetation measurements made. Broods were located by tracking radio marked females and using pointing dogs to up to 50 days following estimated hatching date. The number of hatchlings was recorded, as was the location of the brood for future vegetation measurements.

Vegetation Measurements

Total shrub, sage and individual shrub species canopy cover were recorded using transect intercept methods (BLM 1996) at nest, brood and random locations. Daubenmire frames (BLM 1996) were used to estimate cover of perennial and annual grasses and forbs. Vegetation height measures were made of shrub, sage, grass and forb species within daubenmire frames. Additional height measurements were estimated at the using a robel pole (BLM 1996), observing 10 meters from the pole, at 1 meter in height.

III. Preliminary Findings

Data Review

Compilation of literature, maps and other resources pertinent to sage grouse management in Mono County has been initiated. Citation information, keywords and reviews of accumulated data are being incorporated in a searchable Microsoft Access database. In addition, a written literature review will be available.

Sage Grouse Population Size

Gibson (1987) provided a summary of harvest information and population estimates resulting from hunter surveys in 1987. Ninety-five birds were checked in at

stations with age and sex was determined for 72 birds. Fifty percent of checked harvest was male with no age bias, 36% was juvenile. Fifteen birds were banded. None of these birds were banded in 1984, the first year of banding effort. Two birds were banded in 1985; 1 in 1986; and 12 prior to hunting in 1987. Eight of 32 birds marked prior to hunting in 1987 south of Whitmore hot Springs were harvested. Standard Lincoln-Peterson (L-P) estimates were 342 birds for this region. For the area south of Hot Creek only (a more realistic estimate based on harvest distribution) the estimate is 306 birds. Gibson (1987) states that he believes these values to be biased high, but not as high as lek count bias due to the even sex ratio observed in the harvested sample. Population estimates from lek counts assume a highly skewed sex ratio, which was not apparent from harvest. The proportion of birds harvested from the estimated population was high (27.8%). The author states that up to 200 birds may exist in areas of Long Valley that received little hunting pressure, but provides no support for this estimate. These estimates may not be accurate, however, if hunting pressure is selective for males (e.g. due to larger size and desirability).

Sage Grouse Population Dynamics

Gibson et al. (2000) described the dynamics of lek counts and associated changes in hunting regulations. The methods and statistics used for many inferences drawn by the authors are occasionally invalid or not useful to determine effect sizes (e.g. testing for meaningless effects, naked p-values). However, several of their findings illustrate important implications for future management. Counts of male grouse on leks are correlated with hunting pressure. When the species has been hunted lek counts for male birds are approximately 100 to 200 individuals. When hunting seasons have been closed, lek counts have increased and stabilized at 400 to 500 birds. The numbers provided in the text provide rough calculations of an annual population growth rate, lambda, of 1.2 to 1.46. The authors' interpretations of model results imply either Long Valley has equal sex ratios or harvest is selective for males, assuming female:male sex ratio is greater than 1.0, i.e. every two birds harvested result in 1 less lekking male. Additionally, no appreciable recruitment is possible by their calculations and all hunting mortality is additive with other causes.

Gibson et al. (2000) suggest that zero bird harvest is associated with an increasing population approaching a carrying capacity of around 500 birds. Allowable harvest of one bird will offset recruitment and lower stable population size to around 200 birds. Two bird seasons are associated with a declining population and is not supportable by recruitment. Table 1 summarizes the number of increasing and decreasing annual population trends during three separate bag limit regulations.

Table 1. Population trends relative to bag limit regulations of sage grouse hunting seasons (Gibson et al. 2000).

Bag limit	Number of years	Years with Increasing population	Years with Decreasing population
0	9	9	0
1	21	8	13
2	7	2	5

Sage Grouse Lek Positioning and Habitat

Several papers have identified lek characteristics in the Long Valley. Gibson (1996) states that 60% of leks are located in meadow habitat despite the sage/meadow vegetation complex of Long Valley containing only 9.1% meadow. Bradbury et al. (1989) report 5 of 9 leks occurring in meadow habitat and the meadow leks containing 85% of displaying males. Locations of leks apparently coincide with dispersal patterns of females moving between wintering and nesting ranges (Bradbury et al. 1989). Behavioral adaptations may cause less preferred habitat (i.e. sage) to be used by displaying males in the absence of habitat better suited for display due to the proximity of females (Bradbury et al. 1989). Fine scale analysis of lek positioning may be closely related to vegetation condition, coarse scale positioning may be most related to female dispersal patterns though causal inference is not possible from available studies (Bradbury et al. 1989, Gibson 1996).

Sage Grouse Behavior at Leks

The greatest collection of empirical knowledge on sage grouse ecology in Long Valley relates to lekking behavior of grouse. Specifically, the positioning of leks relative

to movement and radio telemetry locations (discussed above), chronology of lek attendance and male behavior relating to mating success.

Female movements from winter ranges (dispersion) precede lek attendance and usually begin between March 13th and April 8th (Bradbury et al. 1989). Adults depart winter ranges 8.4 days before yearlings. Most birds studied wintered near Crowley Lake and departure from this area was not random. Most females moved northwest to nesting areas, distances traveled were variable, usually 7-10km in length with no correlates found in association with distance traveled (Bradbury et al. 1989). Four of 7 females visited the lek closest to their nesting area and most nesting areas were less than 3 km from the nearest lek (Bradbury et al. 1989). Females generally do not visit leks until after determining a nesting area, then mate and return to nest. Several birds nesting within winter range did not travel long distances to either leks or nesting areas, as active leks [e.g. Lek 2] are located on winter range (Bradbury et al. 1989). There is no evidence that female selection or preference favors larger leks (Gibson 1996)

Seasonal variability in lek attendance by male sage grouse was associated with the sex ratio of birds observed on two leks. When the female: male ratio was high, male attendance tended to increase (Gibson 1996). When the female: male ratio was low, male attendance tended to decrease (Gibson 1996). However, confounding this finding is the suggestive positive covariance between female: male ratio and number of juvenile males (covariance $p=0.07$; Gibson 1996). In other words, the more juvenile males observed on the lek, the greater the female: male ratio. Observed sex ratios were very low 0.028 to 0.766 females per male (Gibson 1996). Increasing the number of males, juvenile or adult, would be expected to reduce the sex ratio. It is possible that one or two adult males are obtaining all matings on these leks, and experienced adult males are moving to other leks with only juvenile males remaining, despite relatively large numbers of females attending.

Male display behavior is correlated with the presence of females within 5-6km of the lek (determined through radio telemetry locations). Females would attend lek after several days of male display. Mating success (mated or not mated) positively associated with display rate, number of days of display, and acoustic characteristics of display (Gibson and Bradbury 1985). Specifically, males with a higher frequency (in kHz) of the

peak whistle portion of their display, and higher frequency of the 1st "pop" in display sequence had higher probability of mating success (Gibson and Bradbury 1985). For those birds which were successful in mating, birds with a higher initial whistle frequency, higher frequency of the 2nd "pop" and greater proportion of this 2nd "pop" with an energy signature greater than 500Hz, obtained more matings (Gibson and Bradbury 1985).

Territoriality and dominance behavior by males was observed at two leks from 1982 to 1986 (Gibson and Bradbury 1987). A lek located in Wheeler Flat was observed in 1982 and 1983, a lek near Crowley Lake was observed from 1984-86. Territory size was widely variable between years and leks. Individuals near Crowley Lake generally used the same territories between days and returned to the same territories between years (Gibson and Bradbury 1987). Large variation in territory use at Wheeler was confounded with heavy snow and a late lekking season in 1983. During this year the entire lek would move 200-400m per day and was initiated only 12 days before the first observed mating compared to >45 days during other seasons (Gibson and Bradbury 1987). Lek attendance was also low during this year (12 birds), though at least four birds were known to be greater that 2 years old based on banding information (Gibson and Bradbury 1987). Most agonistic behavior at Crowley Lake ended without clear winners, those that did have clear winners (n=41) were won mostly (81%) by those birds closer to their territory center (Gibson and Bradbury 1987). Most interactions (88%) at Wheeler had a clear winner, but were determined mostly by individual dominance, which occurred in a hierarchical structure (Gibson and Bradbury 1987). Two birds won most of their interactions, though only one of these mated successfully. Over all years agonistic behavior was weakly correlated with mating success (r=0.327, n=8), but skewness of mating success was most apparent when hierarchical dominance was highest (Wheeler Flat in 1983), compared to when territoriality was highest (Gibson and Bradbury 1987). Disrupted copulation was frequently observed (13.6 of mating attempts), but rarely effective in preventing successful mating between pairs (Gibson and Bradbury 1987). Both breeders and non-breeders appear equally likely to move off lek on any given day. Males are more likely to move off lek when females are present, possible for off-lek copulation, which was observed (Gibson and Bradbury 1987). Authors assert that female choice appears to motivate mating success within territorial lekking systems (Gibson and

Bradbury 1987). When territoriality breaks down, individual dominance may influence but does not guarantee mating success (Gibson and Bradbury 1987). Territoriality vs. dominance modulated mating systems may be lek and/or year dependent (Gibson and Bradbury 1987).

Sage Grouse Seasonal Range and Habitat Use

Radio telemetry of female sage grouse was used to calculate season ranges, and dispersal periods near Crowley Lake (Bradbury et al. 1989). Individual home ranges (MAP 50%) were smallest (~<50 ha) from May to September and largest (~>200 ha) from December to April, except during January (Bradbury et al. 1989). Reasons for smaller ranges in January are unclear but may be related to small sample size or weather conditions.

Additionally, beginning in January and increasing through April, individual home ranges overlapped greatly, and population level range expanded from ~200 ha to 800 ha (Bradbury et al. 1989). This suggests a period of expanding range as females search for nesting territories at the onset of spring, but without territoriality or spatial partitioning. Late spring and summer (May to September) ranges are characterized by large but decreasing population level range use (~1200 ha decreasing to <600 ha) but with partitioning of range into individual territories with little overlap and short daily movements by females (Bradbury et al. 1989). Fall (October through December) was associated with intermediate levels of individual range overlap and increasing population level range use (Bradbury et al. 1989). Daily displacement followed the same patterns as individual home range, with greatest daily movements in winter and early spring and shortest movements during nesting and brooding (Bradbury et al. 1989).

Sage Grouse Nesting Habits

Female sage grouse placed 41% of their nests within 2km of the nearest known lek. Nine females were observed at leks and subsequent nests found. Six of these birds nested within 2km of the lek they visited, 3 nested more than 2km away. Significant correlation existed between the number of females observed on a lek and the number of nests found within 2km of that lek (Gibson 1996).

IV. RESULTS

Telemetry

Capture efforts resulted in 82 individual sage grouse captured and fitted with radio transmitters (Table 2). The majority (n=62; 76%) of marked birds were female with nearly equal age ratios (44 adults, 38 juveniles). Nearly 2700 telemetry locations were obtained by the middle of February. Telemetry efforts are ongoing and augmented with aerial telemetry to locate missing birds.

Table 2. Number of sage grouse fitted with radio transmitters in each study area during 2003.

Study Site	# radio-marked
Jackass Flat	12
Burcham Flat	5
Wheeler	5
Parker	8
Bodie Hills	27
Long Valley	20
White Mountains	5

Home Range

Home range estimates differed greatly between study areas (Table 3; Figure 2). Birds in the Bodie Hills had larger home ranges than any other study area both annually and within seasons (spring, summer and winter). Long Valley birds had larger home ranges during both summer and winter than birds from Burcham/Jackass/Wheeler Flats or birds from Parker Meadows. Seasonal home ranges for many birds overlapped within study areas, indicating that seasonal concentration areas may be delineated during future analysis.

Movement

Movement patterns differed between study areas. Using the recommended 10km distance between seasonal concentration areas (Connelly et al. 2000), only birds from Bodie Hills exhibited migratory behavior (Table 4). Migratory behavior was observed

between integrated spring/summer areas and winter activity centers in the Bodie Hills. Both long Valley and Parker birds moved long distances (<5km between successive tracking efforts) but activity centers remained within 10km between seasons. Short movements characterized the Jackass/Wheeler/Burcham Flats area during all seasons. Detailed seasonal movement maps for radio-marked birds are provided in Appendix A.

Table 3. Home range size (hectares) for sage grouse radio-marked in Mono County, CA (2002-2004). Estimates made using minimum convex polygon and summarized individual study areas and includes all bird with >30 telemetry locations.

Study Area	Sample Size	Annual	Spring [A]	Summer [B]	Winter [C]
Bircham/Jackass/Wheeler Flat	10	1086	83	731	518
Bodie Hills	6	12852	465	2082	10570
Parker	5	2040	323	118	1213
Long Valley	9	3541	335	1090	2607

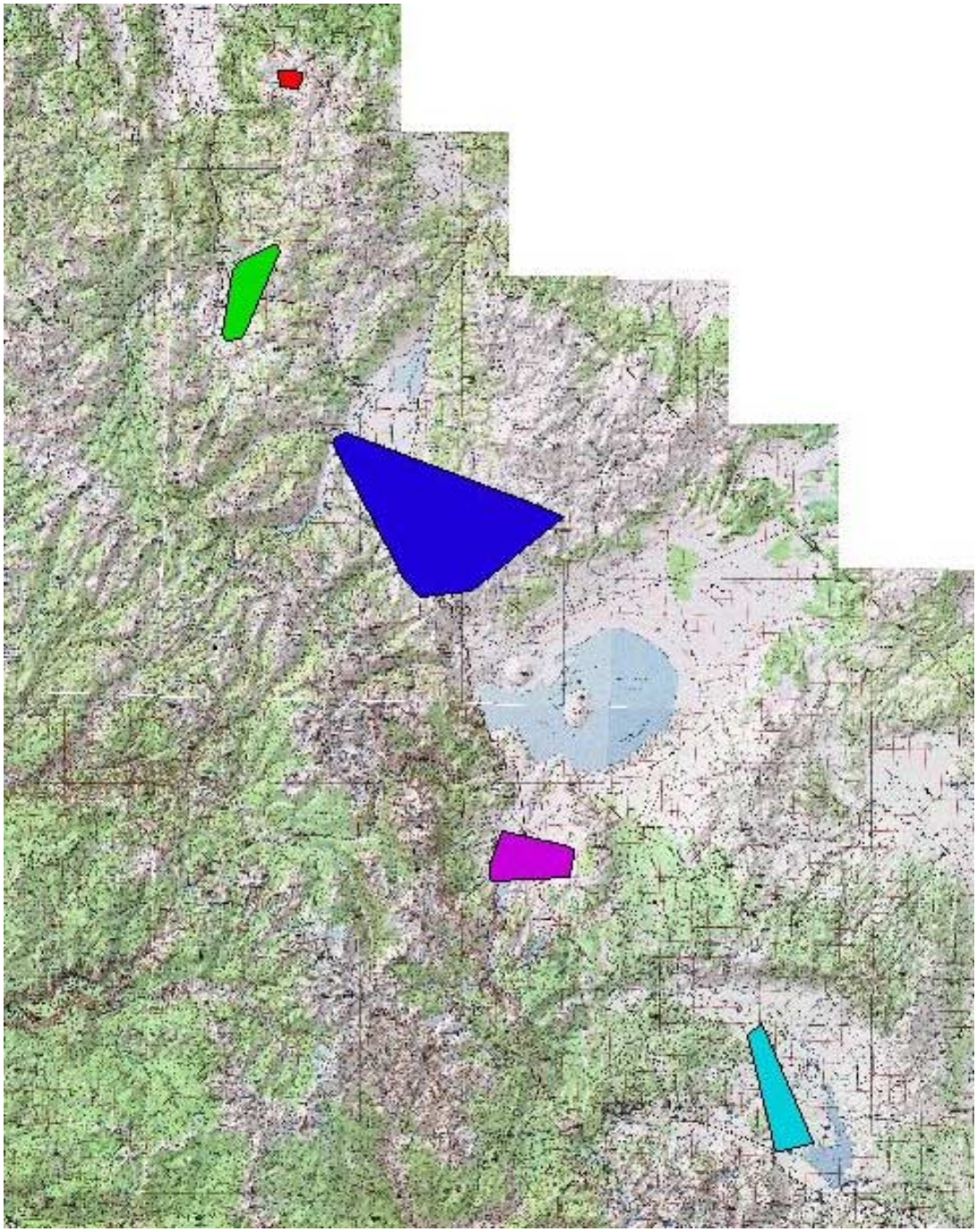
A – March, April, May; 2 birds from Long Valley and 1 from Parker initially marked after May. These birds not included in annual or spring estimates.
B – June, July, August, September
C – October, November, December, January, February; 3 bird from Bodie, and 2 from Jackass/Wheeler/Bircham died before October. These birds not included in annual or winter estimates.

Table 4. Movements by sage grouse in Mono County, CA during 2003-2004, summarized by study area. Includes all birds with at least 30 telemetry locations and 10 winter locations.

Study Area	Total Sample Size	Local Movements [A]	Migratory Behavior [B]
Bircham/Jackass/Wheeler Flat	8	8	0
Bodie Hills	3	0	3
Parker [C]	5	5	0
Long Valley [C]	9	9	0

A – Between and within season movements <10km
B – Between season movements >10km
C – Both Parker and Long Valley birds moved long distances (successive tracking locations >5 km apart) but seasonal activity centers were <10km apart.

Figure 2. Annual minimum convex polygons (MCP) from radio marked sage grouse in Mono County, California during 2003. Each study area shown with one MCP estimate.



Nesting and Brood Success

Preliminary estimates of survival and nesting success were estimated as empirical probabilities. These results are constrained by the same assumptions and limitations as constant survival estimates, and are intended for illustration purposes only due to the likelihood of violations of these assumptions. Habitat variables correlated with nest success (Figures 3 and 4) will be assessed after the 2004 field season when appropriate sample sizes have been obtained.

Nest success was determined for 23 nests initiated during 2003. Six additional nests were censored due to suspected nest abandonment induced by investigators (four due to refit of collar, 2 hens disturbed early in incubation). Twelve nests were unsuccessful, while eleven nests were successful; probability of a nest surviving was 47.8%.

Brood survival was estimated to be 63.6%; 11 successful nests resulted in 7 successful broods. The probability that an individual egg within a successful nest survived to 50 days was 30.7%. This assumes brood counts were accurate and will be biased towards lower survival estimates if brood counts were underestimated.

Combining these preliminary estimates, results in the probability of a nesting hen producing 1 chick that survives to 50 days, which equals 14.7%.

Nesting Vegetation

Sage canopy cover averaged just over 25% and was similar between study areas (Table 5). Overall shrub canopy cover was slightly higher for Bodie Hills than other study areas and averaged slightly more than 50% (Table 5). Vegetation height was also greater at Bodie Hills nests and shorter at Jackass Flat and Long Valley nests, over all study areas Robel vegetation height measurements averaged 71cm (Table 6). Vegetation at non-nesting locations had much less shrub cover but only slightly less sage cover than nesting locations (Table 7). Vegetation height measurements were also slightly lower at non-nesting locations (Table 8).

Figure 3. Unsuccessful nest located in Wheeler Flat in 2003. Nest failed due to predation.

Figure 4. Successful nest located in Long Valley in 2003. All seven eggs in the nest hatched.

Table 5. Shrub and sage cover at sage grouse nests within the Bi-State Planning Area in 2003.

PMU	% Shrub	SD	% Sage	SD	# of Nests
Bodie Hills	63.08	2.59	24.97	8.20	4
Jackass Flat	47.73	7.63	22.92	10.89	4
Long Valley	46.25	13.14	28.15	15.17	11
Parker	55.05		17.40		1
Wheeler/Burcham Flats	54.03	10.99	28.37	11.98	5
Total	51.08	11.78	26.42	12.25	25

Table 6. Vegetation height at sage grouse nests within the Bi-State Planning Area in 2003.

PMU	Robel Vegetation Height (cm)	SD	Nests #
Bodie Hills	102.07	15.01	4
Jackass Flat	53.34	16.37	4
Long Valley	61.18	16.85	11
Parker	60.63		1
Wheeler/Burcham Flats	85.18	21.85	5
Total	71.25	24.25	25

Table 7. Shrub and sage cover at sage grouse non-nesting locations within the Bi-State Planning Area in 2003.

PMU	% Shrub	SD	% Sage	SD	# of Locations
Bodie Hills	36.93	20.09	19.71	12.83	11
Jackass Flat	21.40	20.15	17.83	25.21	2
Long Valley	25.52	12.35	10.40	9.54	3
Wheeler/Burcham Flats	32.62	17.36	24.22	14.71	12
Total	32.75	17.99	21.32	14.32	28

Table 8. Vegetation height at sage grouse non-nesting locations within the Bi-State Planning Area in 2003.

PMU	Robel Vegetation Height (cm)	SD	# of locations
Bodie Hills	52.66	20.23	11
Jackass Flat	26.94	6.98	2
Long Valley	30.09	18.18	3
Wheeler/Burcham Flats	71.88	19.30	12
Total	56.55	24.08	28

Lek Site Identification

We were able to identify one new Lek site in the vicinity of Jackass and Fourth of July Spring, about 11 miles north of Burcham Flat. We counted 10 male grouse during the peak count of 2003. This lek is located at 8,000 feet (32,00 meters) in elevation, in a mosaic community of mountain big and low sagebrush. Portions of the surrounding habitat have recently burned.

IV. Conservation Planning

The Bi-State planning process has proceeded with a final draft due to the Governor's Team on March 12, 2004. Each of the PMU groups have drafted sections for inclusion in the Bi-State Plan, including risk assessments, conservation strategies and a list of action items. The South Mono PMU and Bodie Hills PMU have been able to integrate some of the newly collected data on radio-marked grouse into their individual plans. The Bi-State plan contains reference to adaptive management strategies which allow for future inclusion of new data into the existing plan in an adaptive fashion.

Although the draft Bi-State Plan will be sent to the Governor's Team in mid-march, we realize the need to continue to advance all of the PMU plans to ensure that the Bi-State plan can stand alone as a conservation planning document which ultimately meets the PECE requirements of the USFWS. In order to attain this goal, findings of our research and other newly generated information must continue to be updated into the Bi-State plan. In addition, additional risk factors and conservation strategies are still being considered in the South Mono PMU which need to be addressed. We will continue to help facilitate those planning efforts and actively participate in the conservation planning process.

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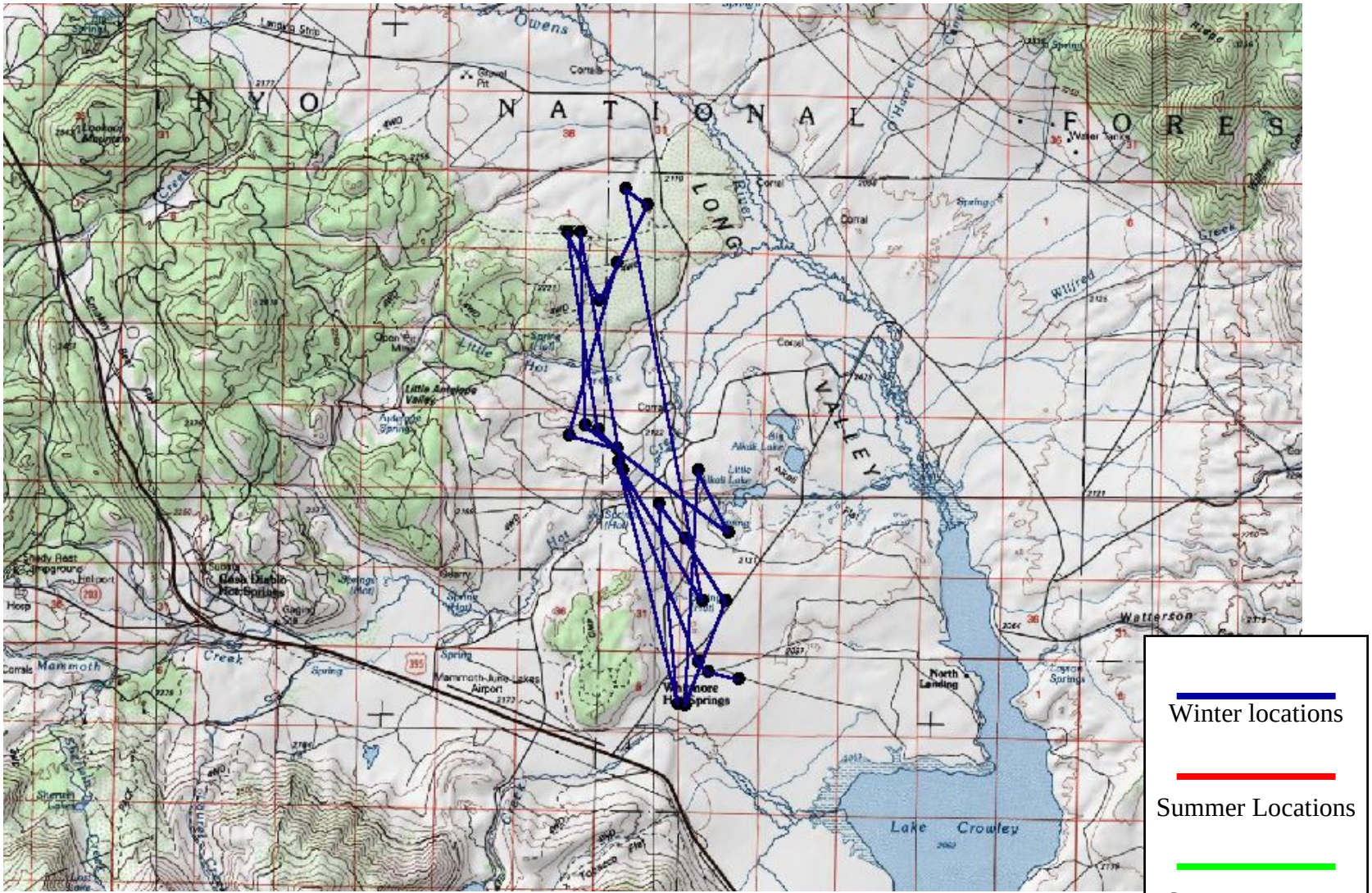
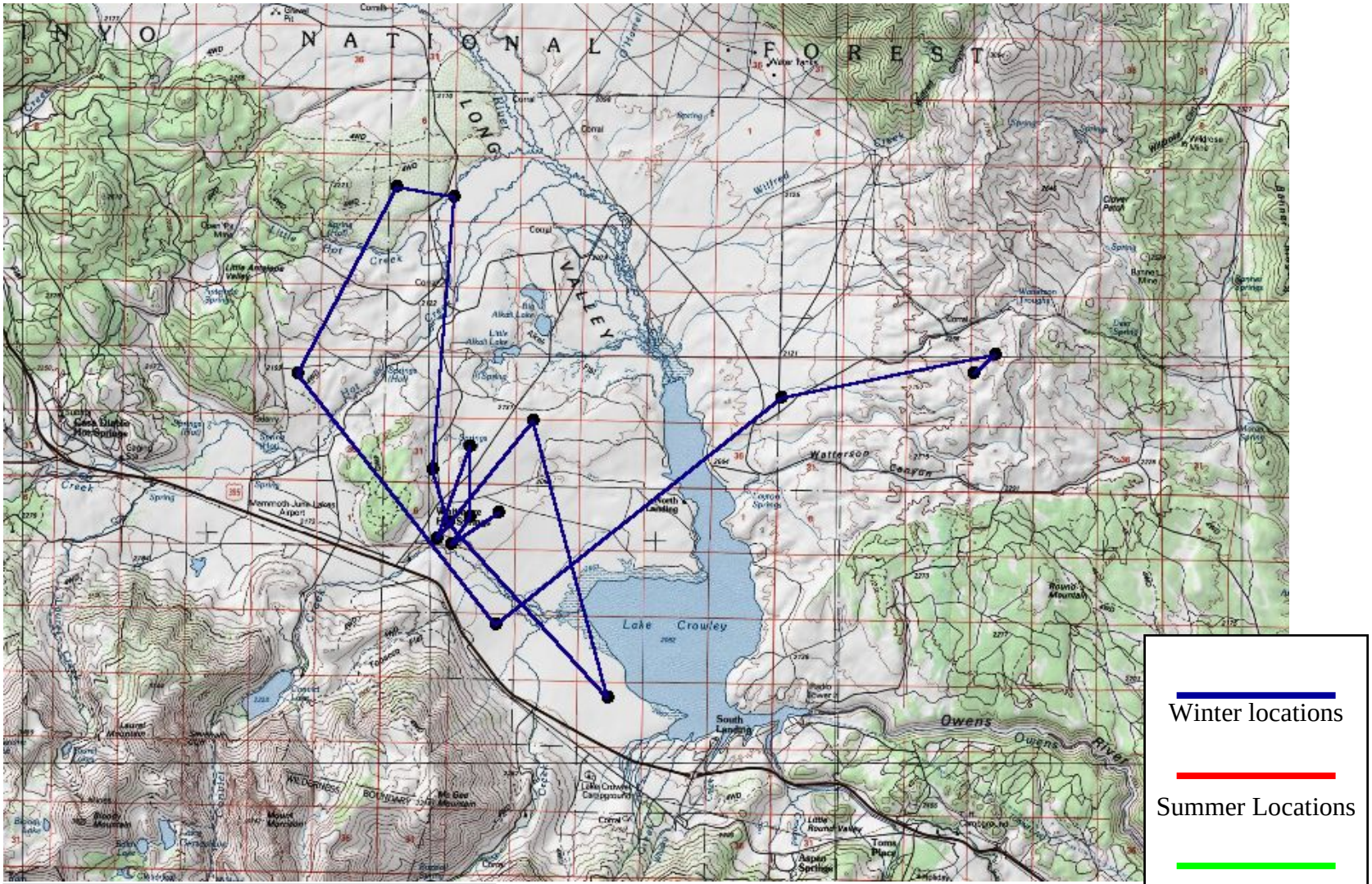
Appendix

Appendix A. Movements of individual grouse during 2003 within the Bi-State study area. Grouse with adequate telemetry records (>30 locations) and those currently being tracked are included.



Bird ID	Sex	Age	Capture/Study Site
104	Male	Adult	Long Valley



Bird ID	Sex	Age	Capture/Study Site
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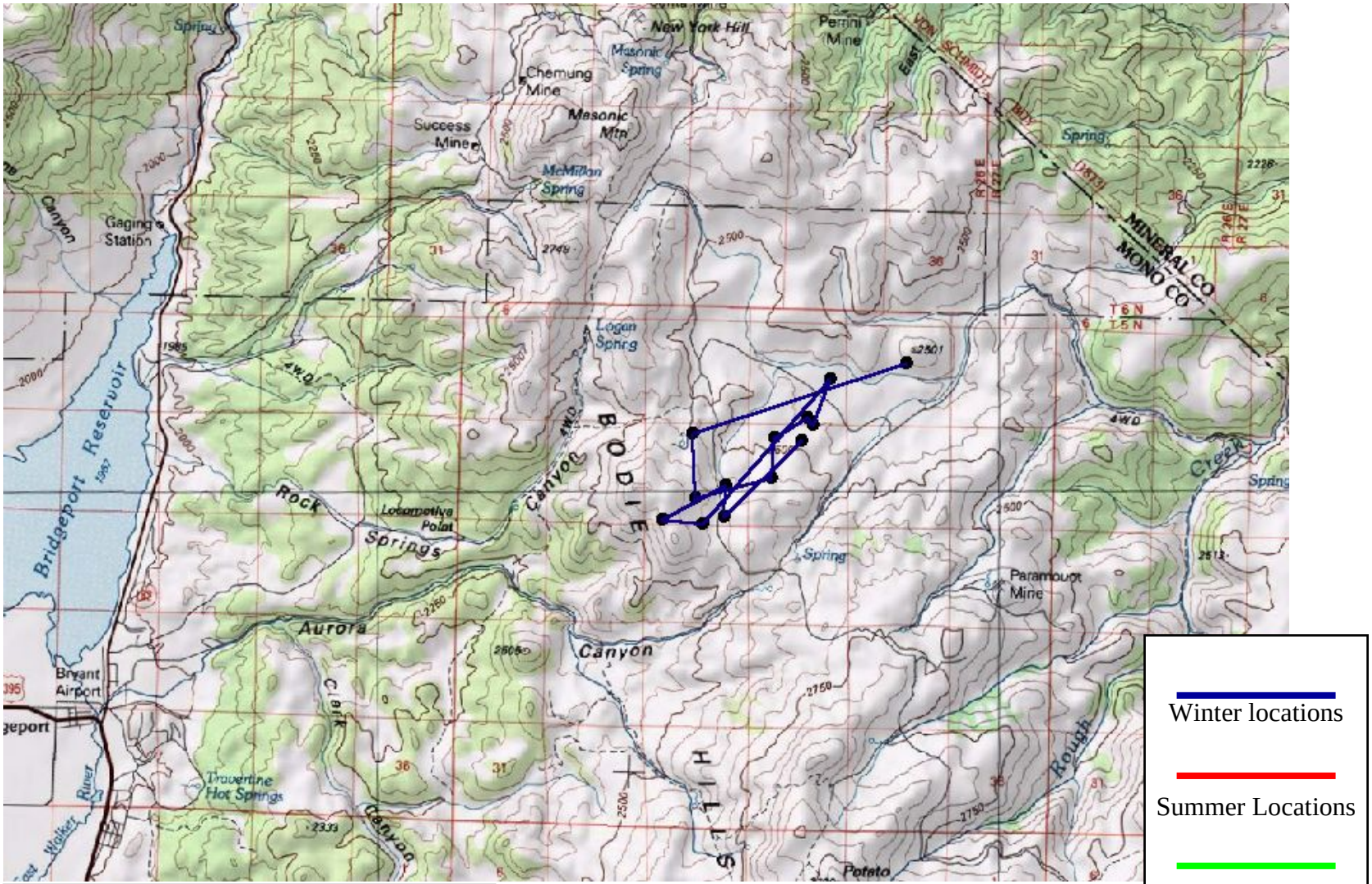
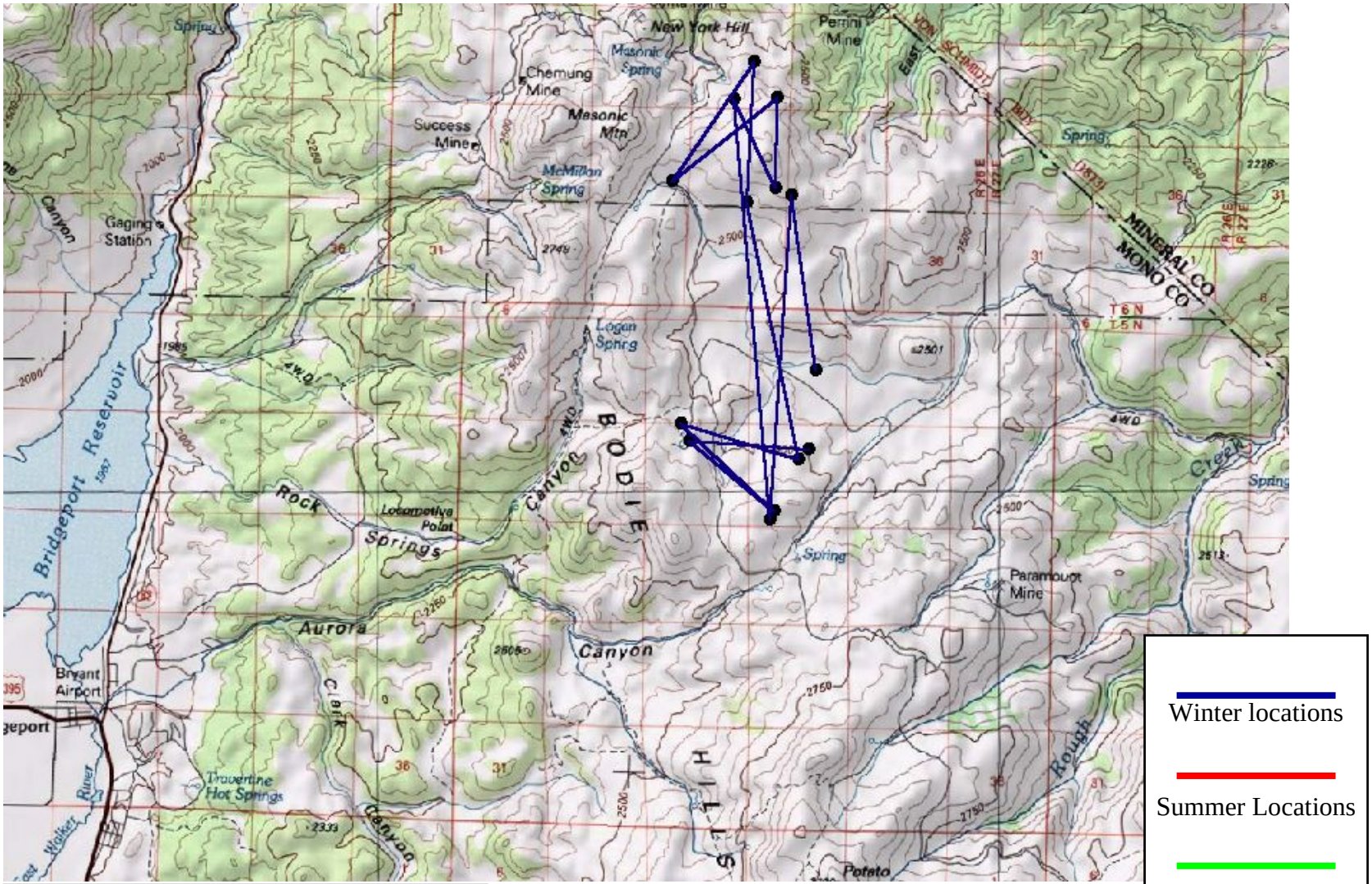
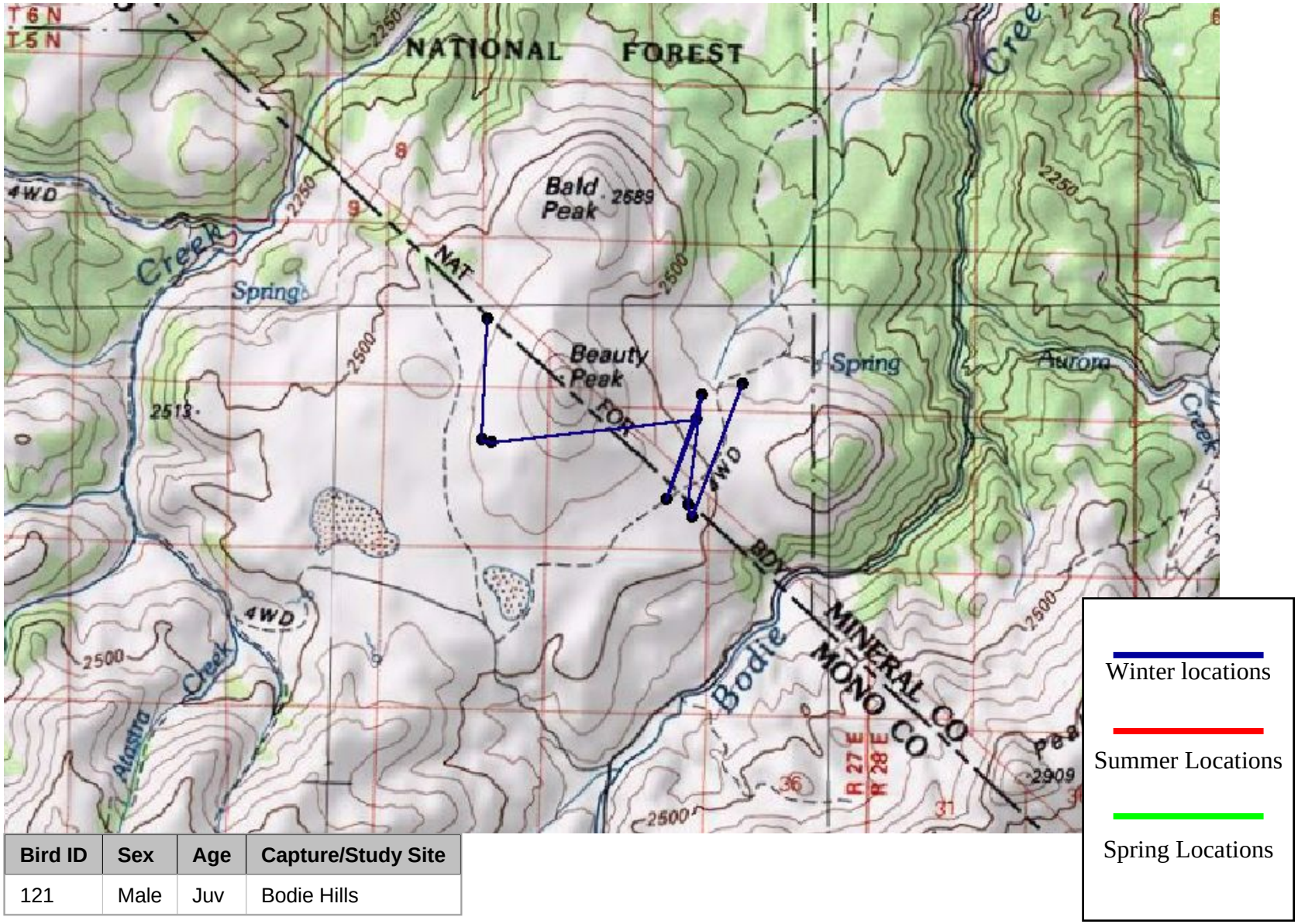


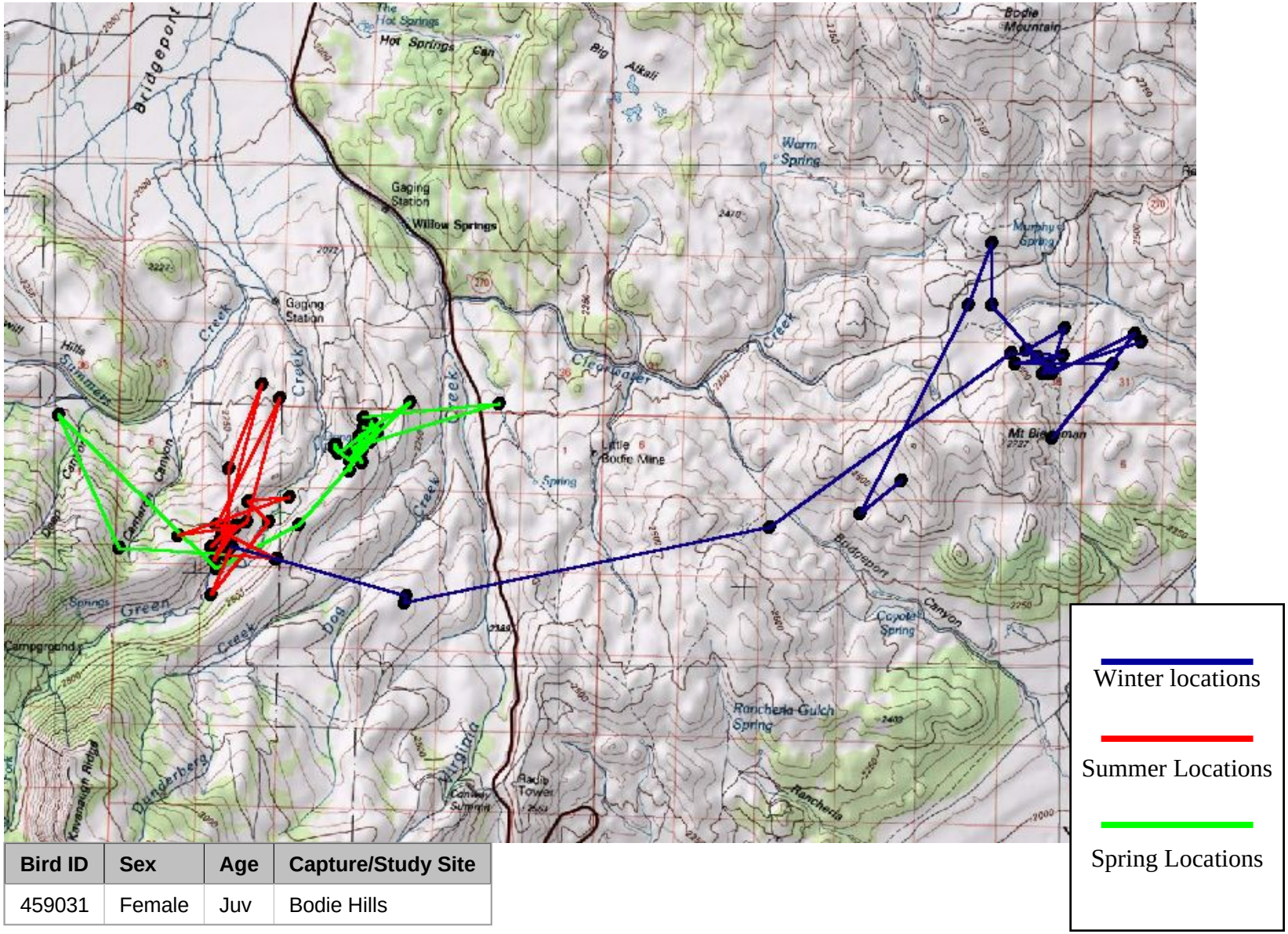
Bird ID	Sex	Age	Capture/Study Site
115	Male	Adult	Bodie Hills



Bird ID	Sex	Age	Capture/Study Site
116	Male	Juv	Bodie Hills



Bird ID	Sex	Age	Capture/Study Site
121	Male	Juv	Bodie Hills

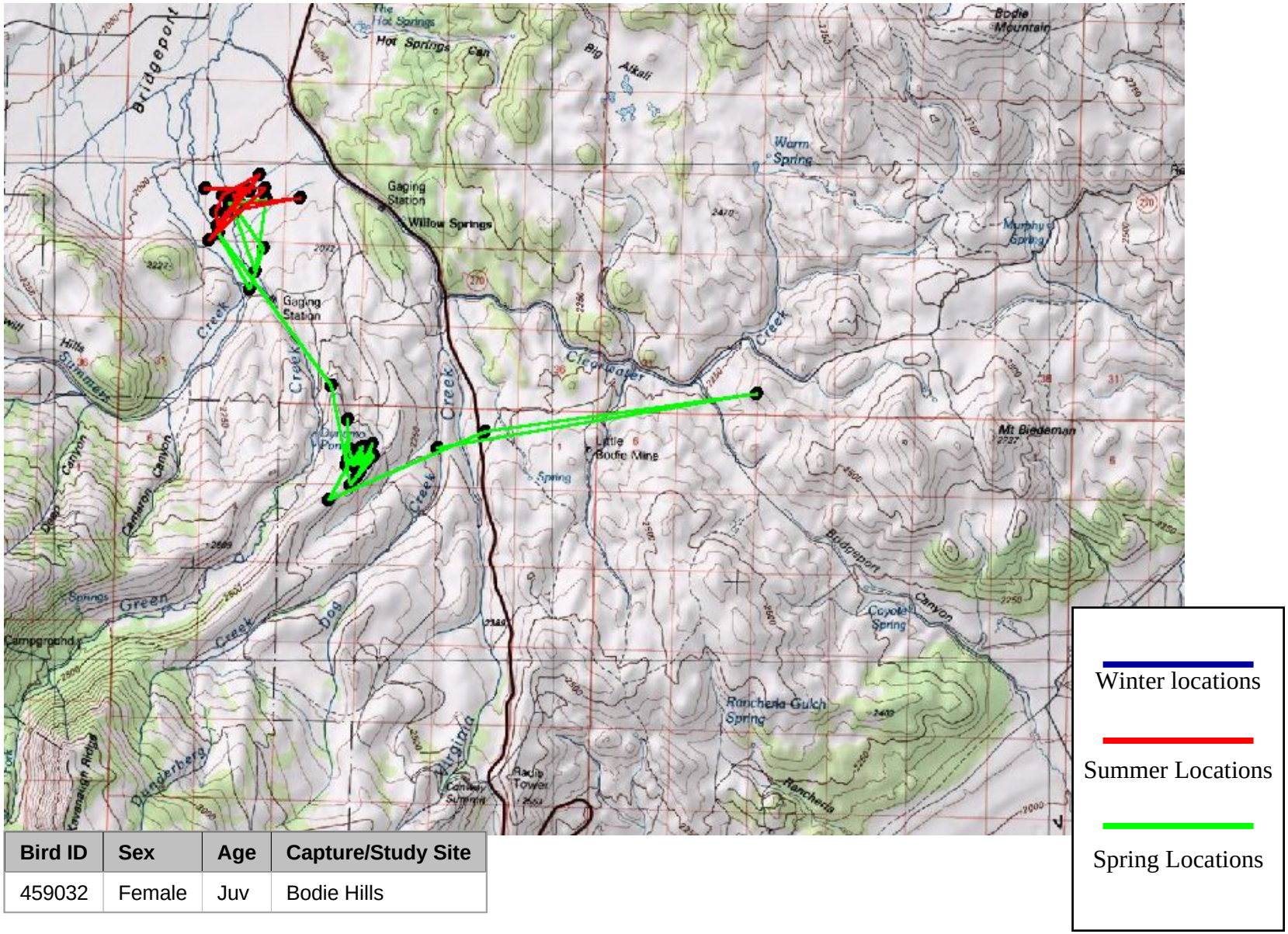


Bird ID	Sex	Age	Capture/Study Site
459031	Female	Juv	Bodie Hills

Winter locations

Summer Locations

Spring Locations

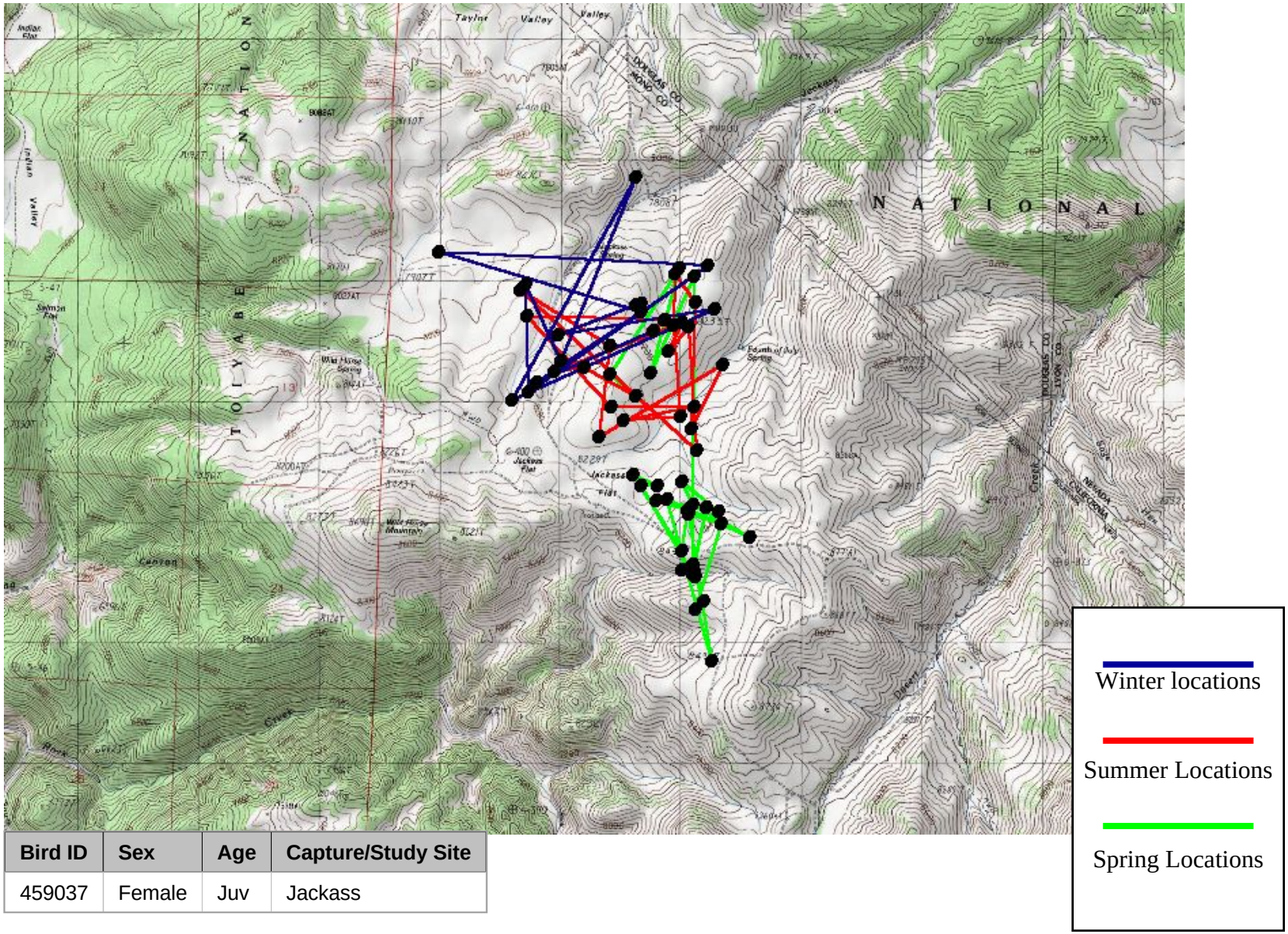


Bird ID	Sex	Age	Capture/Study Site
459032	Female	Juv	Bodie Hills

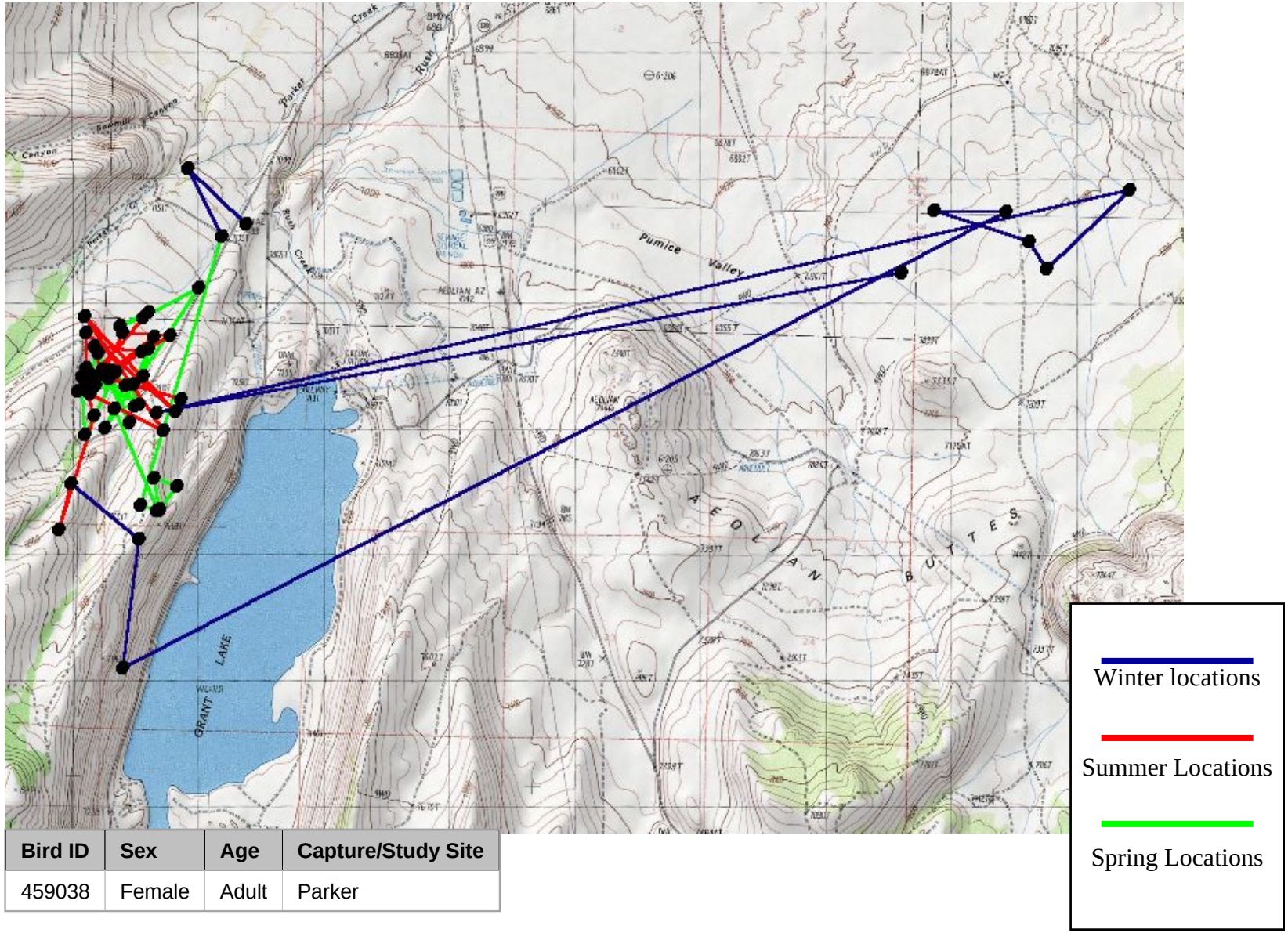
Winter locations

Summer Locations

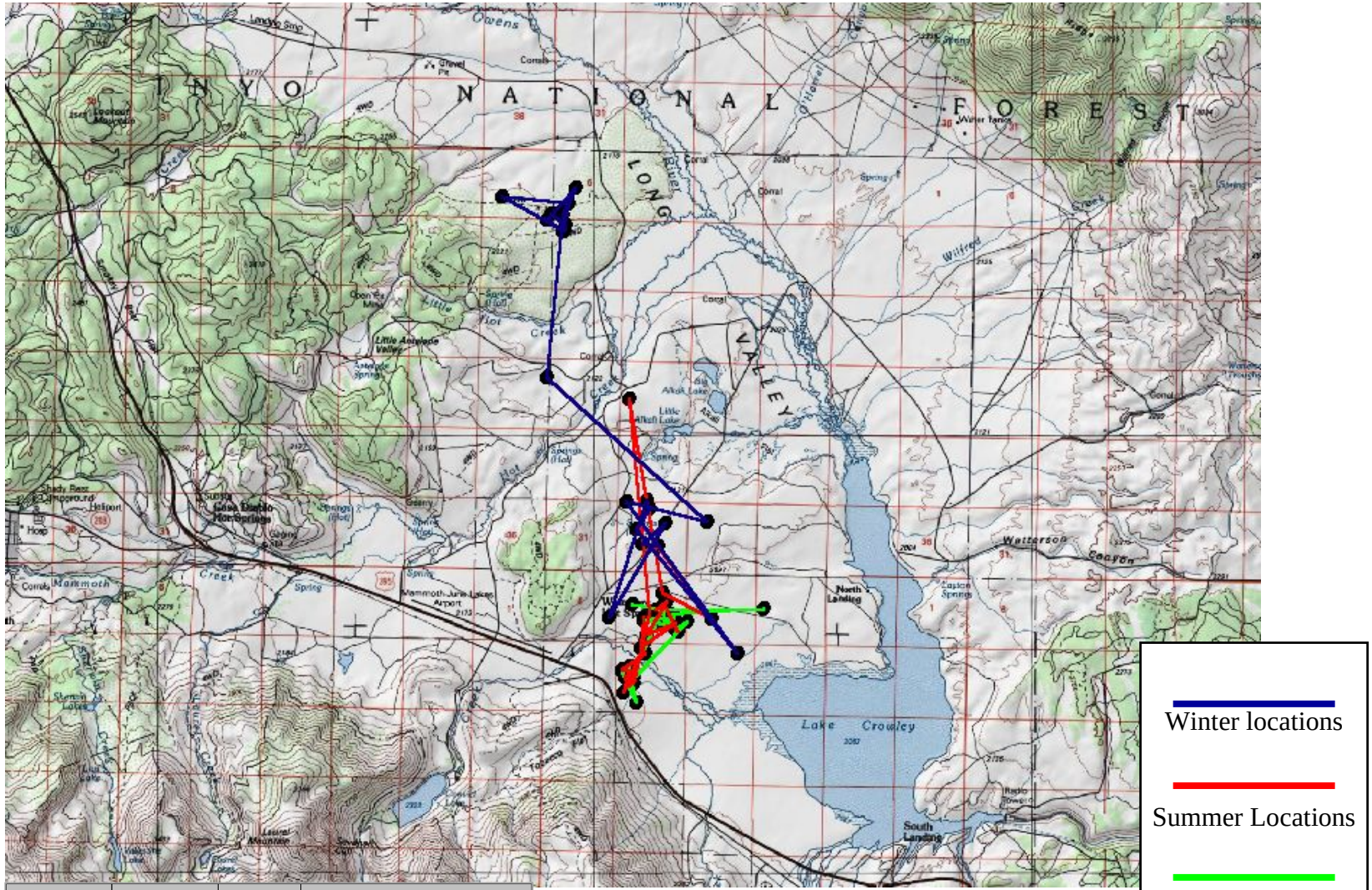
Spring Locations



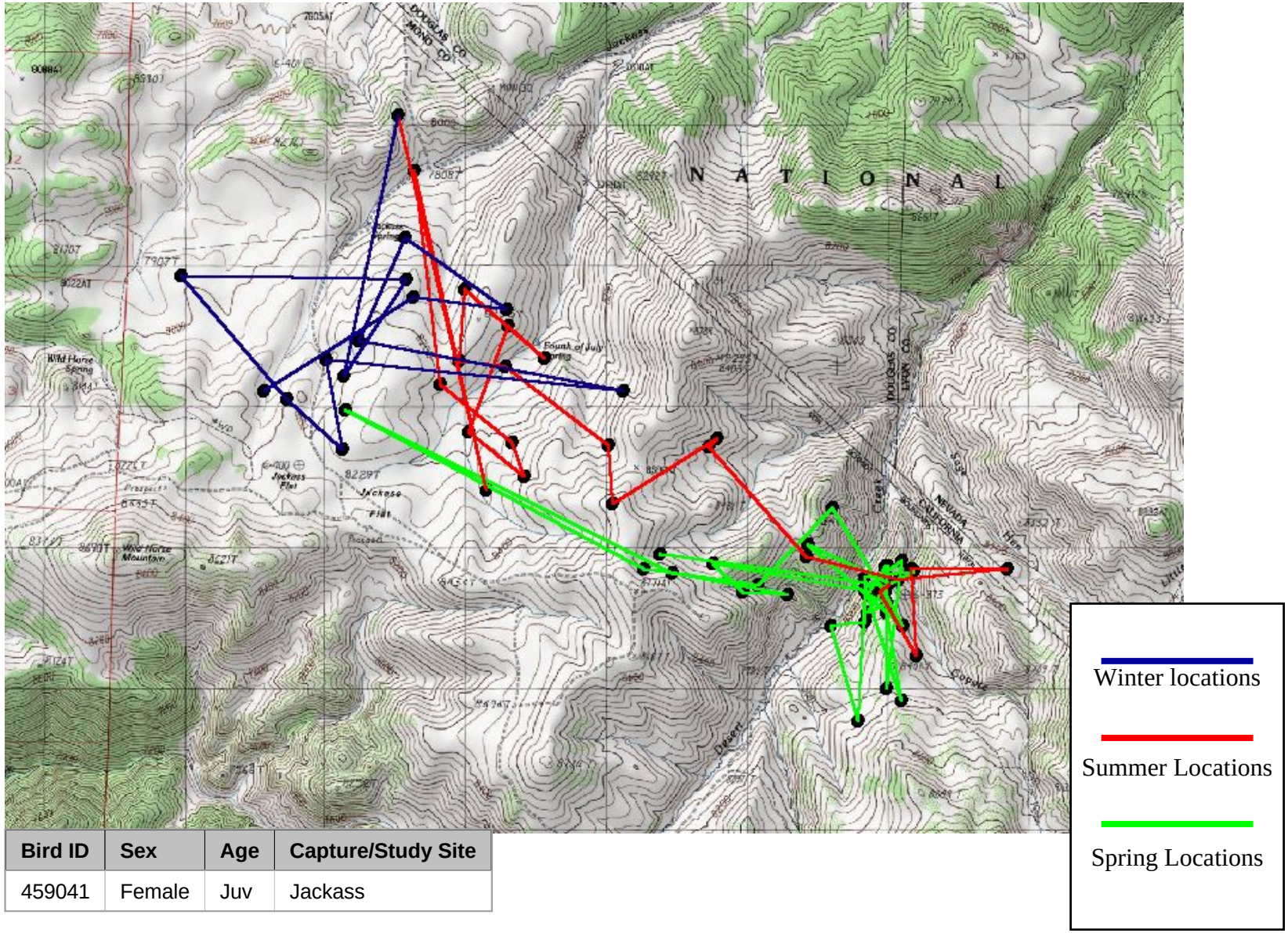
Bird ID	Sex	Age	Capture/Study Site
459037	Female	Juv	Jackass



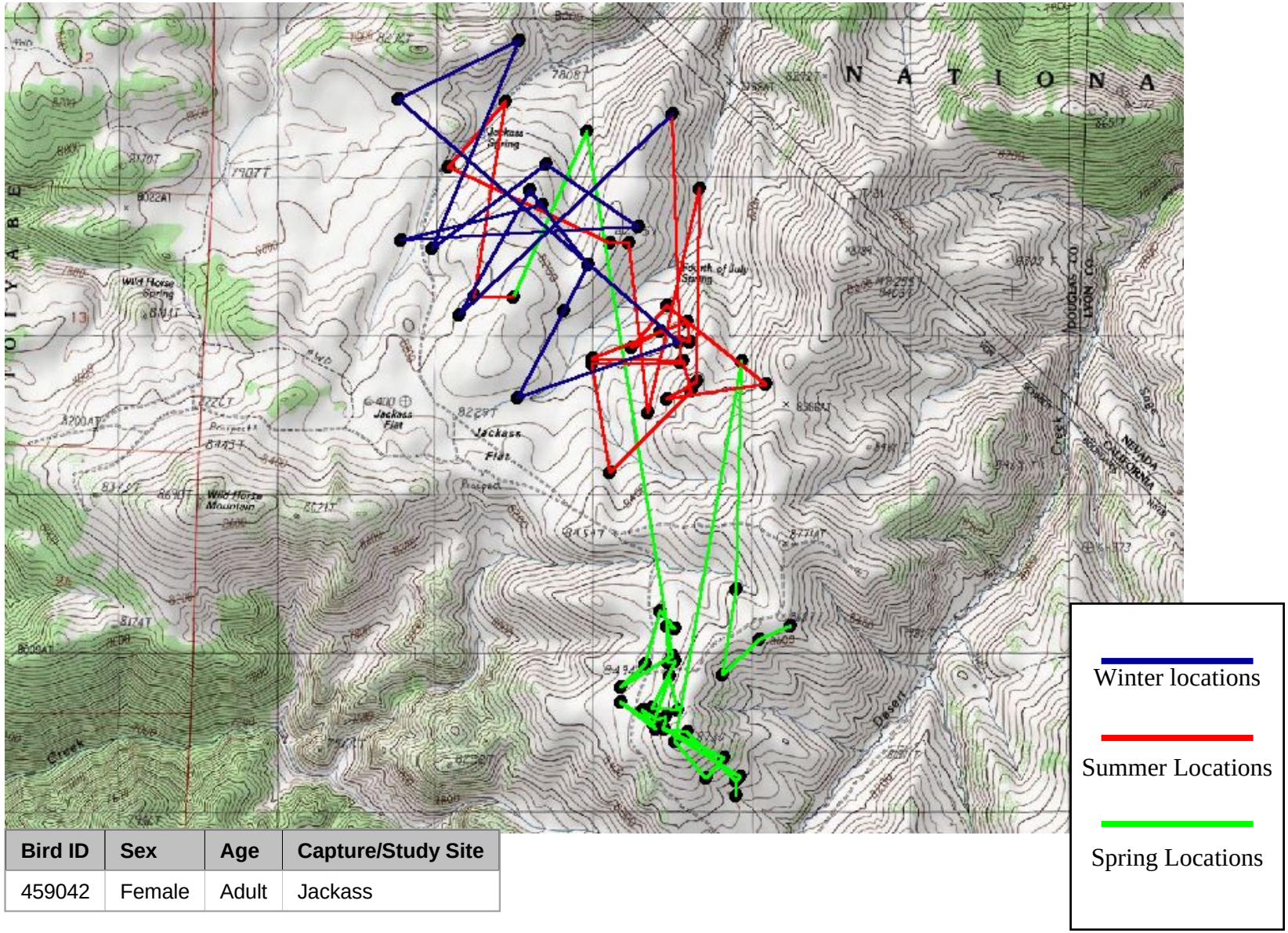
Bird ID	Sex	Age	Capture/Study Site
459038	Female	Adult	Parker



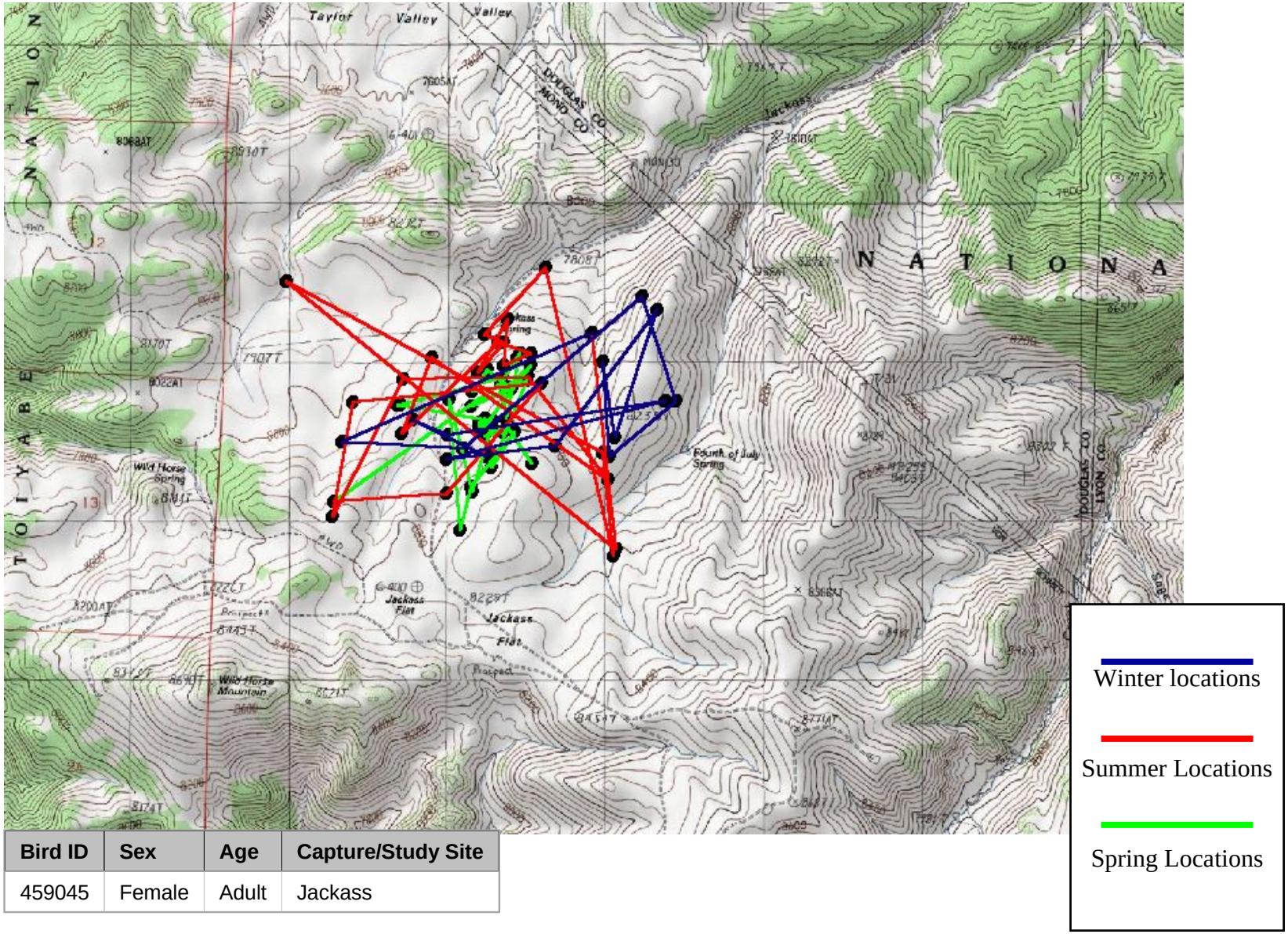
Bird ID	Sex	Age	Capture/Study Site
459040	Female	Adult	Long Valley



Bird ID	Sex	Age	Capture/Study Site
459041	Female	Juv	Jackass



Bird ID	Sex	Age	Capture/Study Site
459042	Female	Adult	Jackass



Bird ID	Sex	Age	Capture/Study Site
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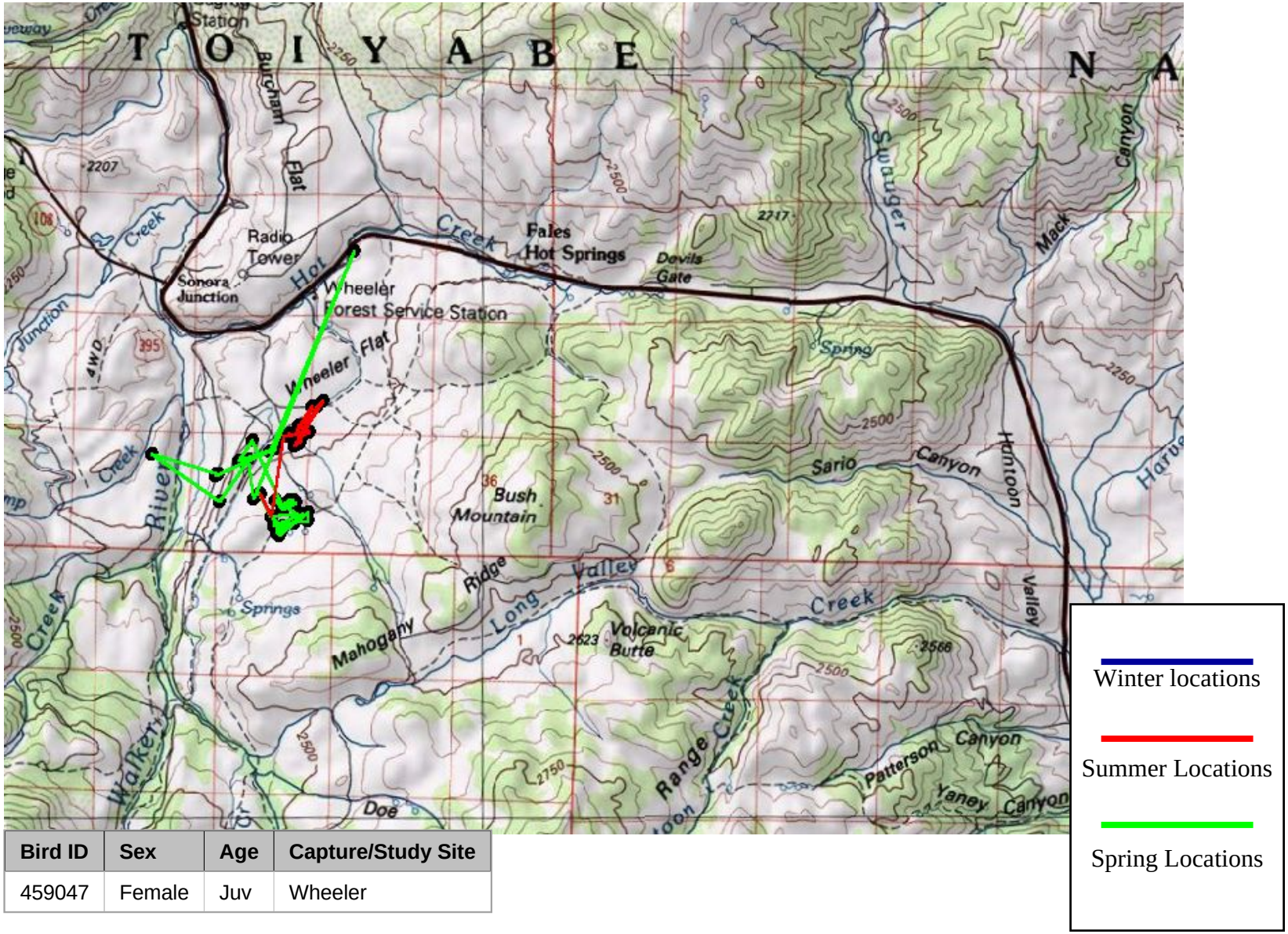
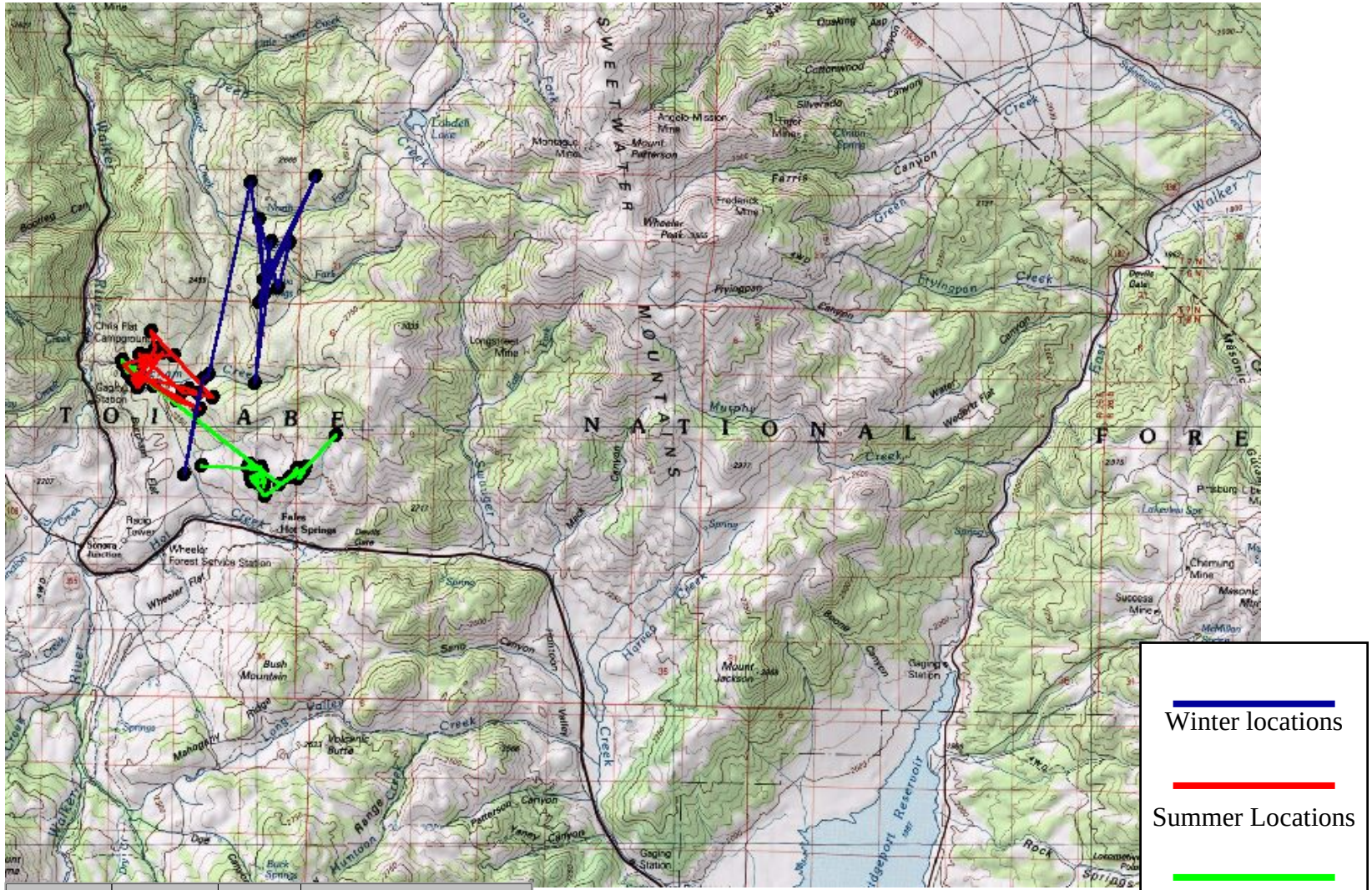


Bird ID	Sex	Age	Capture/Study Site
459047	Female	Juv	Wheeler

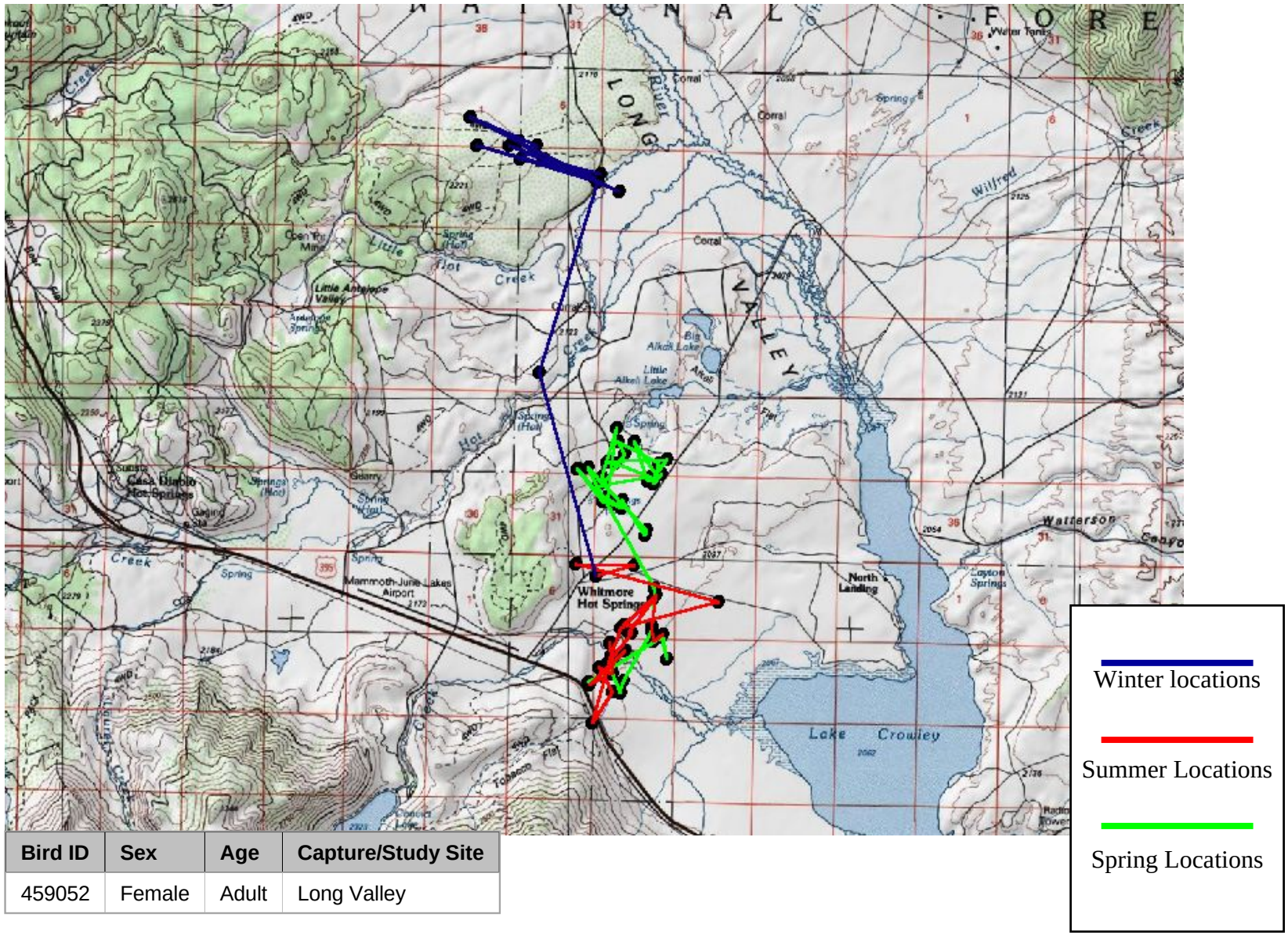
Winter locations

Summer Locations

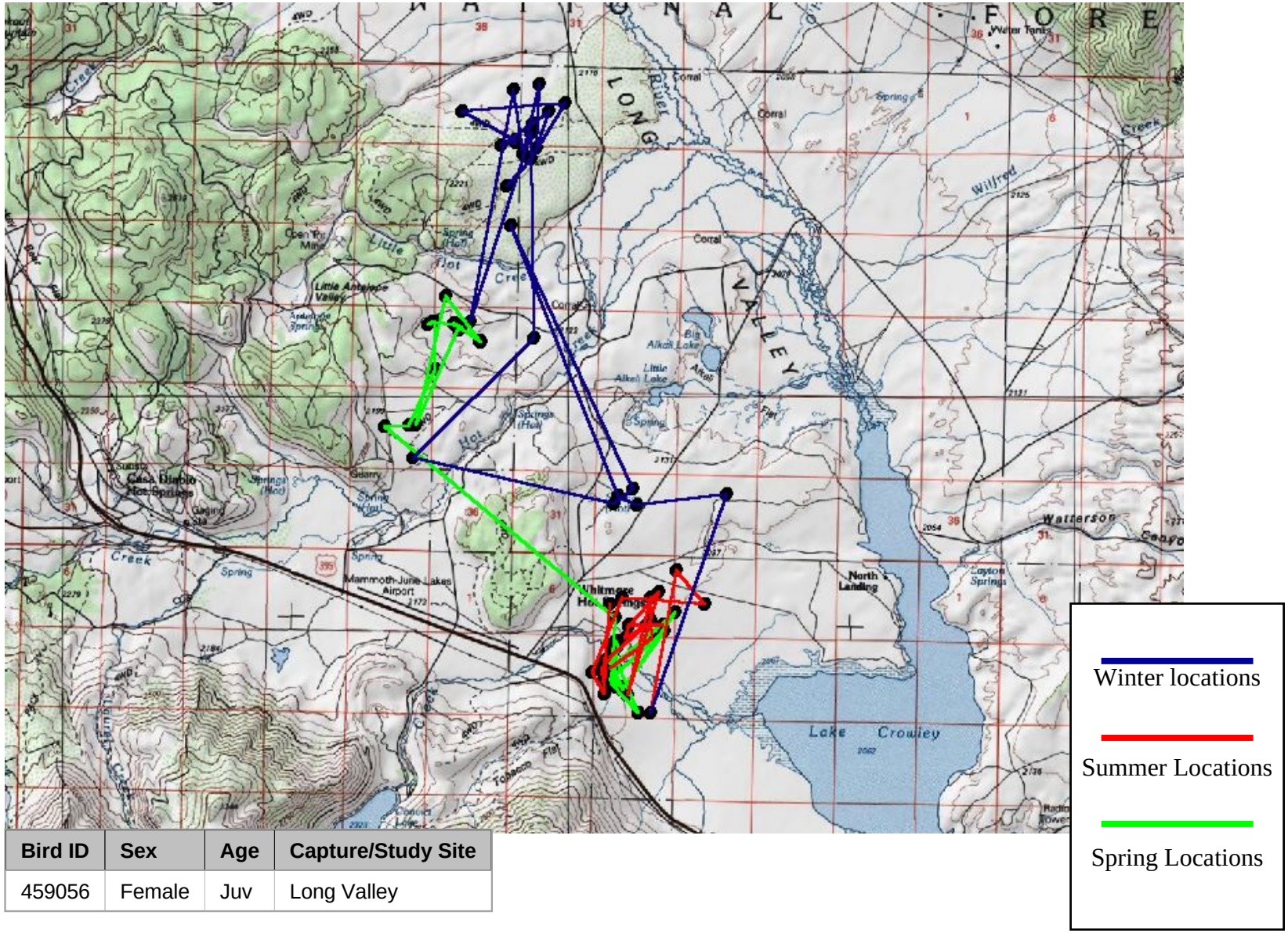
Spring Locations



Bird ID	Sex	Age	Capture/Study Site
459048	Female	Adult	Burcham Flat



Bird ID	Sex	Age	Capture/Study Site
459052	Female	Adult	Long Valley



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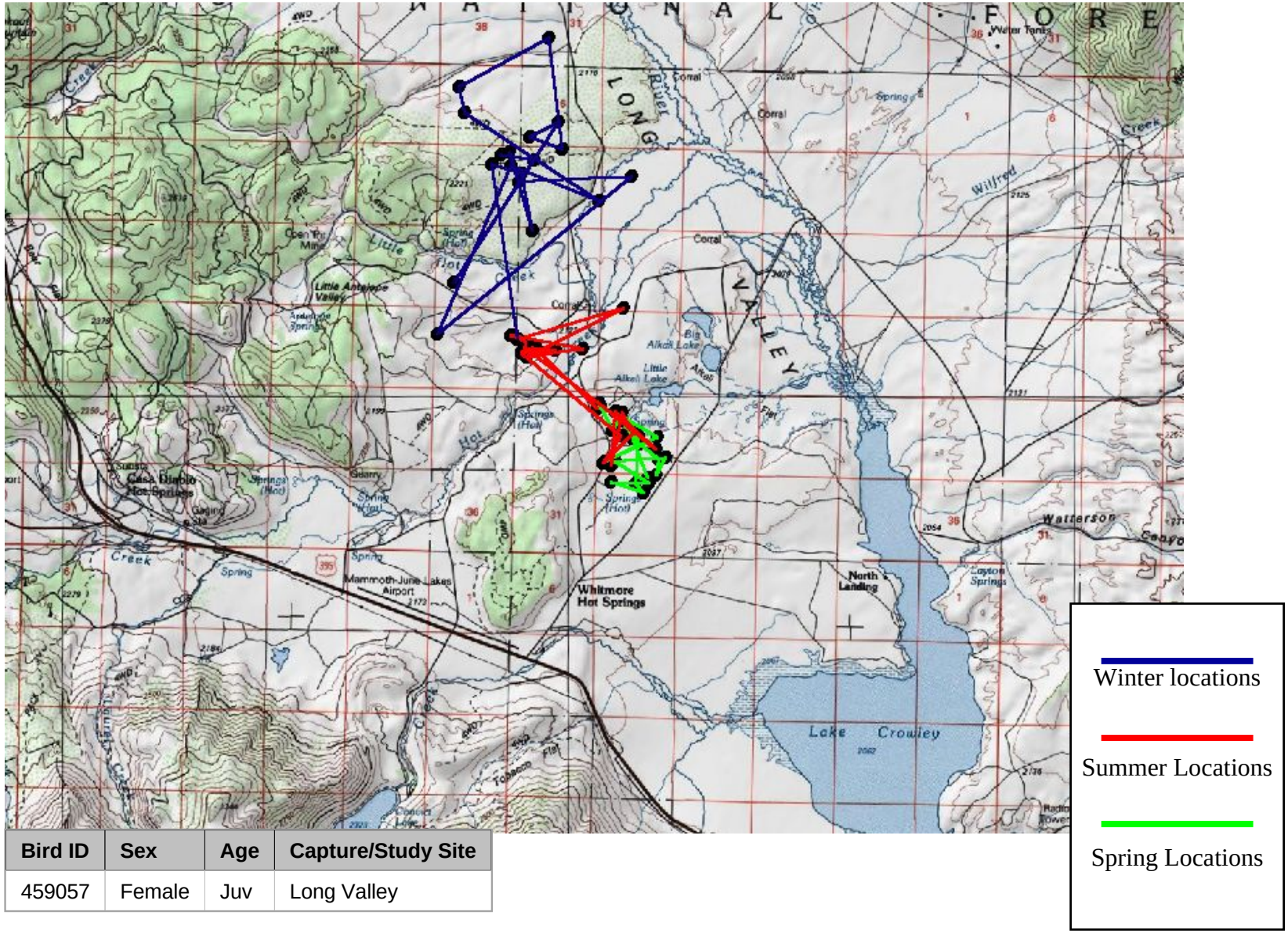

Bird ID	Sex	Age	Capture/Study Site
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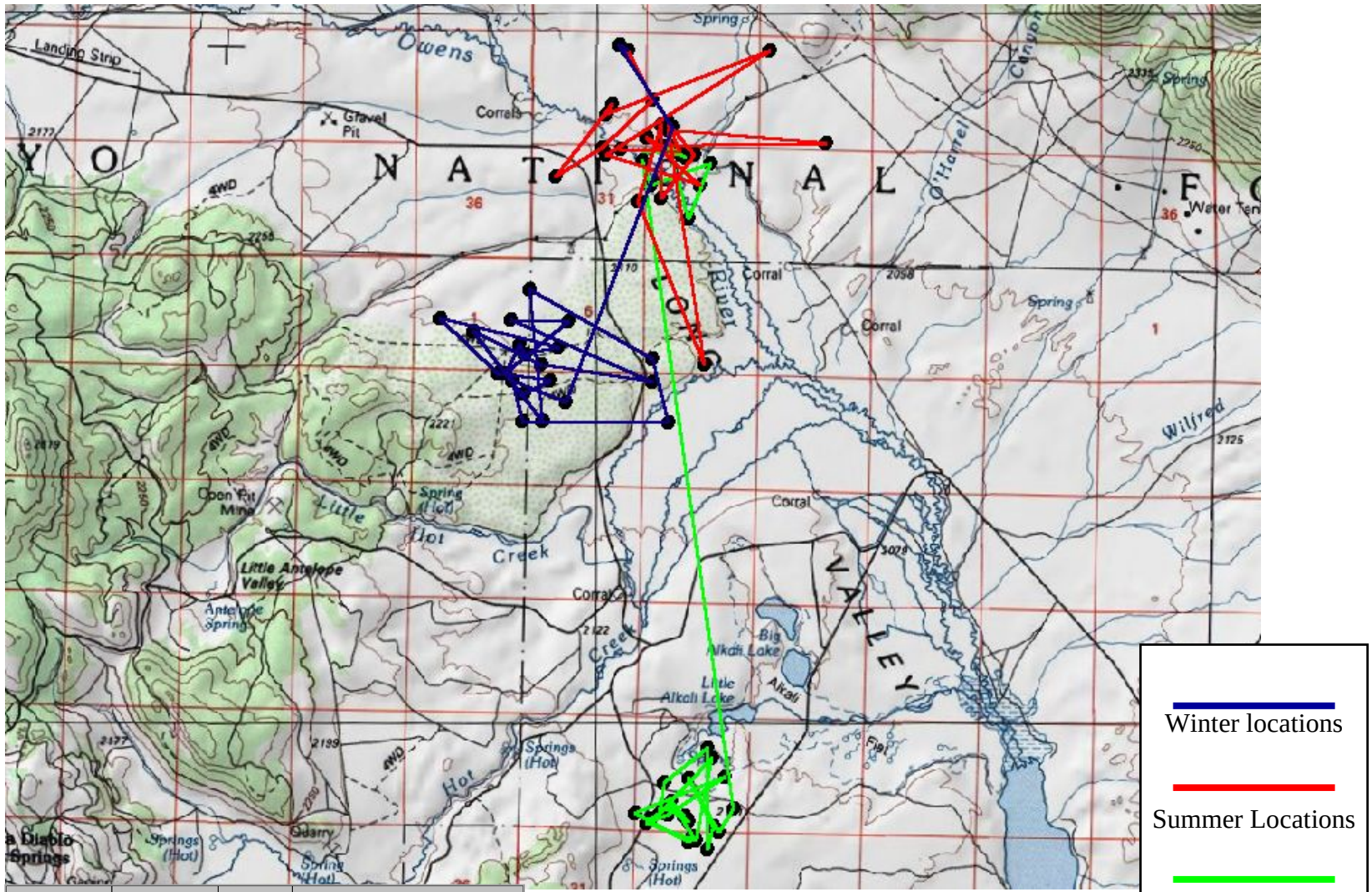

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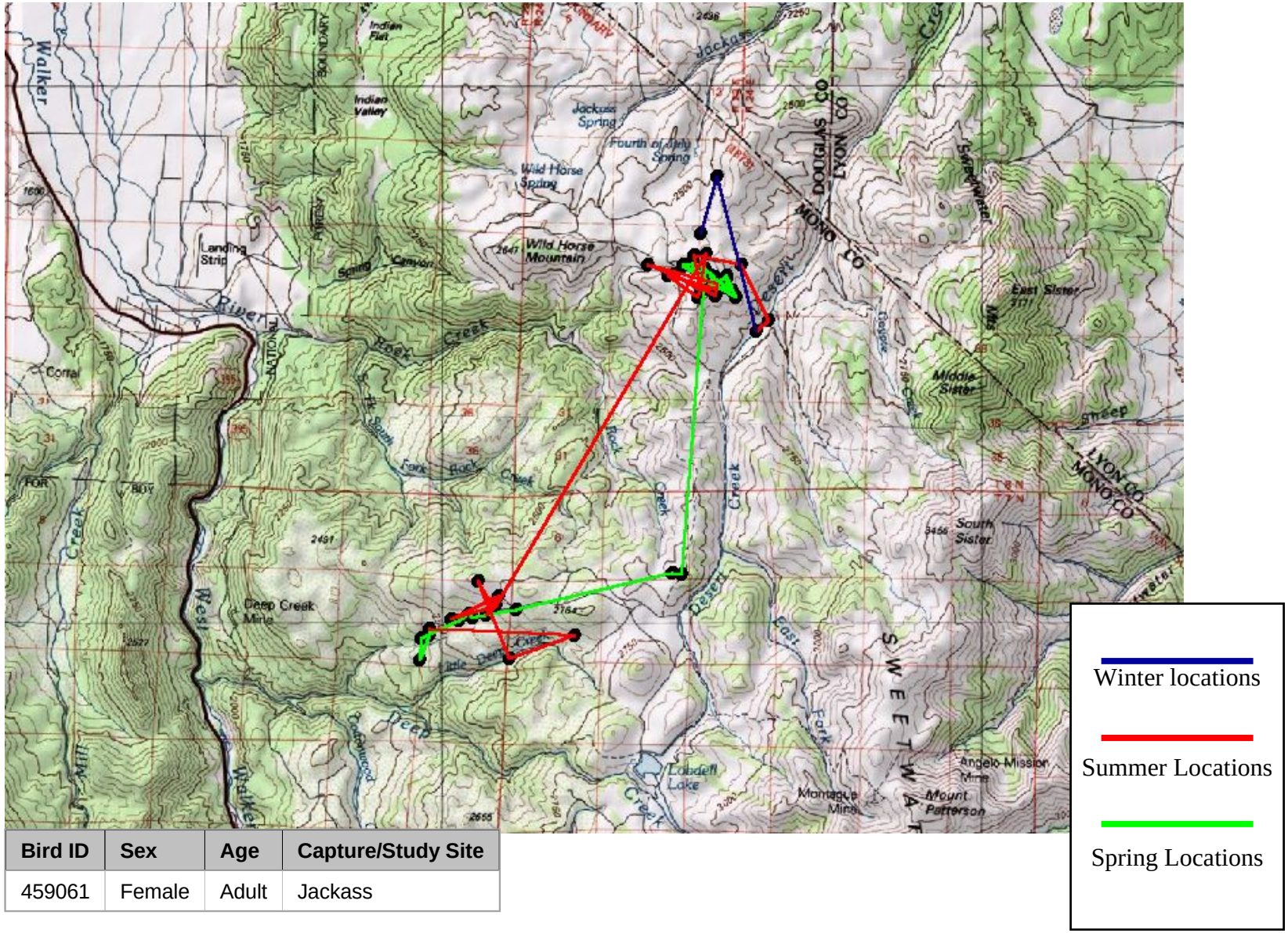

Bird ID	Sex	Age	Capture/Study Site
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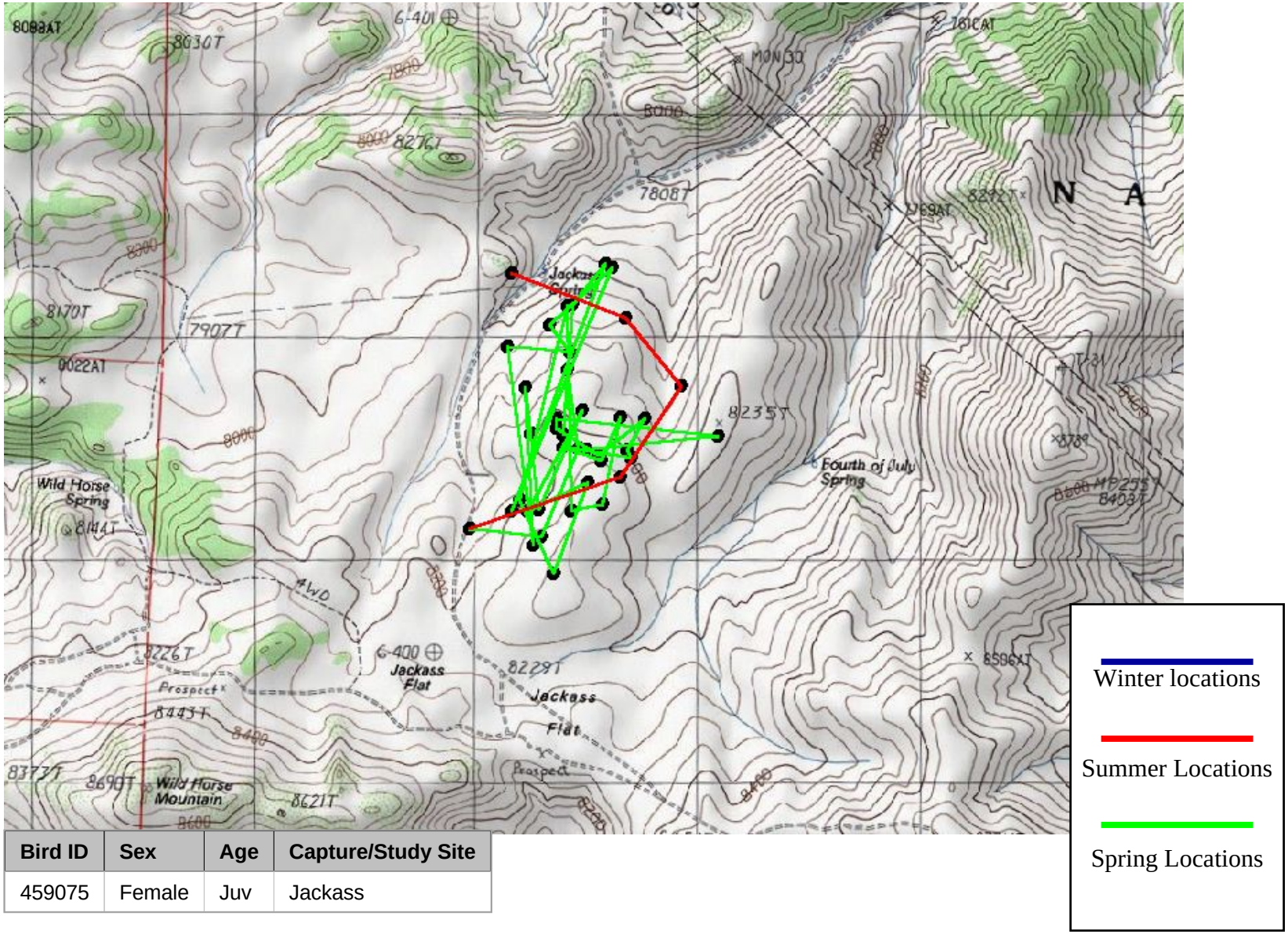

Bird ID	Sex	Age	Capture/Study Site
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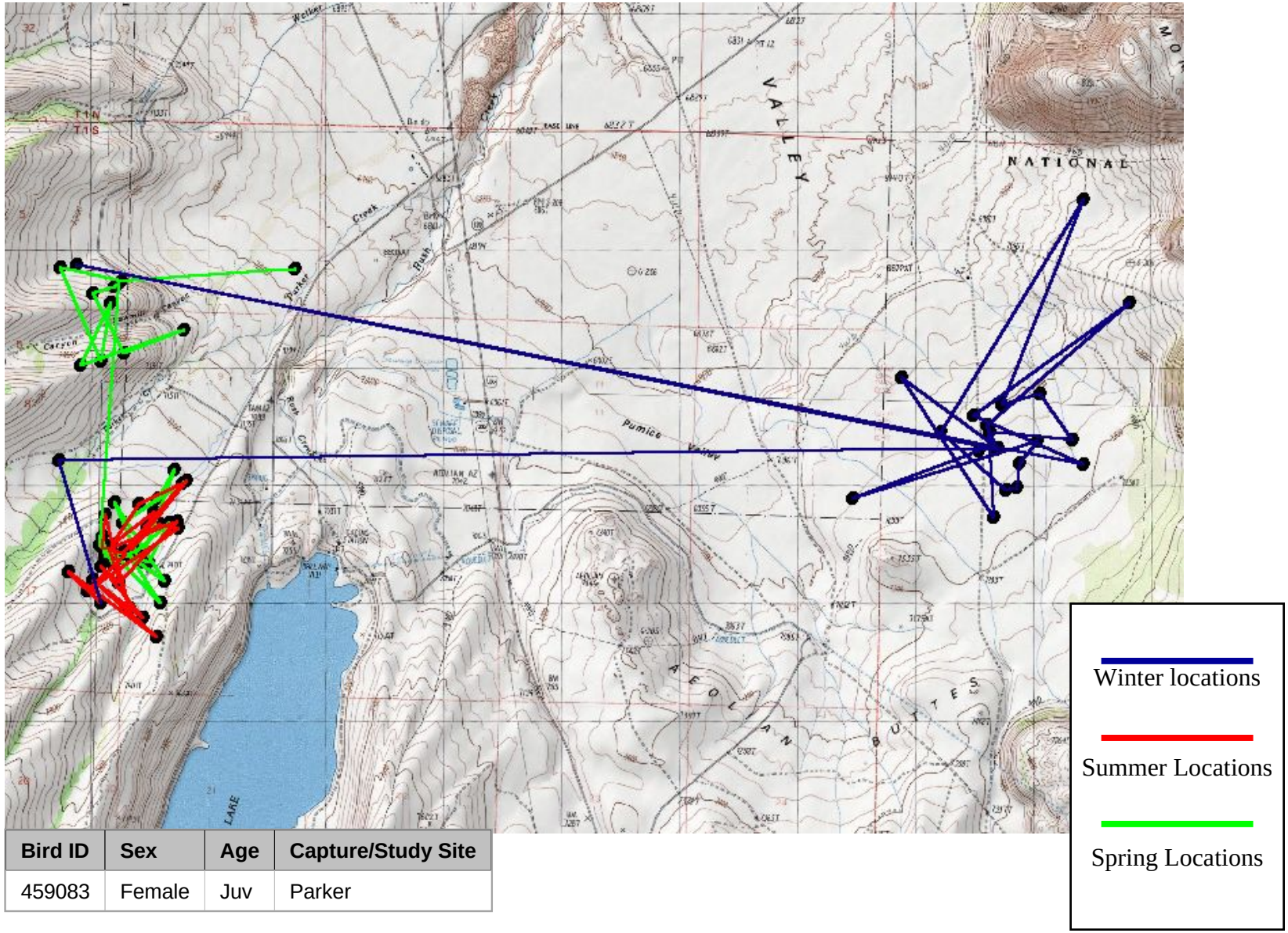
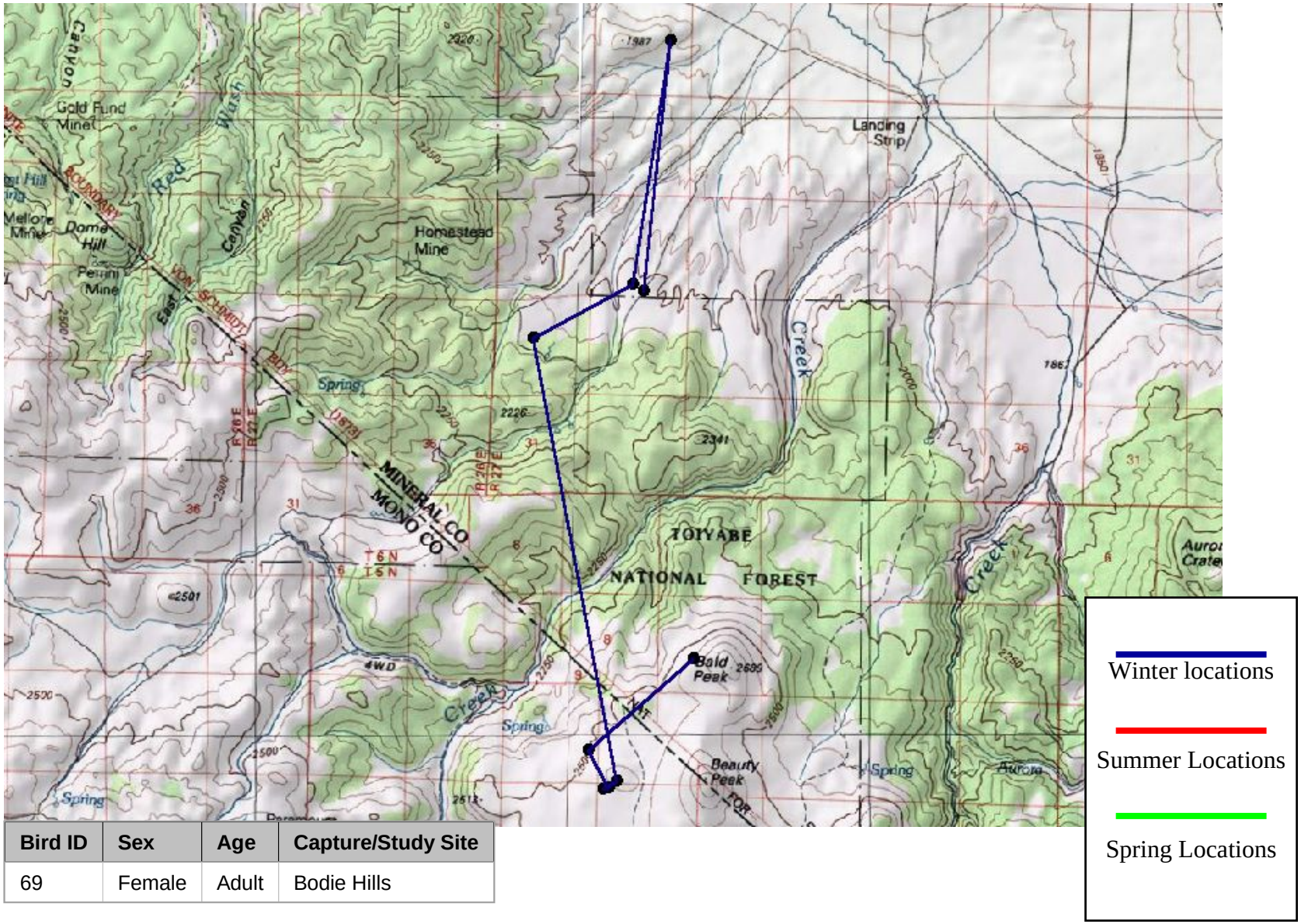
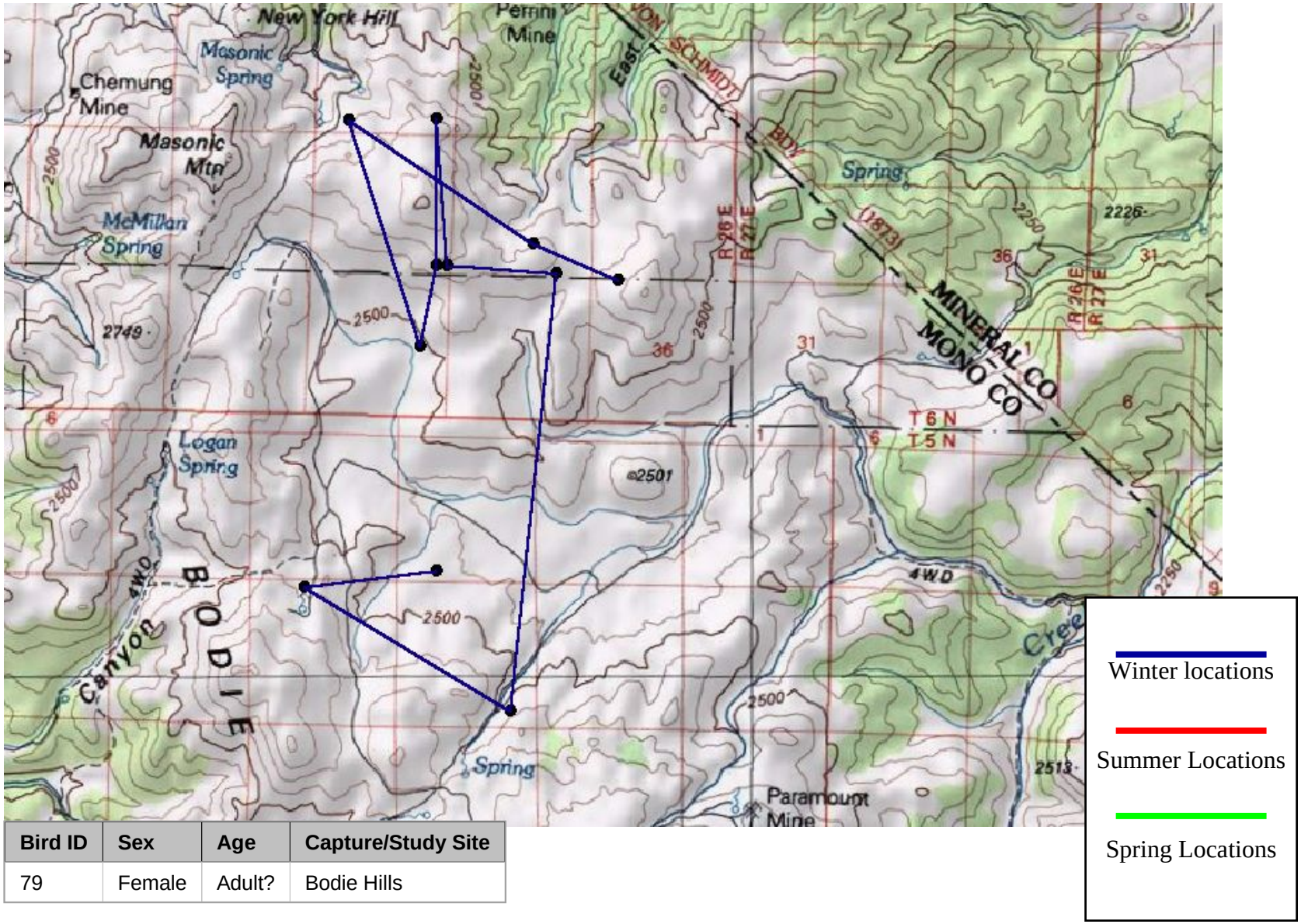


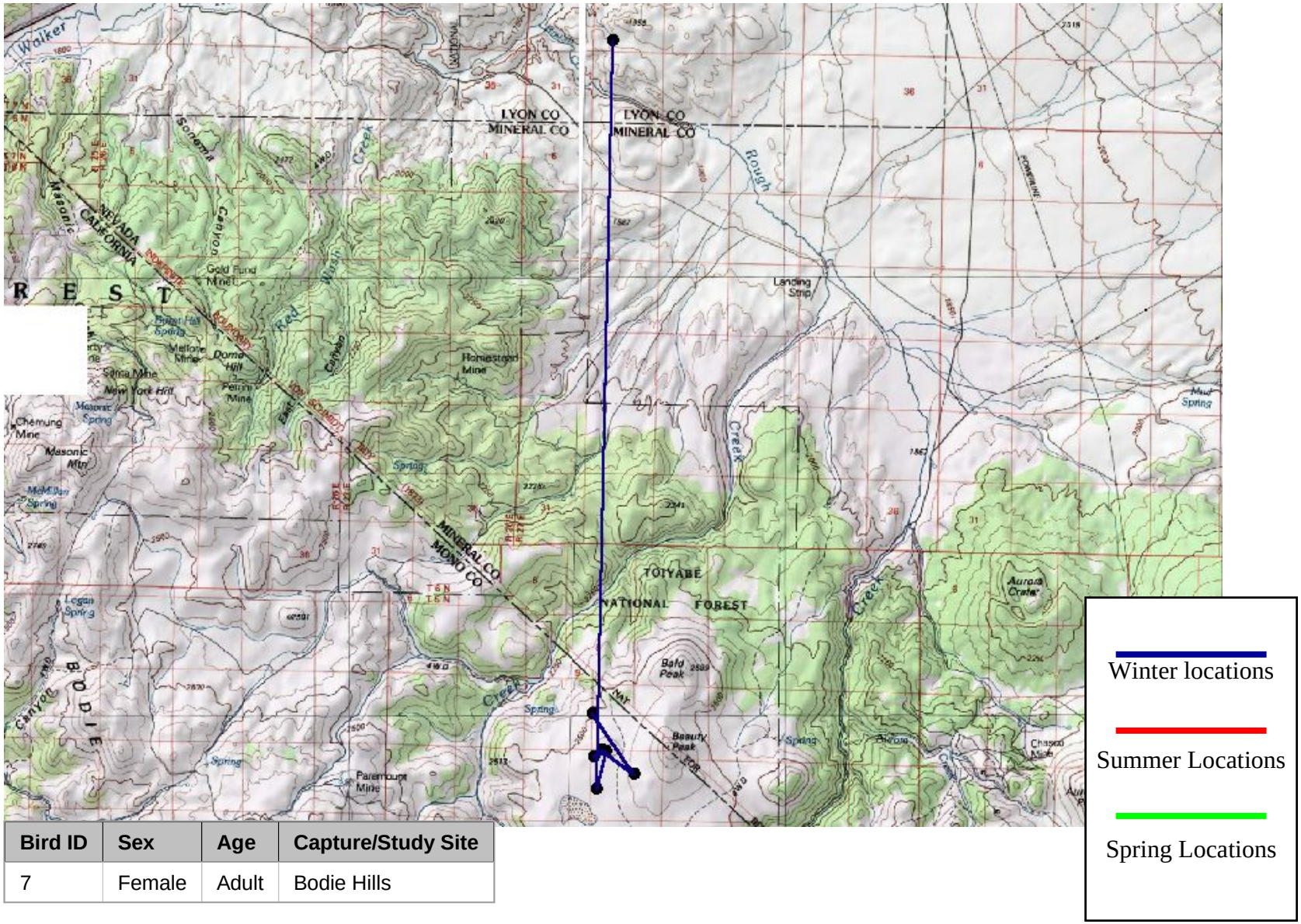
Bird ID	Sex	Age	Capture/Study Site
459083	Female	Juv	Parker



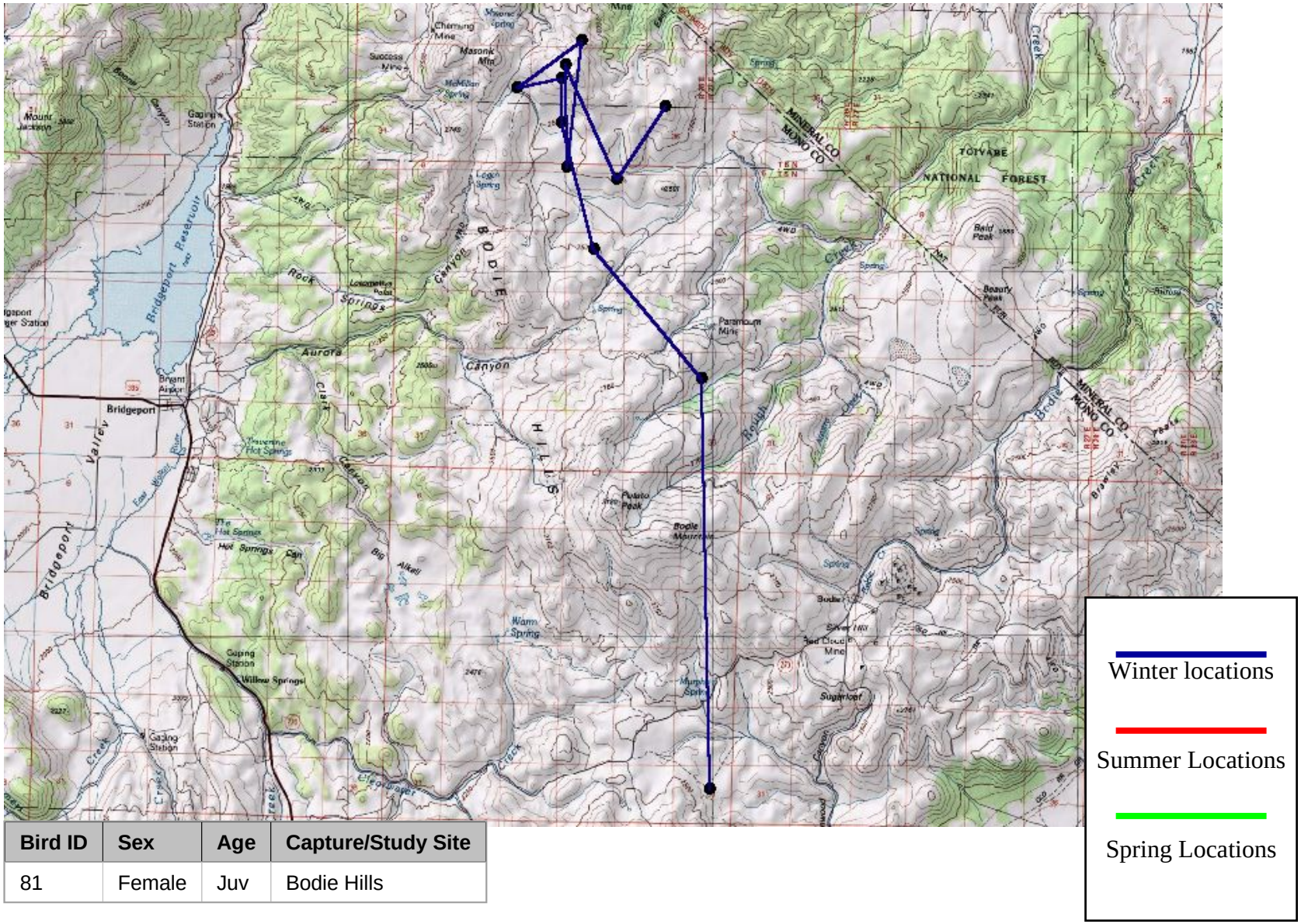
Bird ID	Sex	Age	Capture/Study Site
69	Female	Adult	Bodie Hills



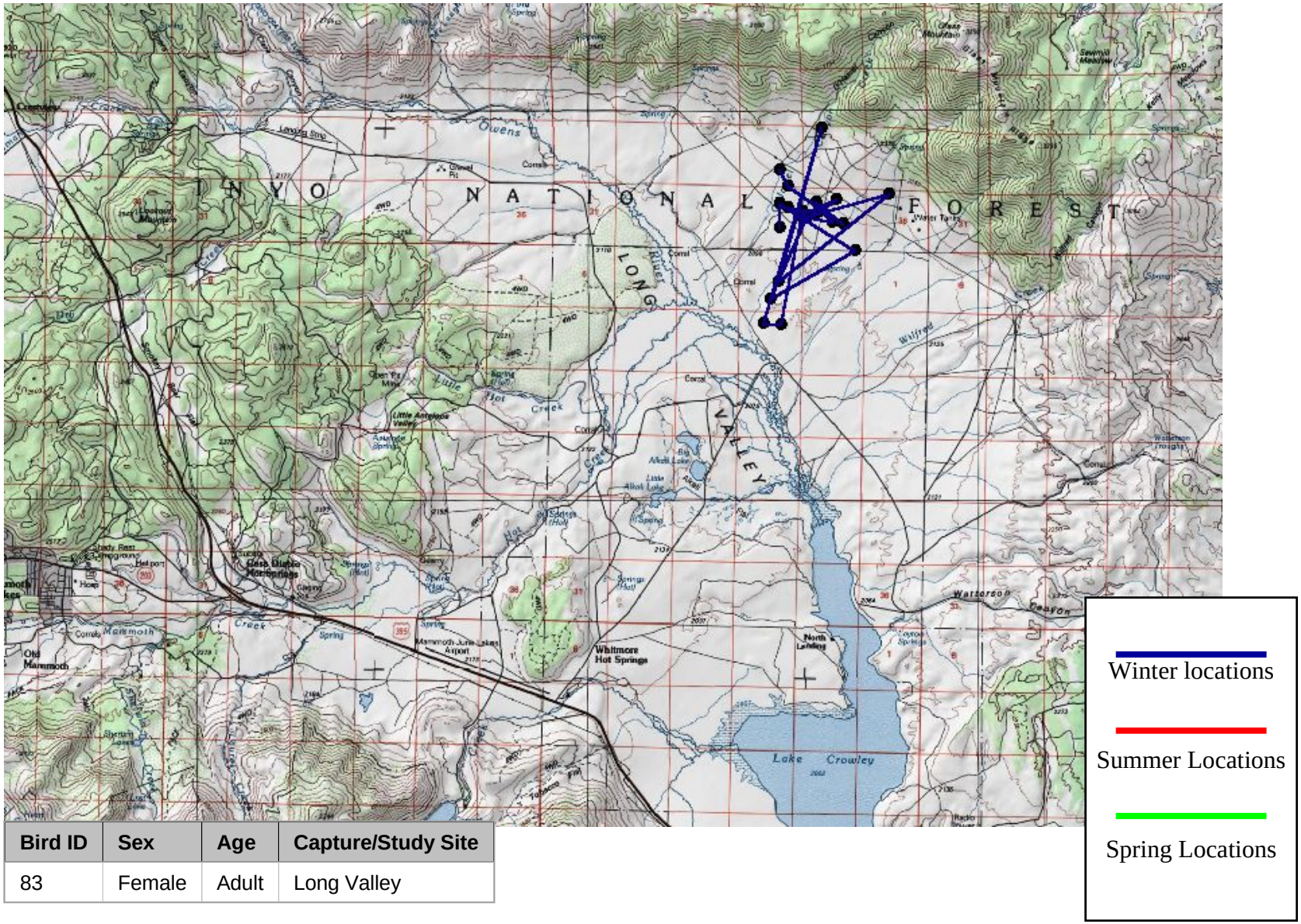
Bird ID	Sex	Age	Capture/Study Site
79	Female	Adult?	Bodie Hills



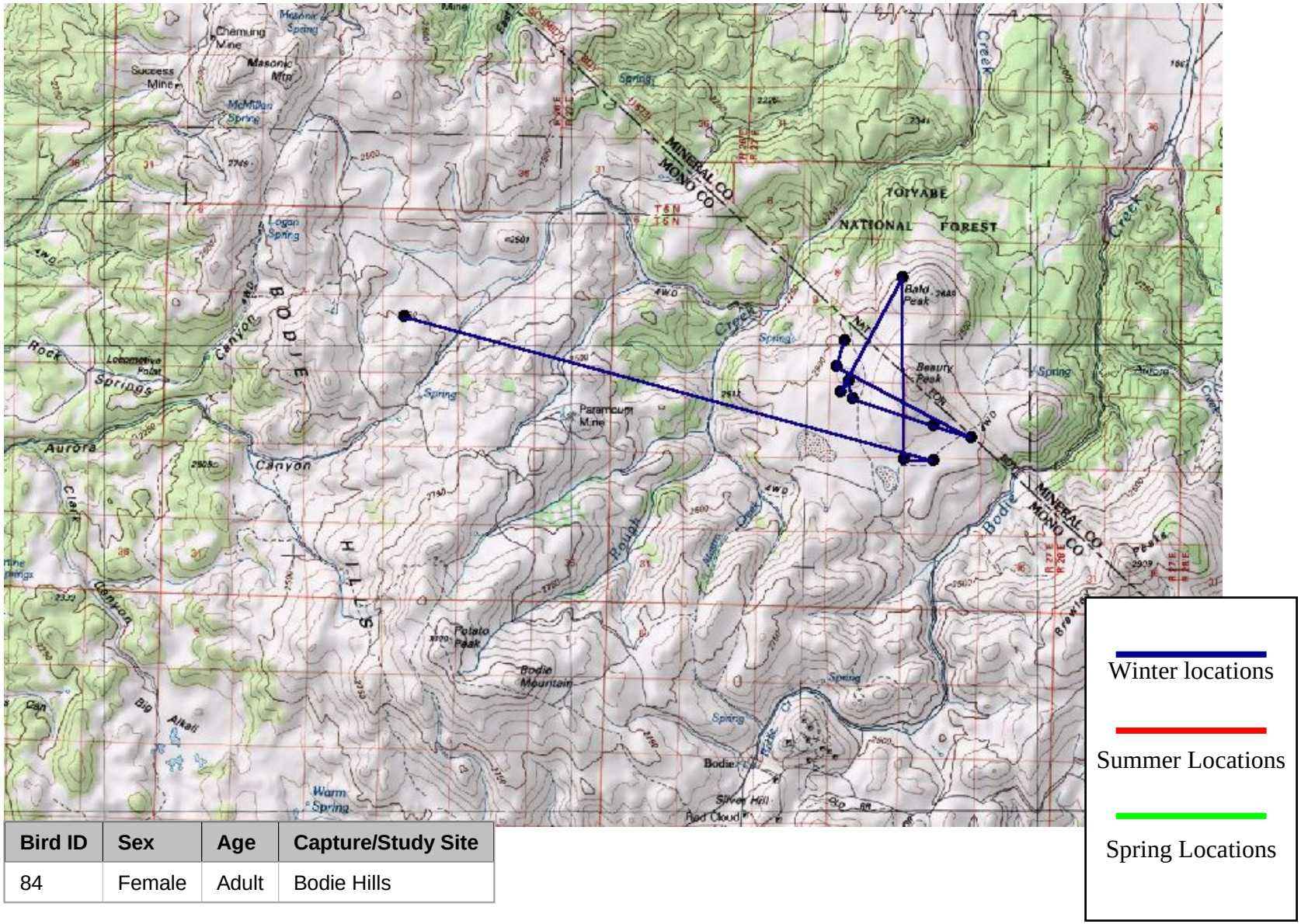
Bird ID	Sex	Age	Capture/Study Site
7	Female	Adult	Bodie Hills



Bird ID	Sex	Age	Capture/Study Site
81	Female	Juv	Bodie Hills



Bird ID	Sex	Age	Capture/Study Site
83	Female	Adult	Long Valley



Bird ID	Sex	Age	Capture/Study Site
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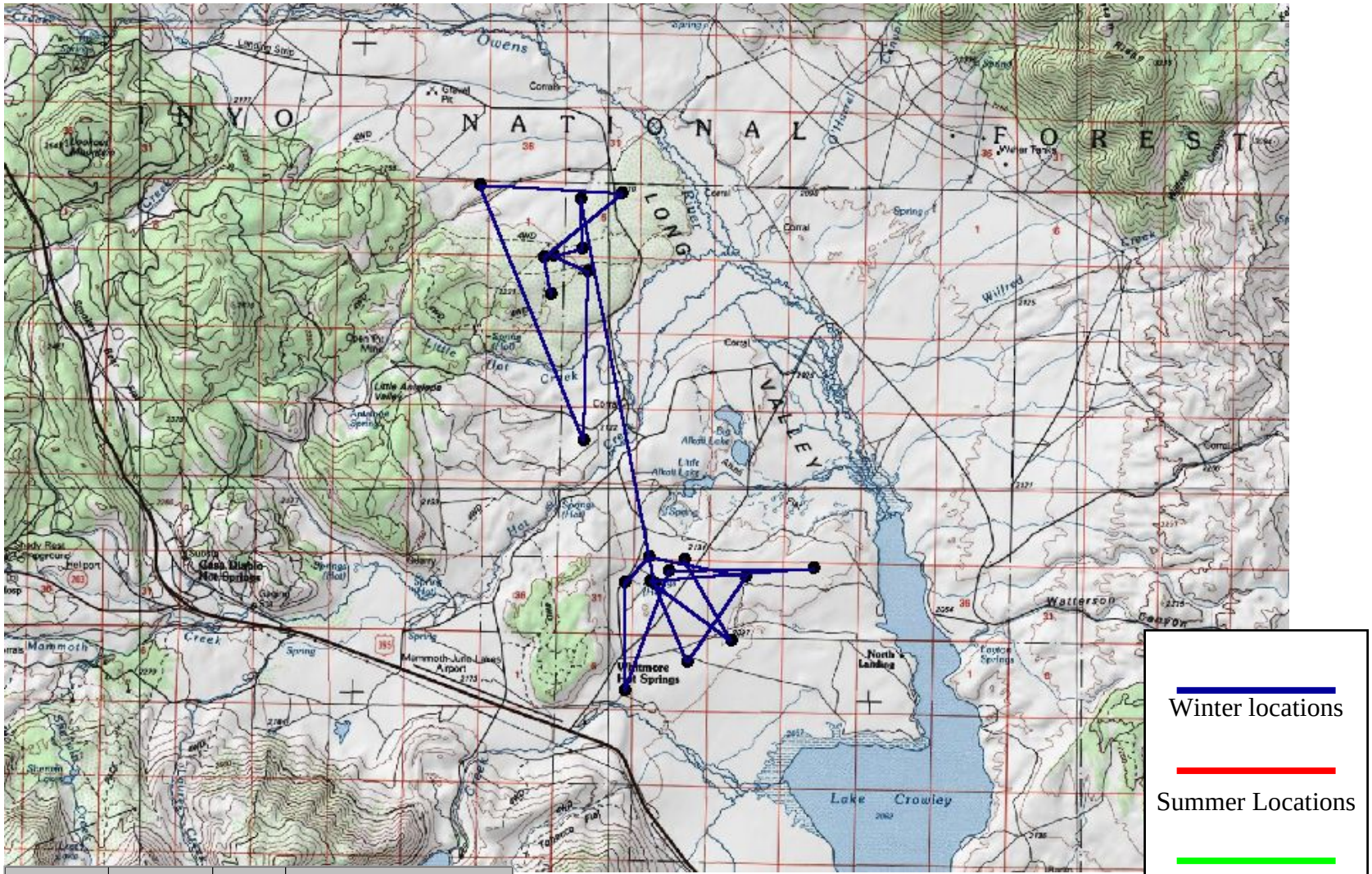
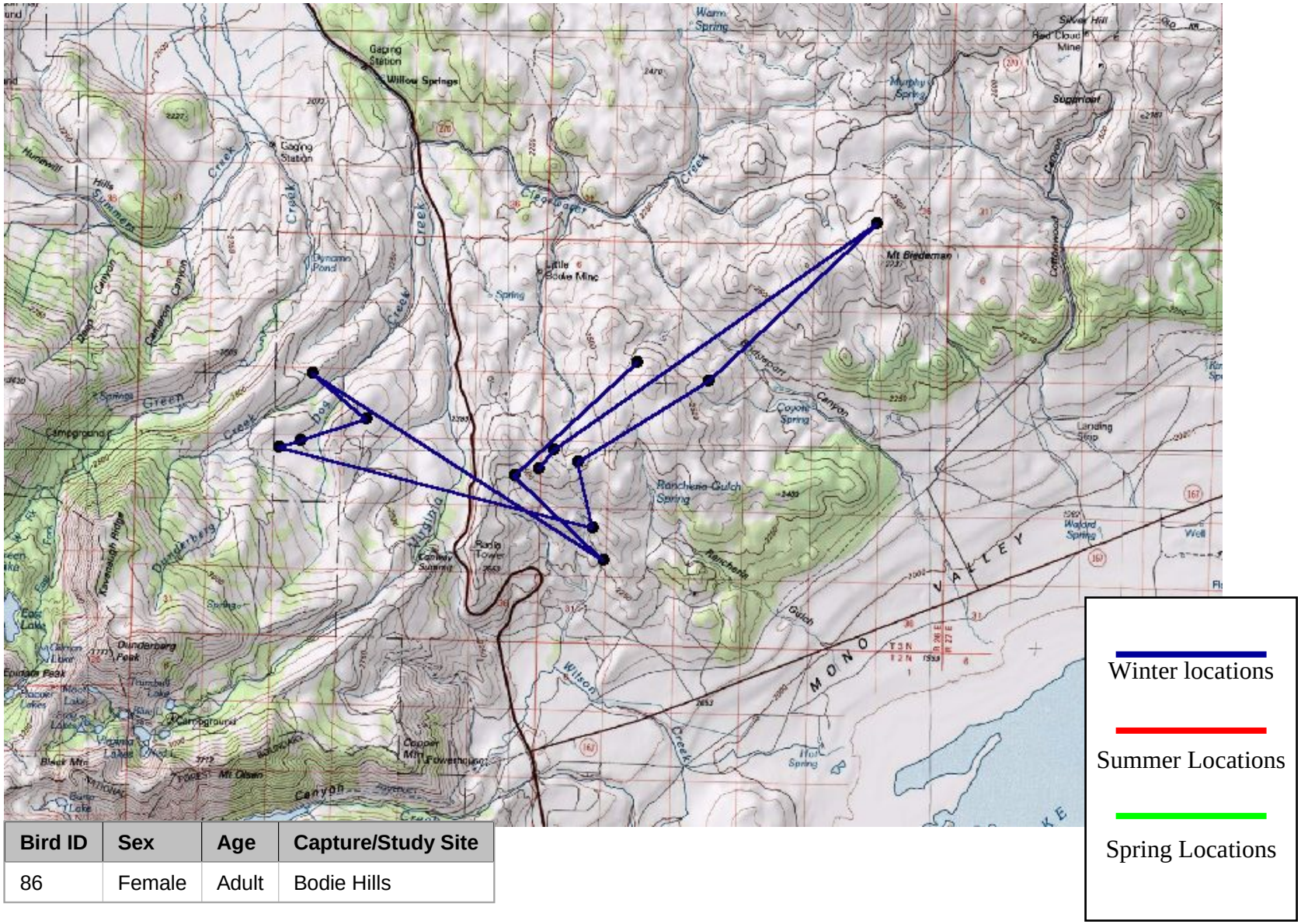
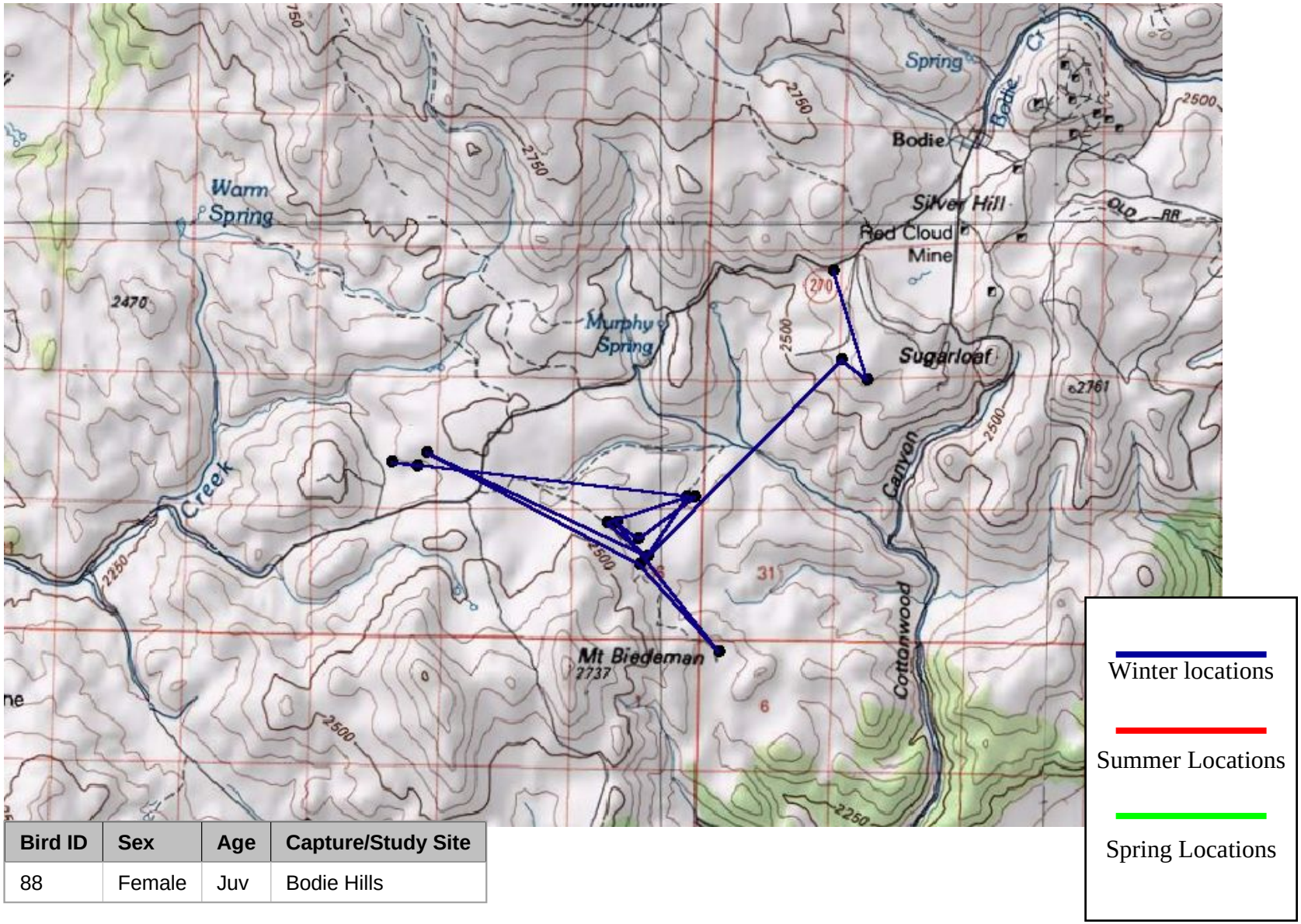


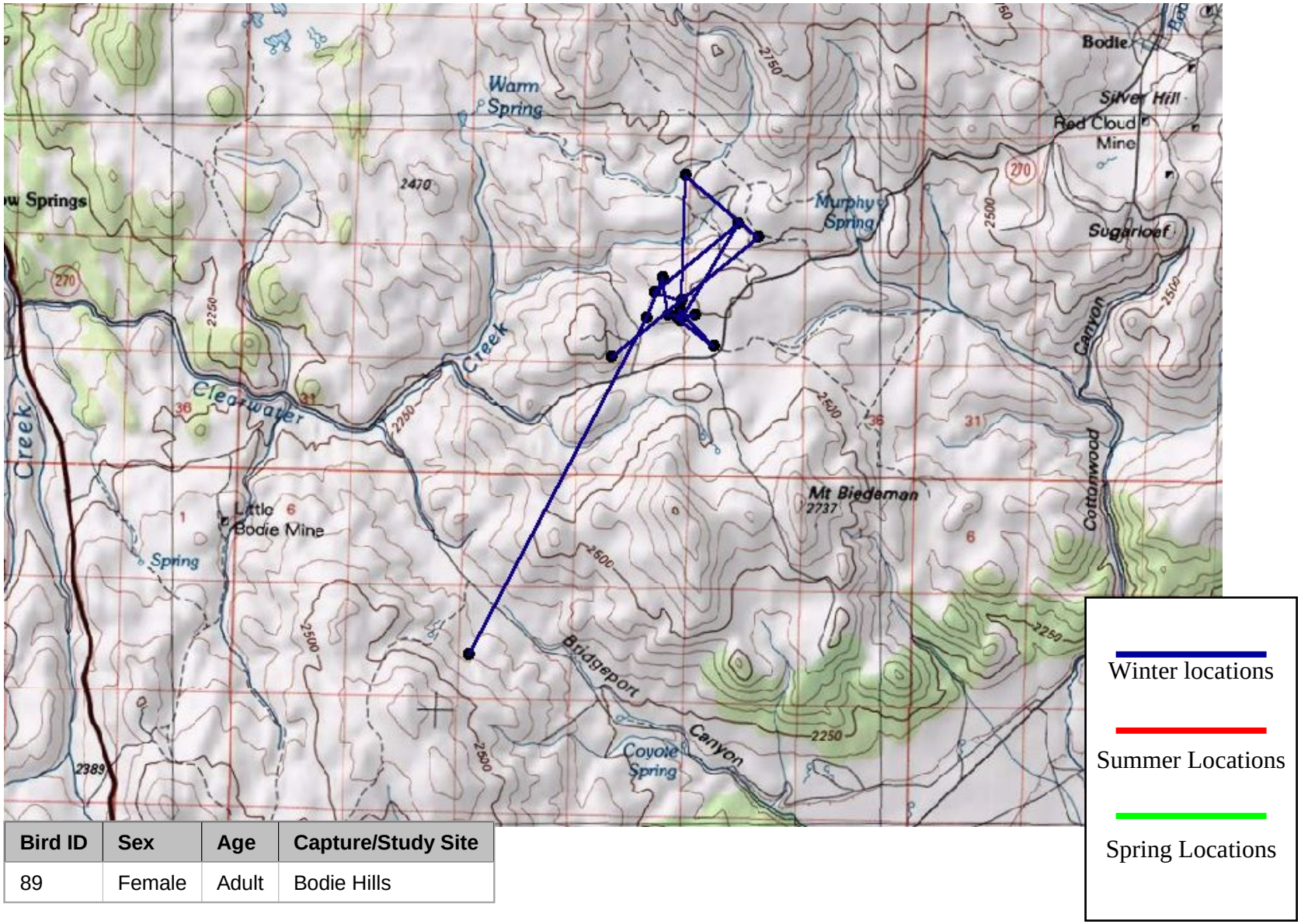
Bird ID	Sex	Age	Capture/Study Site
85	Female	Juv	Long Valley



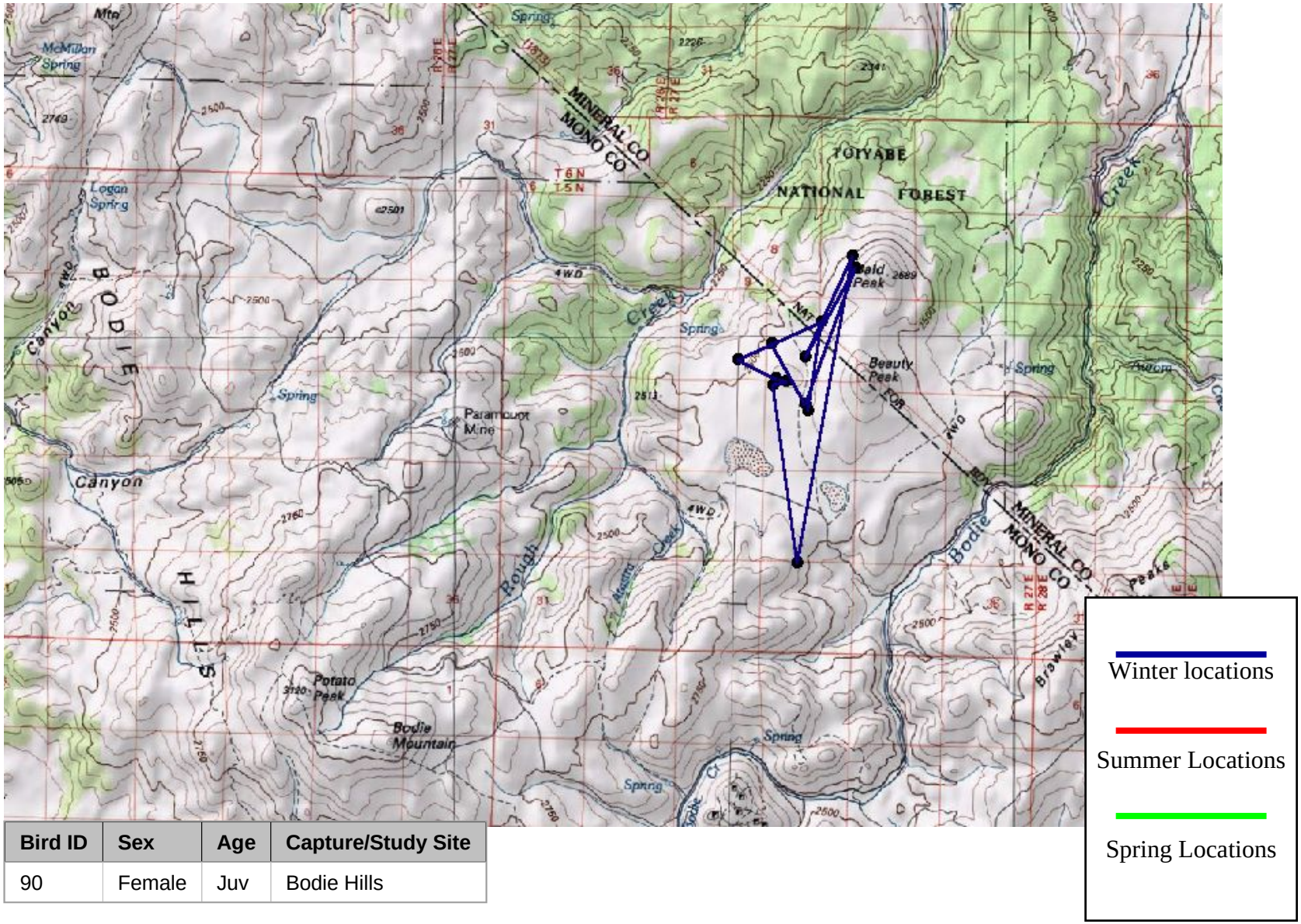
Bird ID	Sex	Age	Capture/Study Site
86	Female	Adult	Bodie Hills



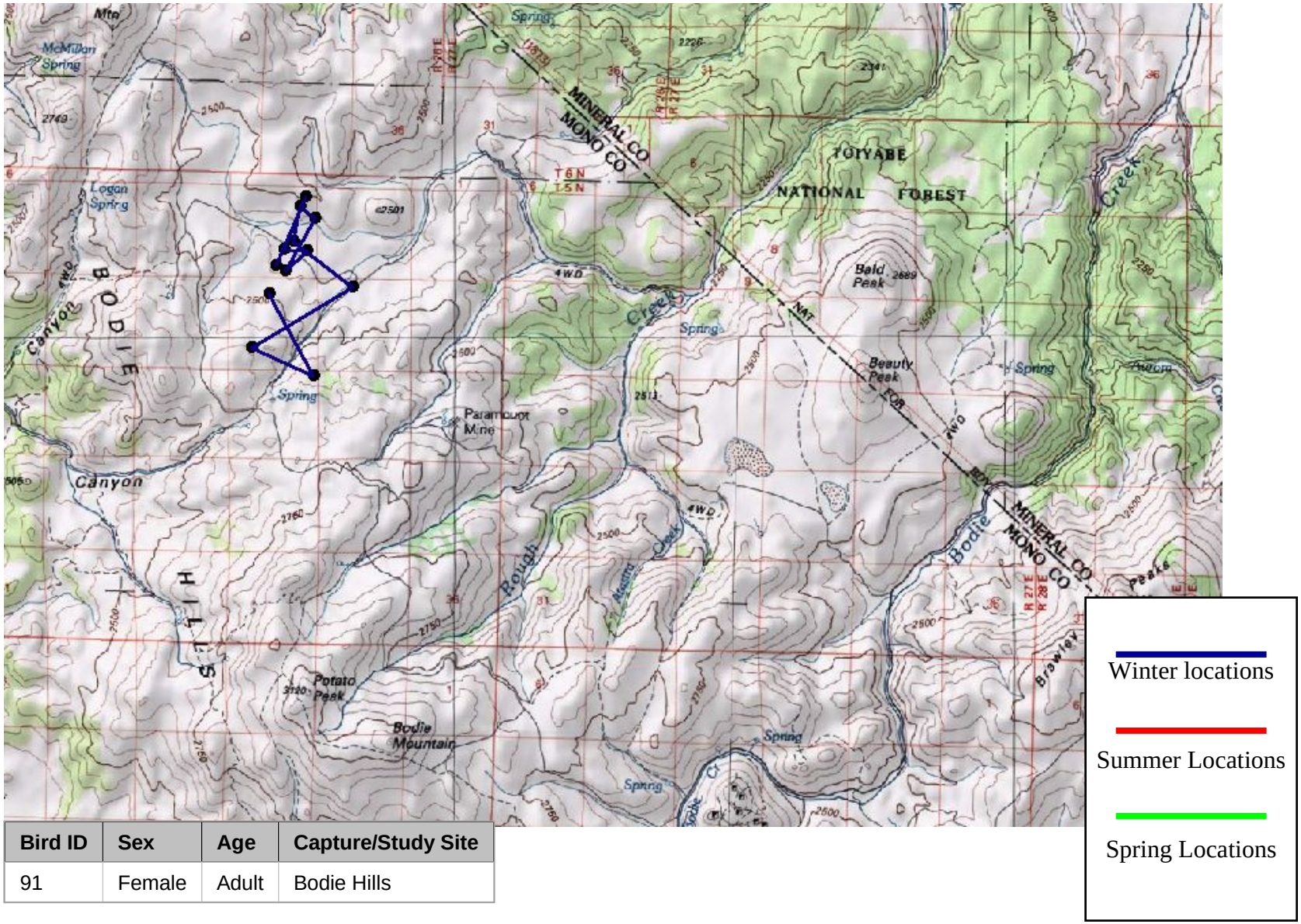
Bird ID	Sex	Age	Capture/Study Site
88	Female	Juv	Bodie Hills



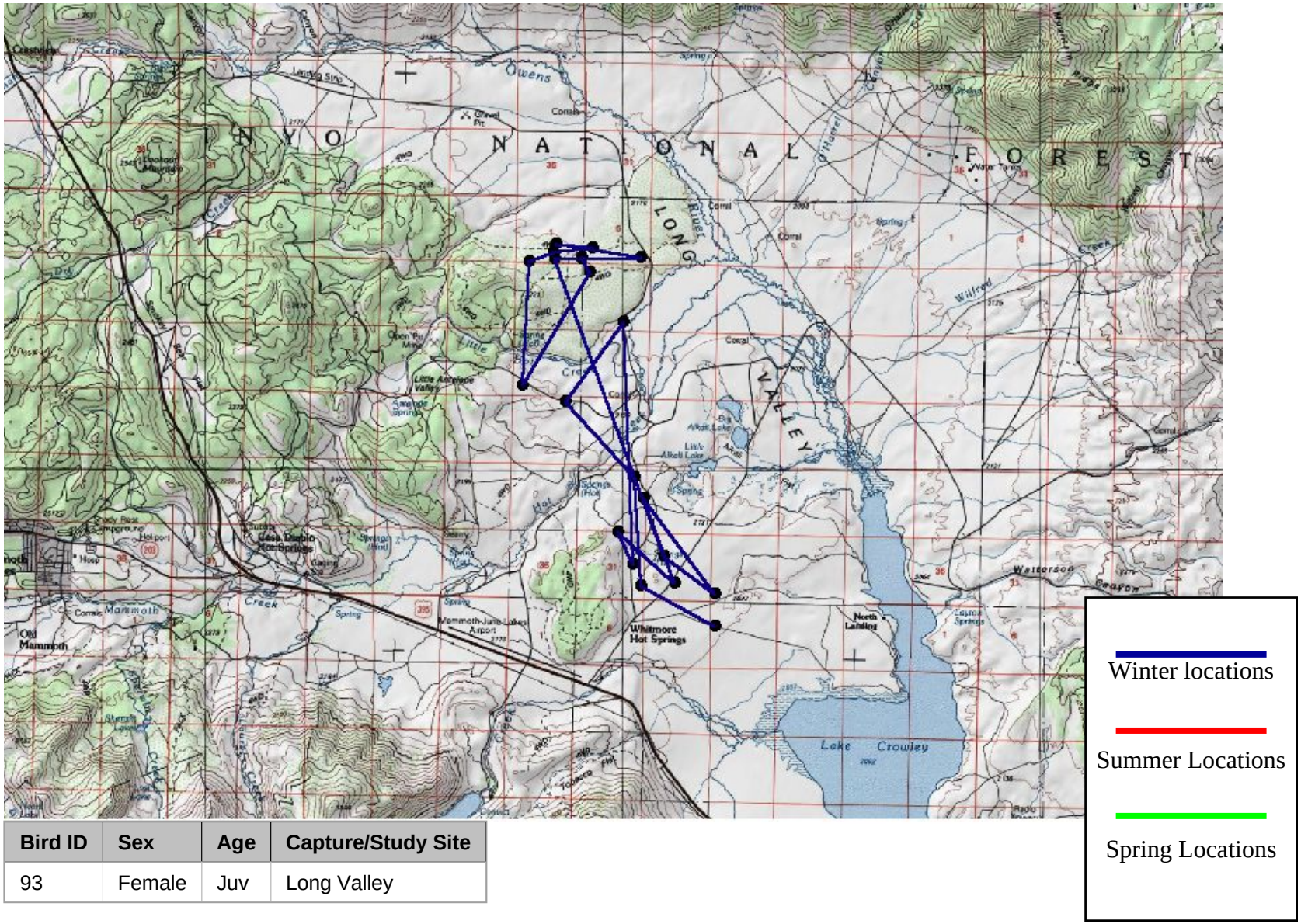
Bird ID	Sex	Age	Capture/Study Site
89	Female	Adult	Bodie Hills



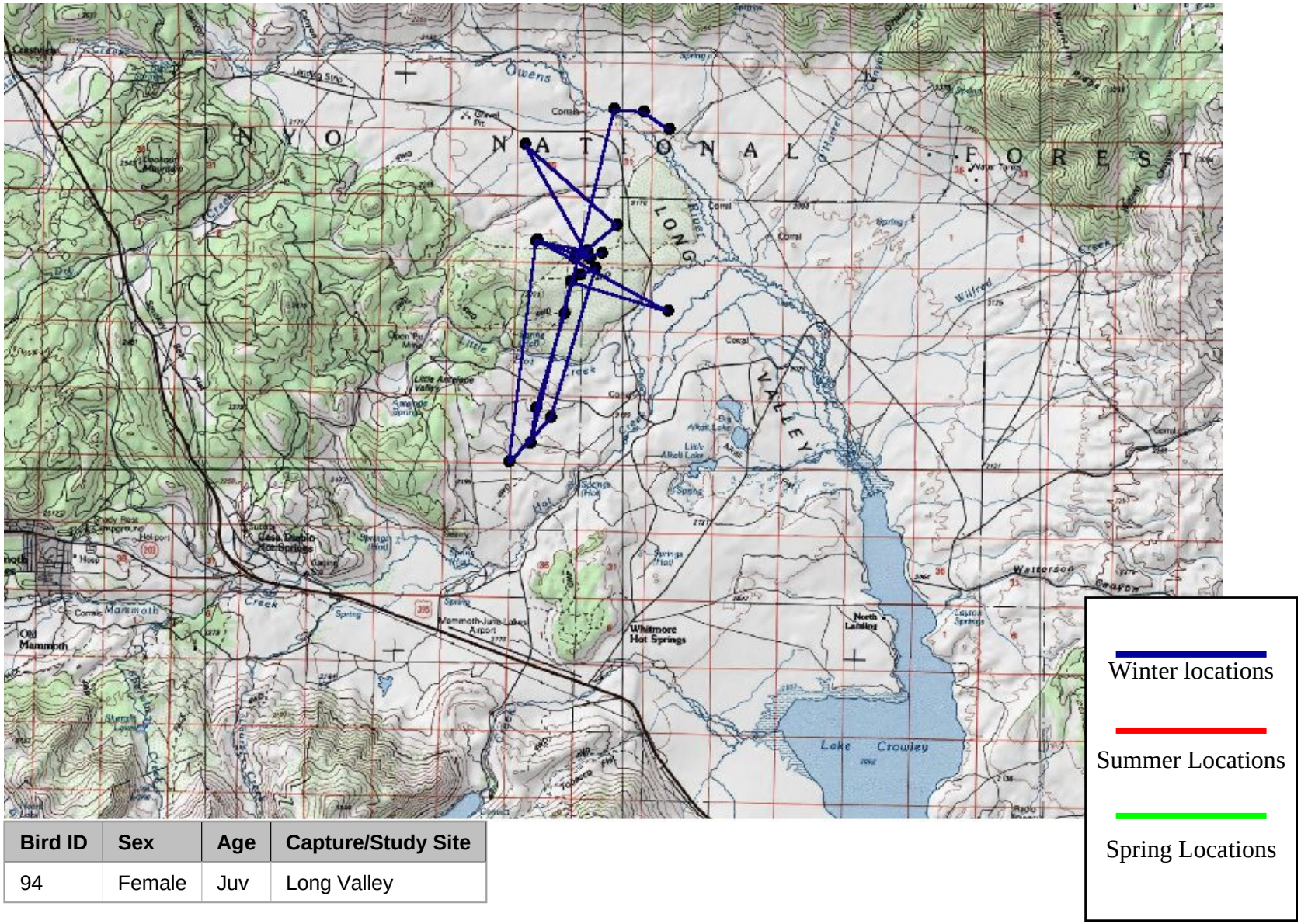
Bird ID	Sex	Age	Capture/Study Site
90	Female	Juv	Bodie Hills



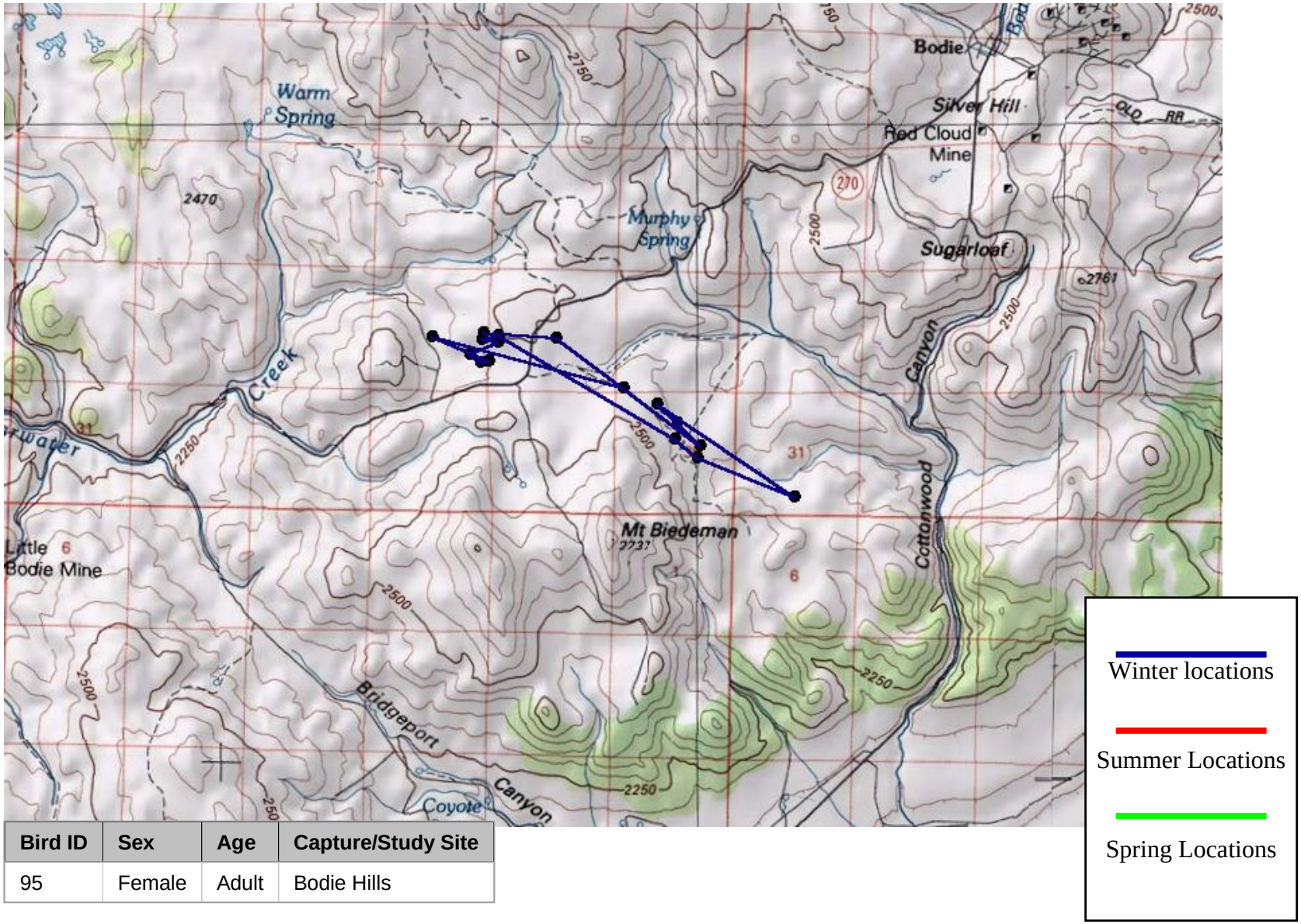
Bird ID	Sex	Age	Capture/Study Site
91	Female	Adult	Bodie Hills



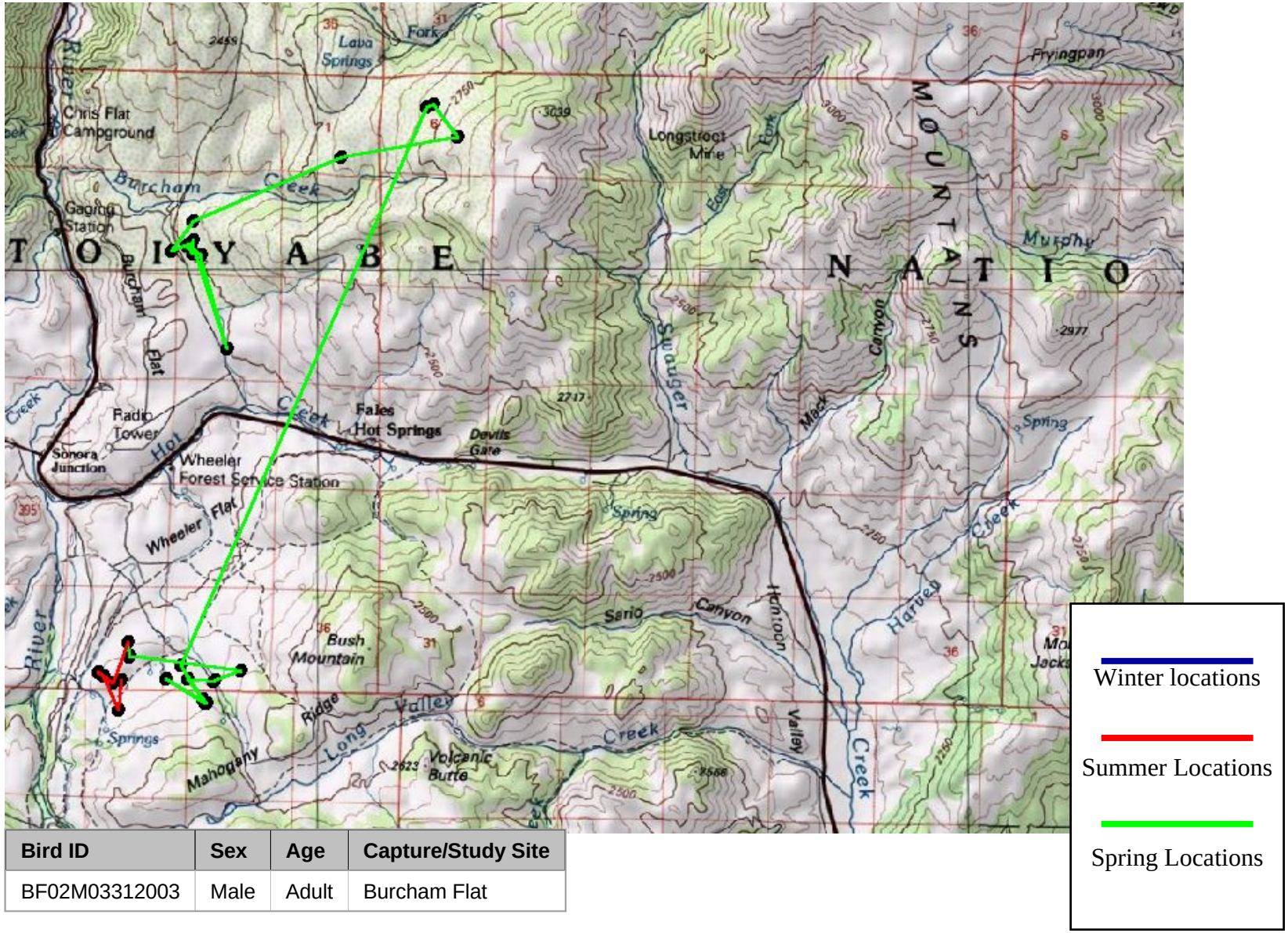
Bird ID	Sex	Age	Capture/Study Site
93	Female	Juv	Long Valley



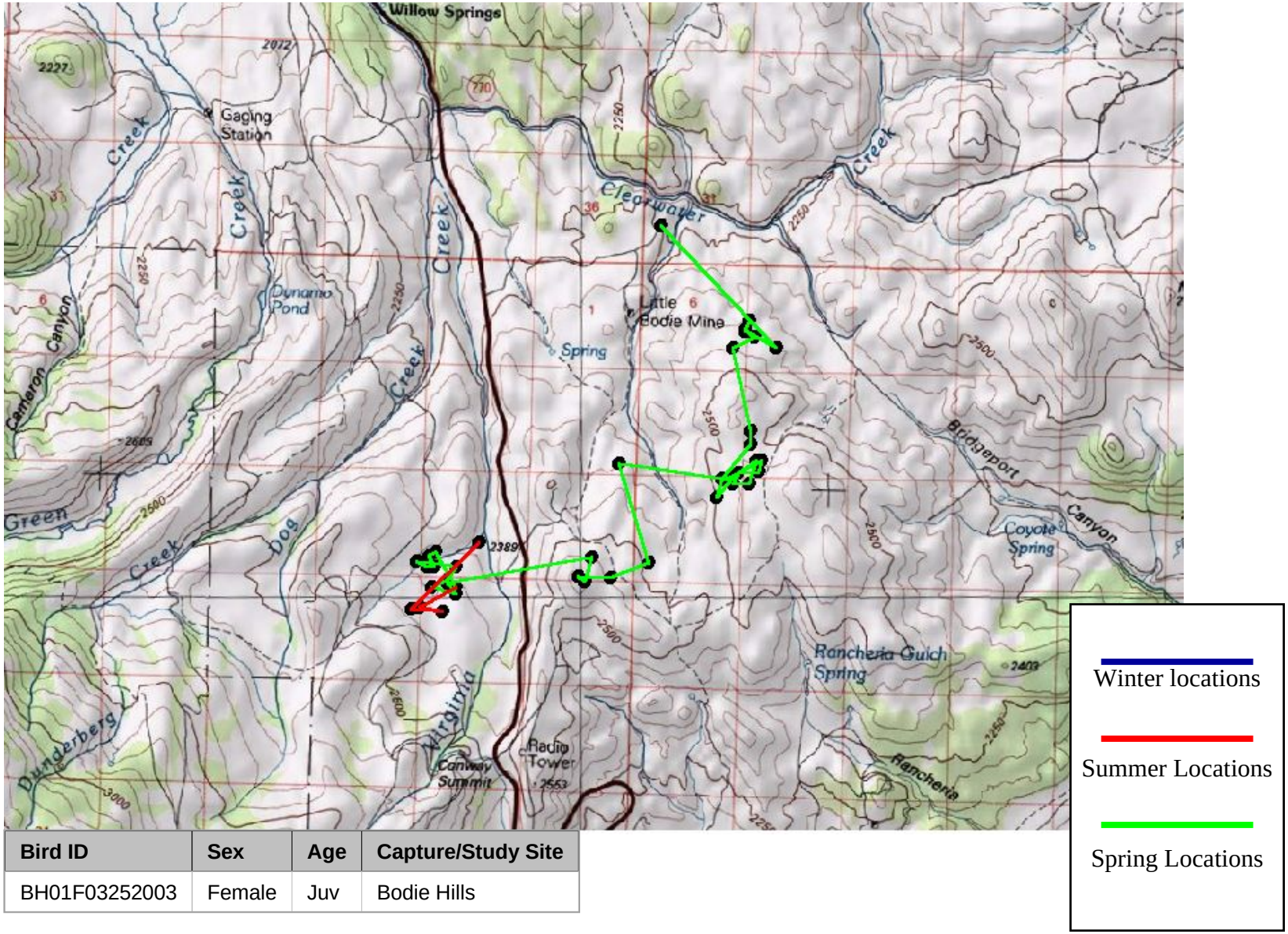
Bird ID	Sex	Age	Capture/Study Site
94	Female	Juv	Long Valley



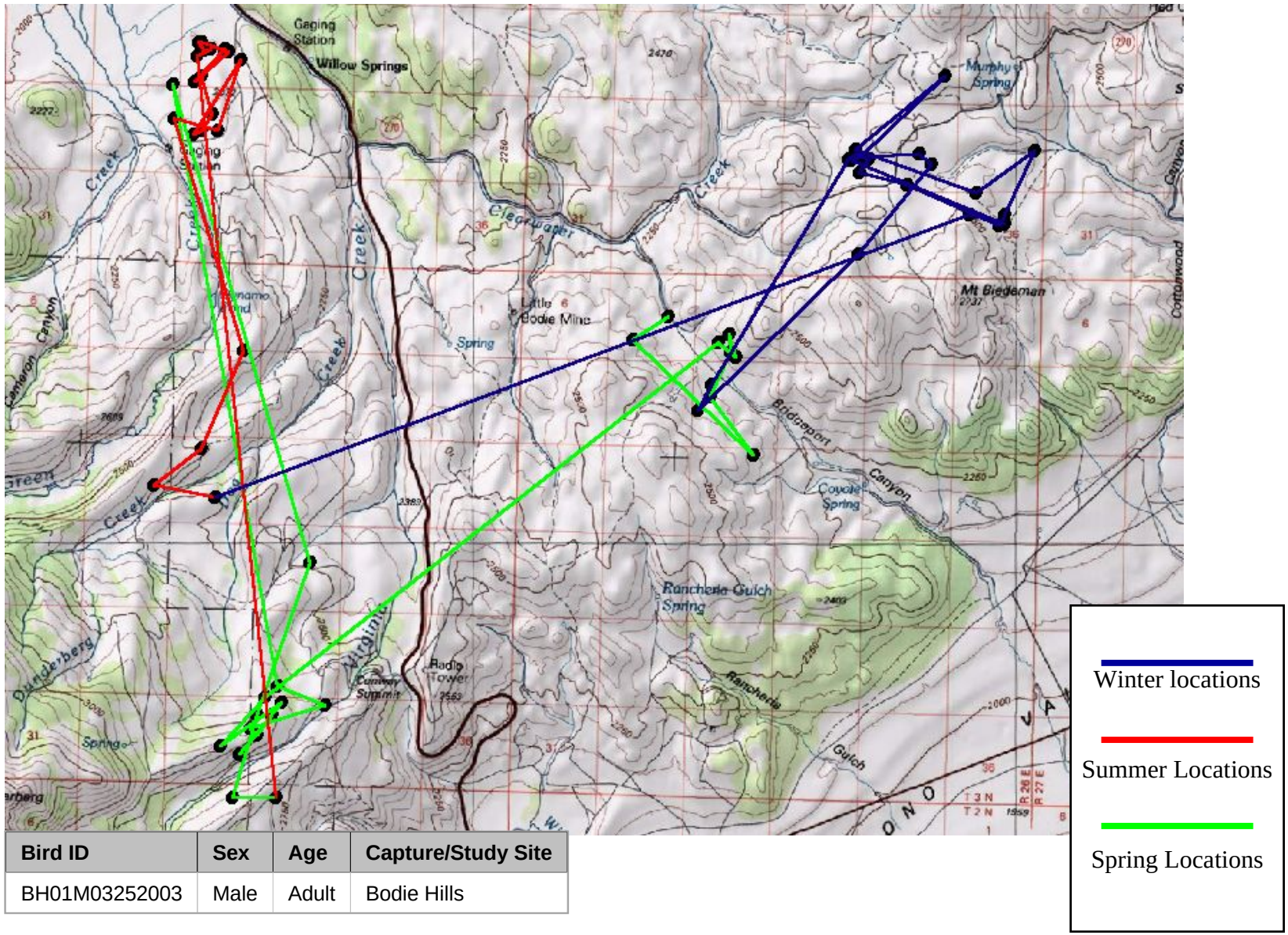
Bird ID	Sex	Age	Capture/Study Site
95	Female	Adult	Bodie Hills



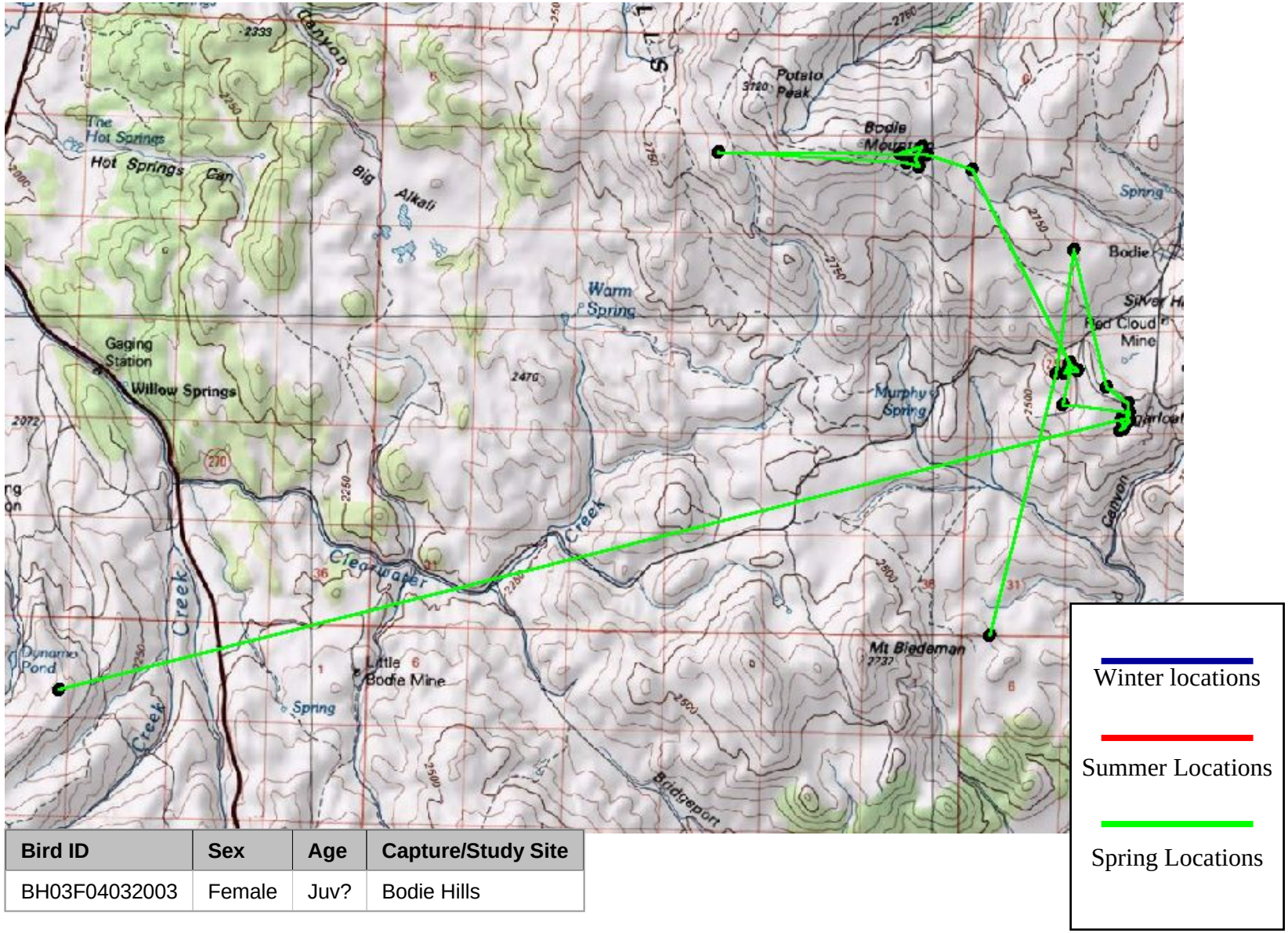
Bird ID	Sex	Age	Capture/Study Site
BF02M03312003	Male	Adult	Burcham Flat



Bird ID	Sex	Age	Capture/Study Site
BH01F03252003	Female	Juv	Bodie Hills



Bird ID	Sex	Age	Capture/Study Site
BH01M03252003	Male	Adult	Bodie Hills



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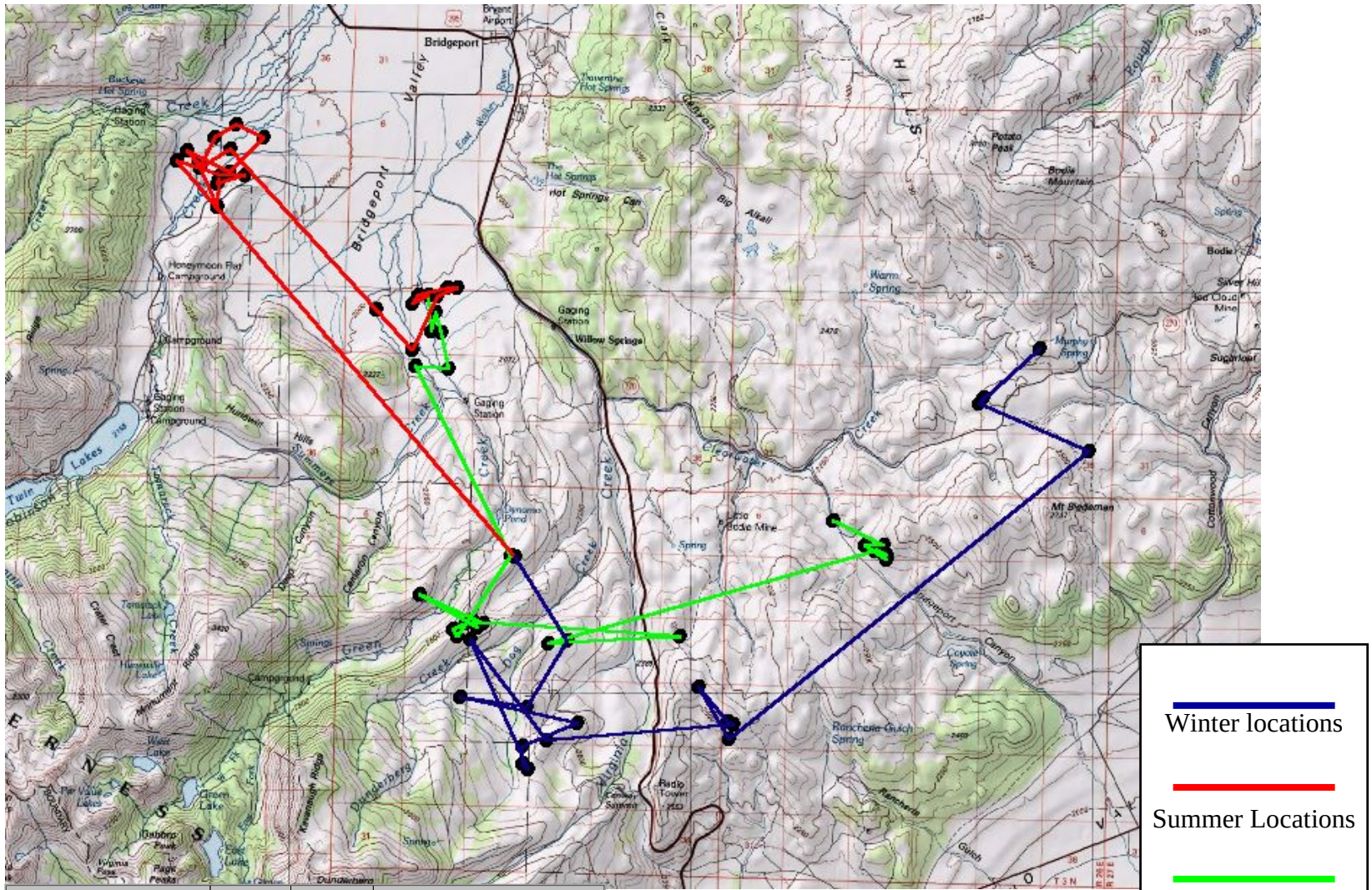
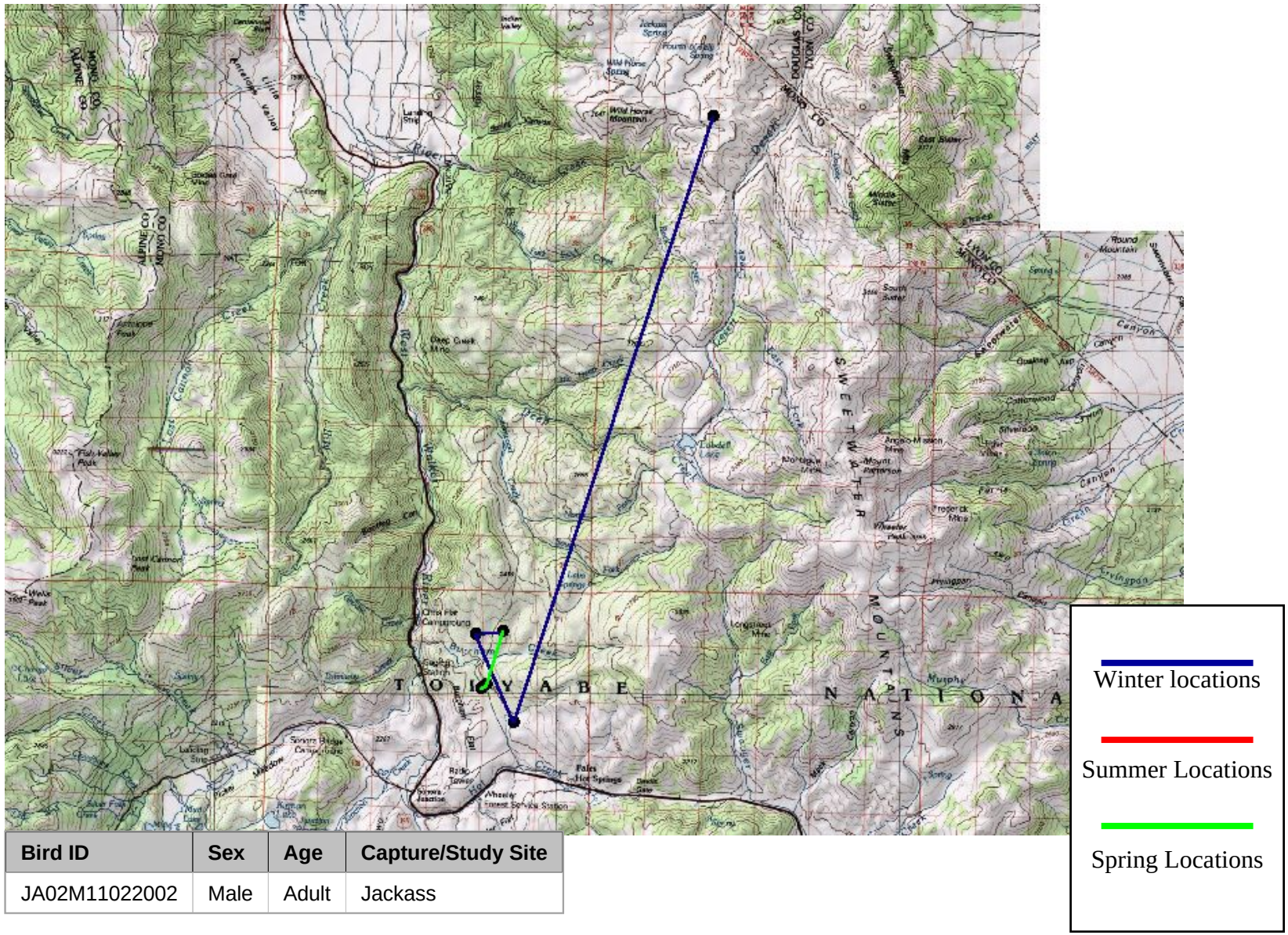
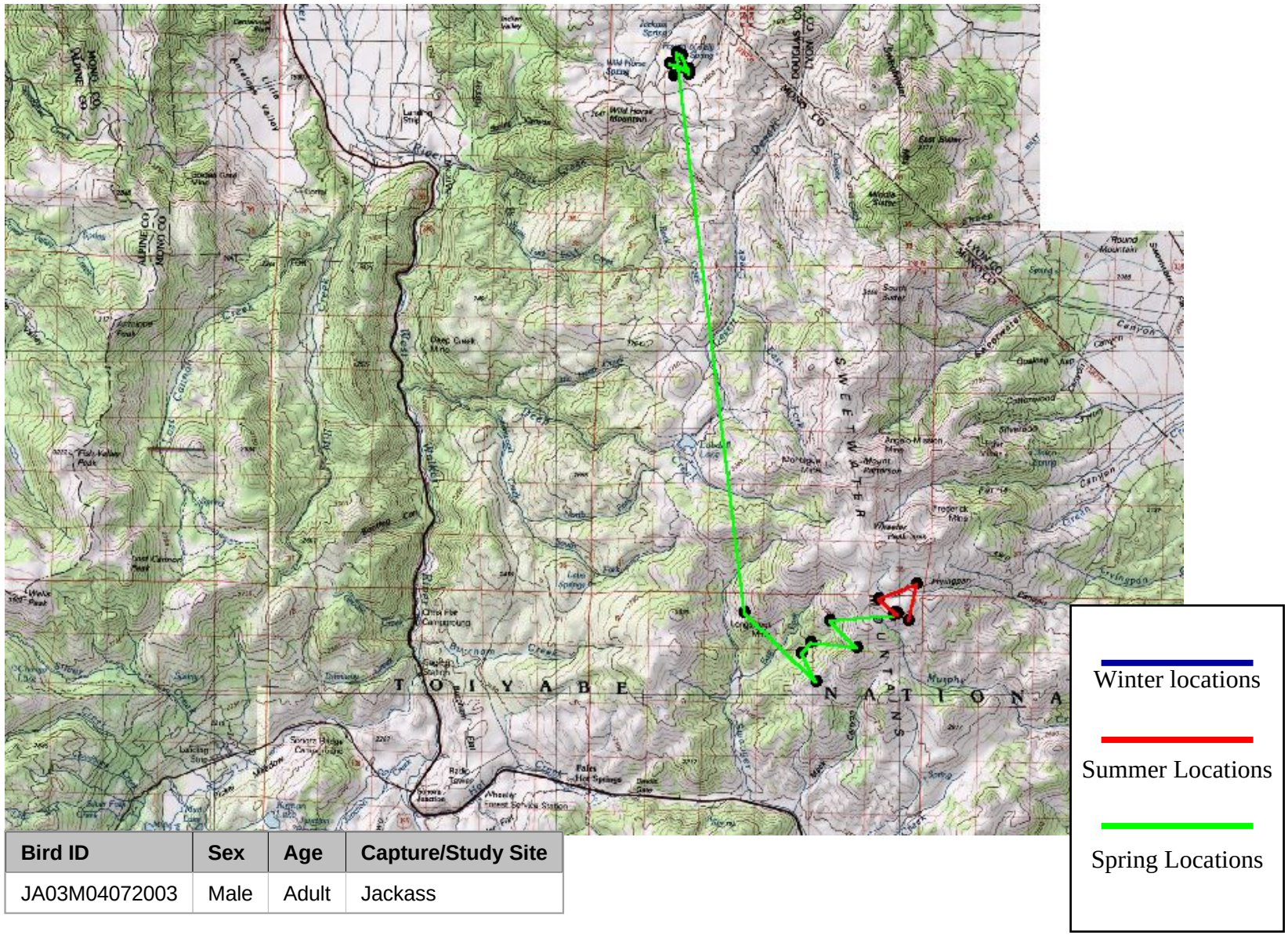
BH03F04032003	Female	Juv?	Bodie Hills



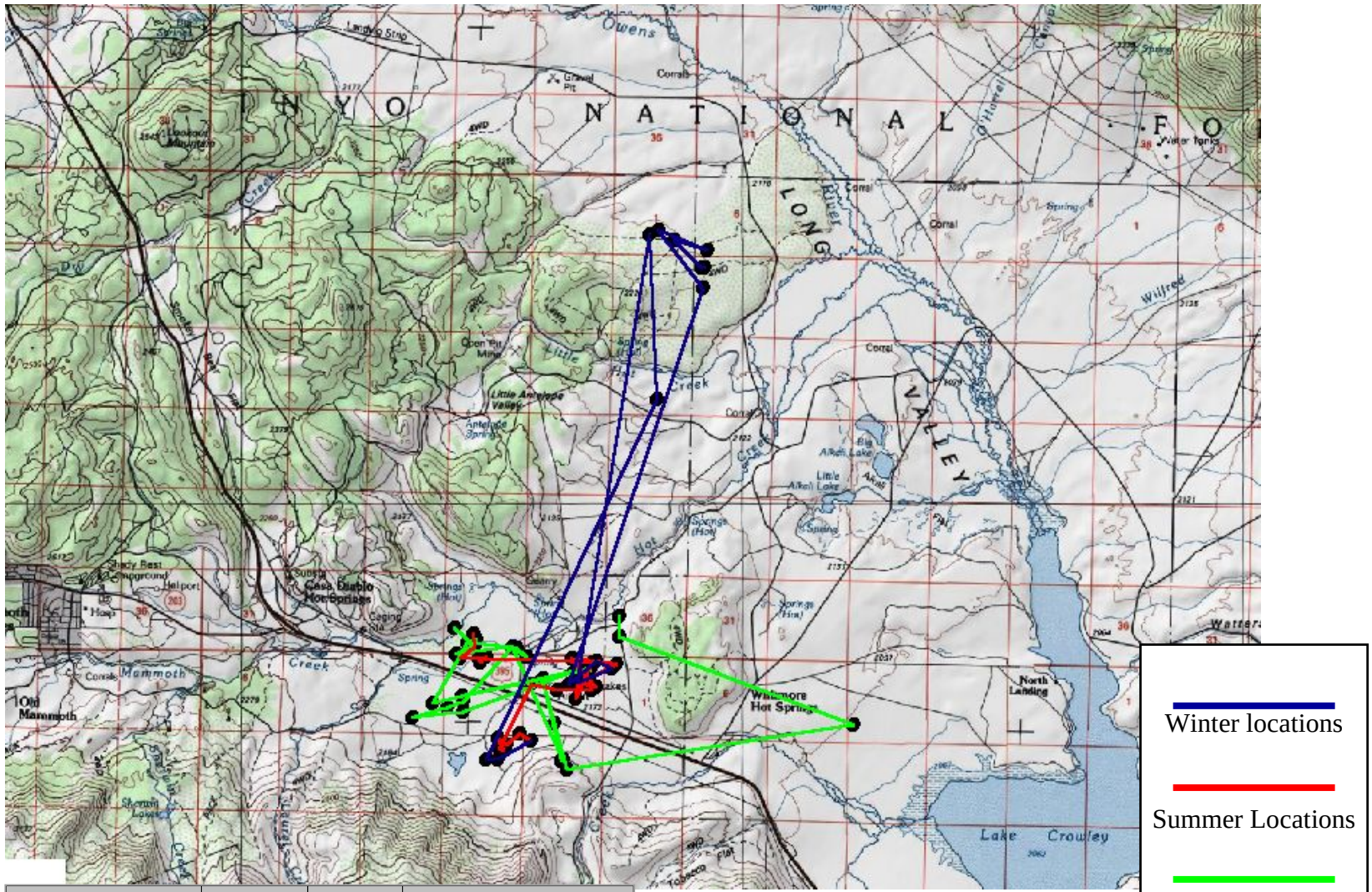
Bird ID	Sex	Age	Capture/Study Site
BH03M03252003	Male	Adult	Bodie Hills



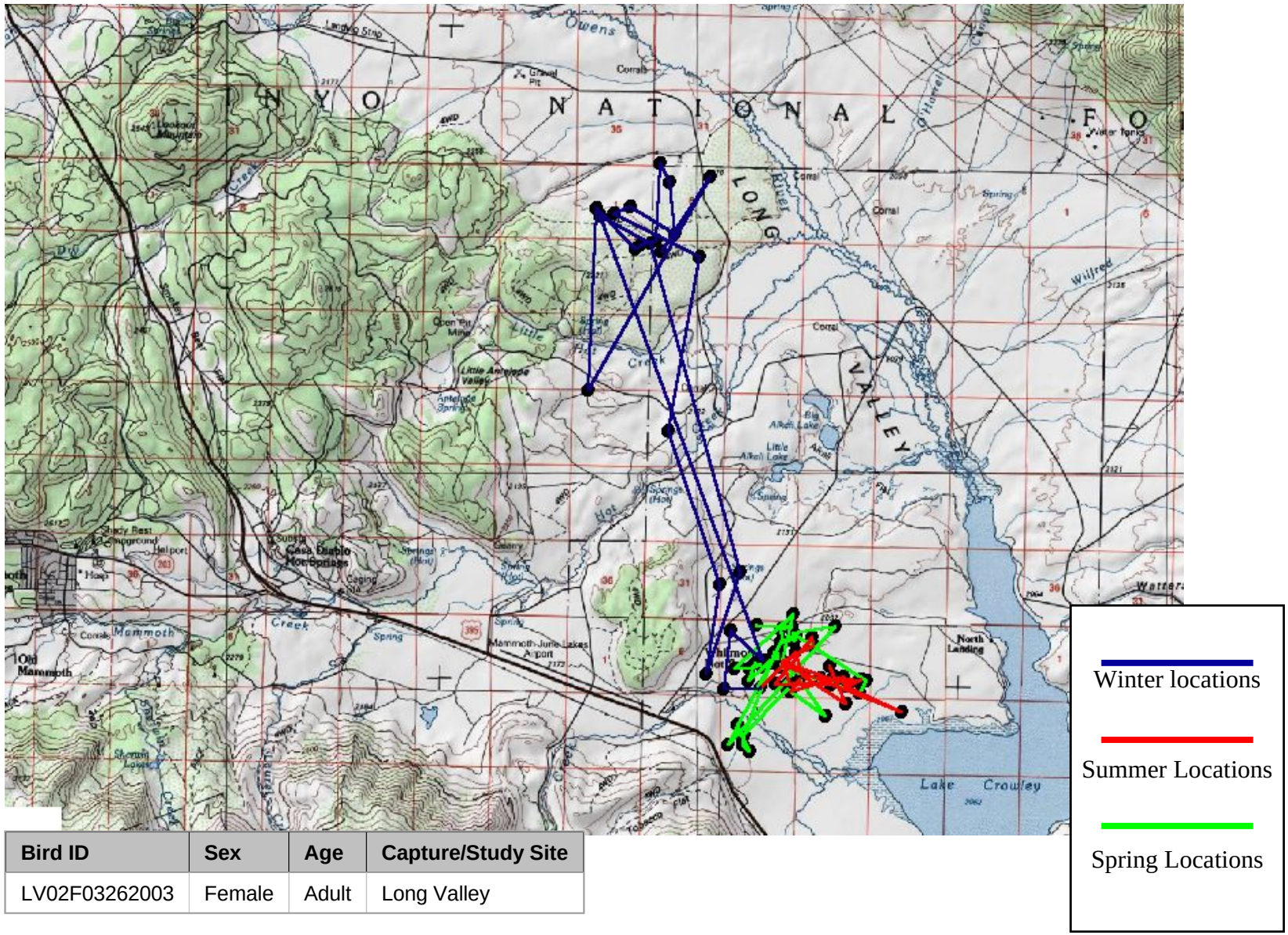
Bird ID	Sex	Age	Capture/Study Site
JA02M11022002	Male	Adult	Jackass



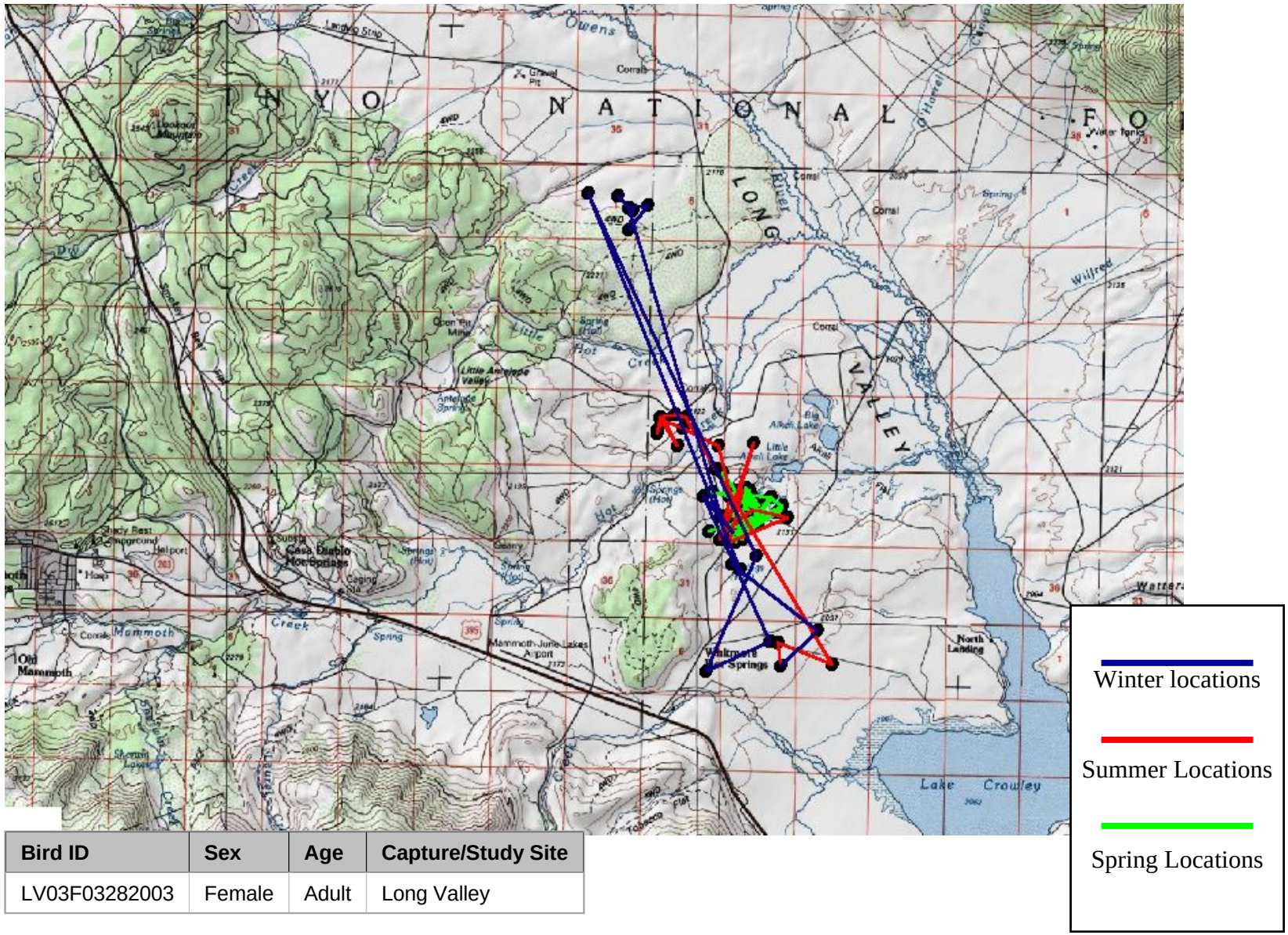
Bird ID	Sex	Age	Capture/Study Site
JA03M04072003	Male	Adult	Jackass



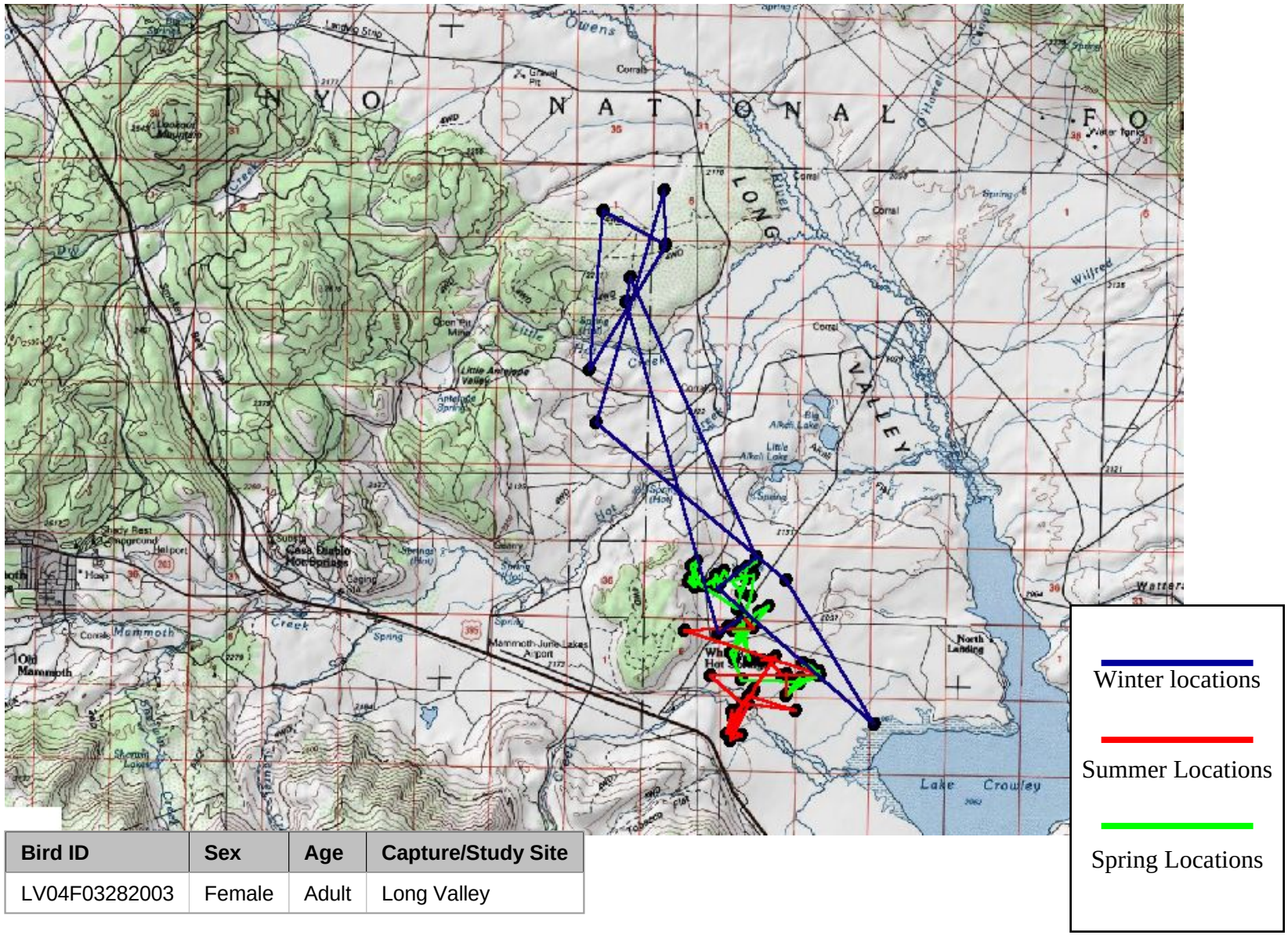
Bird ID	Sex	Age	Capture/Study Site
LV01F03262003	Female	Adult?	Long Valley



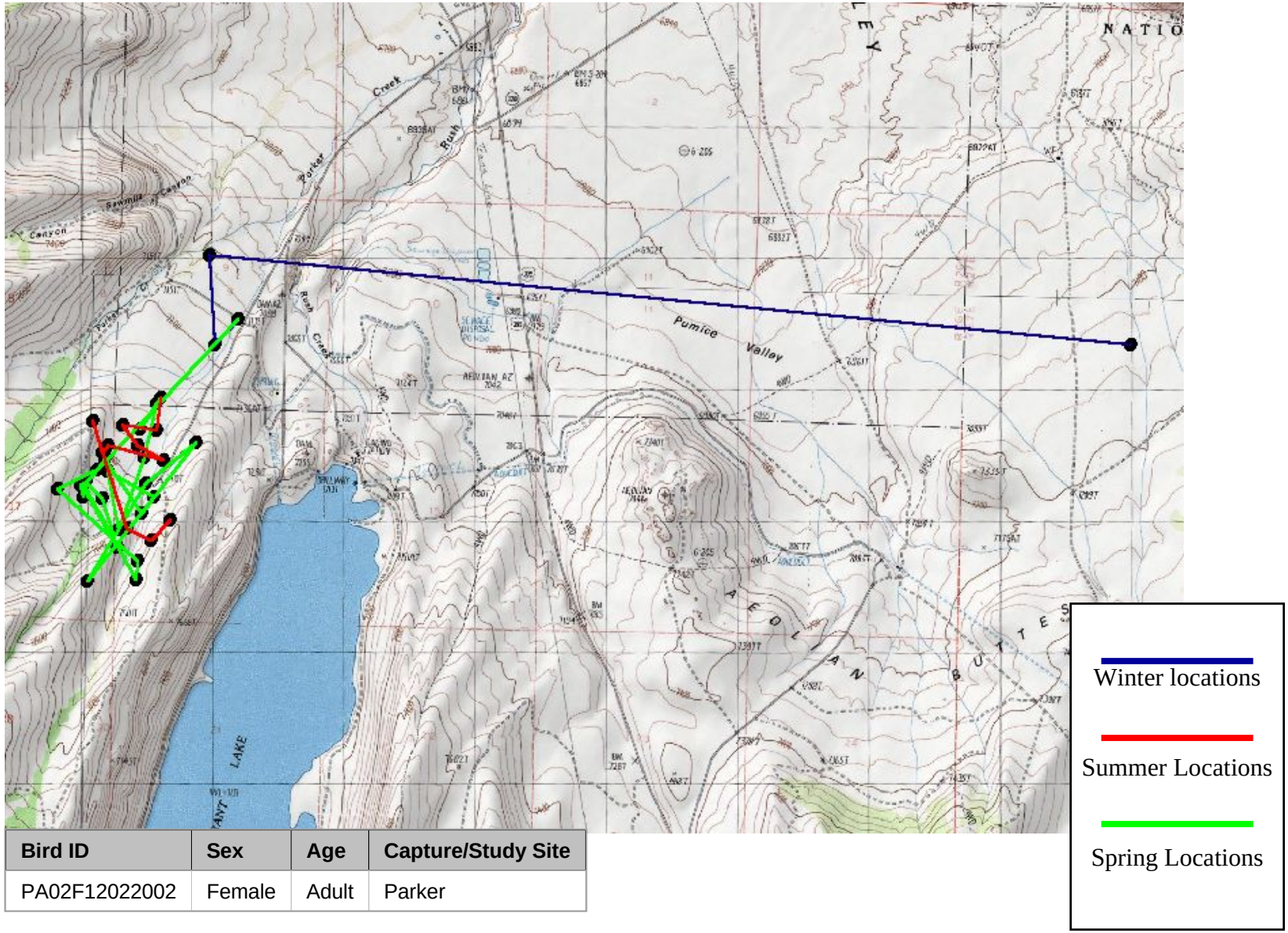
Bird ID	Sex	Age	Capture/Study Site
LV02F03262003	Female	Adult	Long Valley



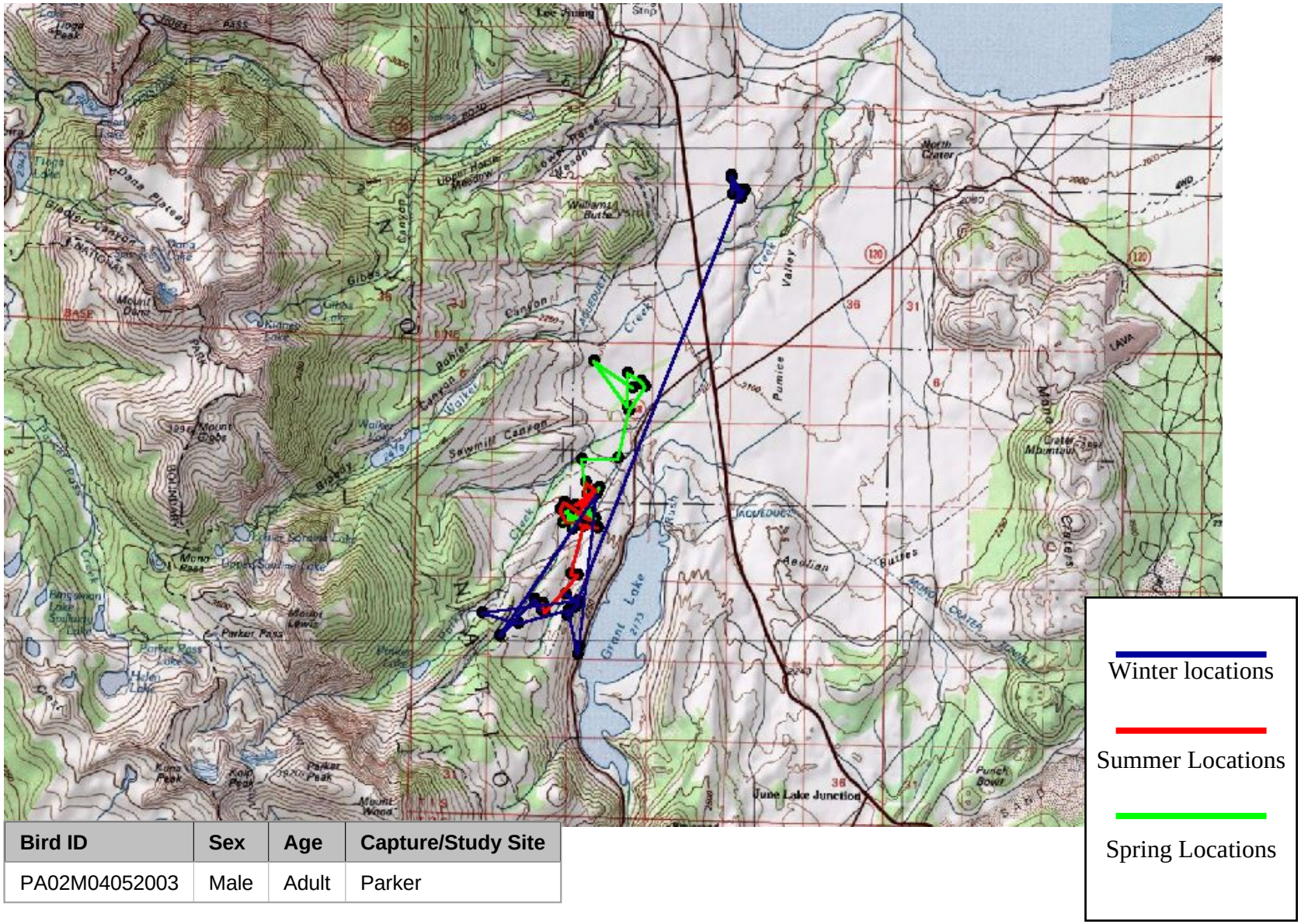
Bird ID	Sex	Age	Capture/Study Site
LV03F03282003	Female	Adult	Long Valley



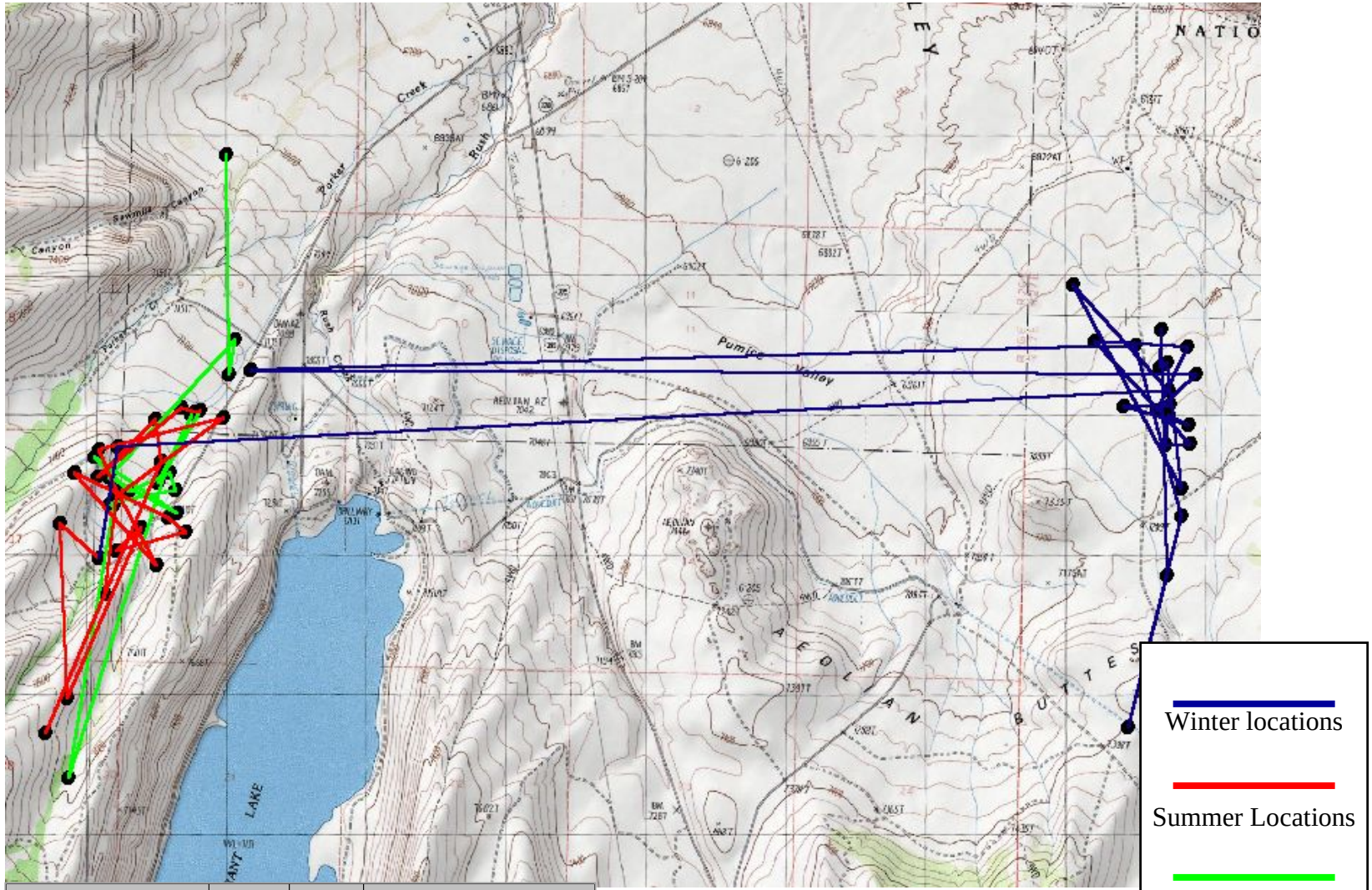
Bird ID	Sex	Age	Capture/Study Site
LV04F03282003	Female	Adult	Long Valley



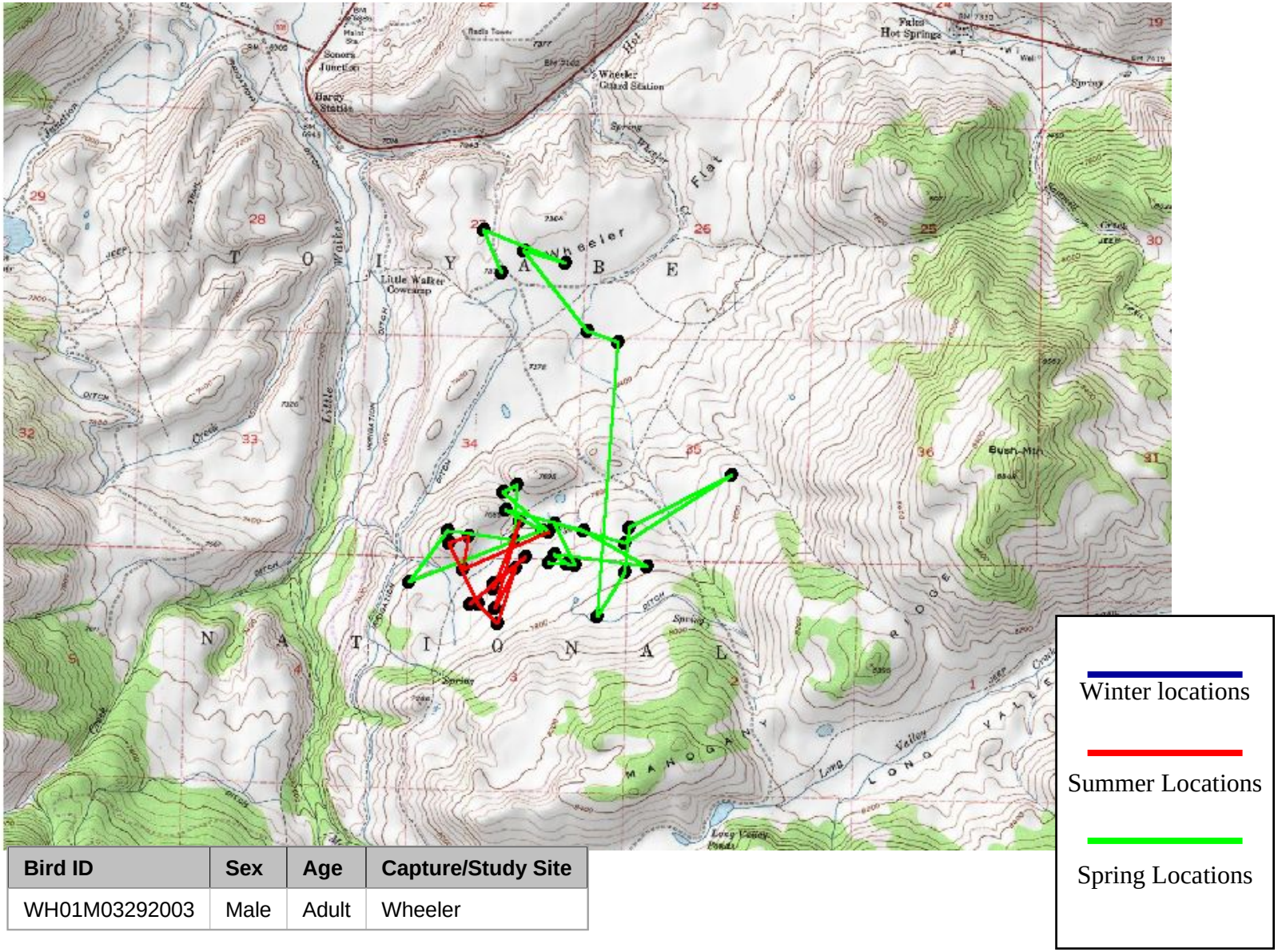
Bird ID	Sex	Age	Capture/Study Site
PA02F12022002	Female	Adult	Parker



Bird ID	Sex	Age	Capture/Study Site
PA02M04052003	Male	Adult	Parker



Bird ID	Sex	Age	Capture/Study Site
PA04M06022003	Male	?	Parker



Bird ID	Sex	Age	Capture/Study Site
WH01M03292003	Male	Adult	Wheeler