Alberta Arctic Butterfly Surveys in the Capulin Volcano National Monument Area 2003-2004

Final Report

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Introduction

The area east of Raton, New Mexico consists of a variety of extinct volcanic features such as lava flows, shield volcanoes, and cinder cones. Extending eastward from the Rocky Mountain Front Range into the high plains, the Raton Mesa complex varies in elevation from 2200m to 2700m, and the climate is harsh compared to surrounding areas (Cary 2001). This archipelago of volcanic uplands harbors several endemic butterfly subspecies and relict butterfly species not known from other localities in New Mexico or Colorado (Cary and Holland 1992 [1994]). Capulin Volcano National Monument (CAVO) is one of several uplands in this complex.

North American butterflies in the genus *Oeneis* are commonly called "arctics," because they generally inhabit windy, tundra-like habitats, often at high elevation. The Alberta arctic (*Oeneis alberta* Elwes) occupies the lowest habitats for its genus. Its core population is on the prairies of Alberta, Saskatchewan, Manitoba, Montana and North Dakota (Scott 1986:249). A small number of outlier colonies have been identified far to the south in the White Mountains of Arizona (*O. alberta daura* Strecker), in central Colorado (unnamed), and on the Raton mesa complex (*O. alberta capulinensis* F. M. Brown) of northeast New Mexico.

The Capulin subspecies of the Alberta arctic butterfly (*O. alberta capulinensis*) was first collected by Brown and associates in May 1969 (Brown 1971[1972]). He promptly described it as a new subspecies (Brown 1970). The Capulin Volcano population has been found in patches of bunch grass on the outer slope of the north volcano rim and on the inner slope of the cinder cone's south rim (Brown 1970). Since its discovery at Capulin Volcano, it has been found to inhabit other windblown grassy mesas in the Raton Mesa complex: Little Horse Mesa at Sugarite Canyon State Park, Dale Mountain on Johnson Mesa, and Sierra Grande (Figure 1, Toliver et al. 1994, Cary 2001).

At Capulin Volcano, Brown (1970) found the butterfly in flight at the crater rim in mid-May, but not after early June. In Brown's study, only males were flying, while females stayed in grass clumps or cracks in the rock. Coloration is variable, from light to darker greyish brown. The underside is lighter than the upper side. The upper forewing typically has one to three dark ocelli on the forewing and one on the hindwing. The female upper forewing may be less grey

than that of the male, making females appear brighter in color. The host plant is not known with certainty, but the butterfly associates with bunch grasses of the genus *Festuca* (Brown 1970, Scott 1986:249), and the host is probably a member of this genus (Parmenter et al. 2000).

The Capulin Alberta arctic butterfly is not considered threatened by human activities within the national monument (Parmenter et al. 2000). However, so little is known about the species' distribution and biology within the park that it is difficult to assess potential threats. Brown (1970:137) found *O. a. capulinensis* to be much more variable than other populations of this species. The variation suggested a small population in which isolation has allowed many recessive traits to be expressed phenotypically (Brown 1970:137).

Human or natural impacts on the small known populations could threaten this subspecies' existence. For example, loss of larval host plant(s) within the park would threaten the butterfly. Implementation of a fire management plan (currently in preparation) could heavily impact the butterfly. Because the population is so small and its distribution within the park so limited, drought and severe weather such as hailstorms during the flight period could greatly affect the CAVO butterflies. Basic natural history information is needed before potential impacts to the population can be anticipated and a management strategy developed.

The purpose of this study was to investigate the biology of the Capulin Alberta arctic butterfly at CAVO, with particular emphasis on determining its distribution, larval host plant(s), and potential conservation issues. The primary goal is to provide management recommendations for this endemic butterfly.

Methods

In 2003, we conducted surveys at CAVO and Johnson Mesa, NM, on state land near the park, on 27-28 May. KJ, SC, and LP, accompanied by Bruce Robinson (park biological technician) and Sheryl Horton (Student Conservation Association intern) conducted all surveys. On 27 May we conducted walking area searches of the outer slope of the north rim of the cone at CAVO and on the inner slope of the south slope of the cone, from approximately 1300h to 1400h. On 28 May we again conducted walking area searches of the outside north rim from 830h to 945h.

We surveyed at Johnson Mesa on 27 May from 1400h to 1500h and on 28 May from 1045h to 1245h. We searched various habitat types on the east side of the mountain, east of the communications tower, on the first day. On 28 May, we focused on wetter, greener areas having apparently greater plant diversity, because butterflies appeared to be more abundant in those habitats, and we avoided large bunch grasses, where we had seen few butterflies.

In 2004, we surveyed at CAVO, Little Horse Mesa, Johnson Mesa, and Sierra Grande. On 10 May, SC, KJ, Chris Roberts, and Bruce Robinson surveyed the outside north and inside south slopes of the volcano cone at CAVO from about 1300h until 1530h. Conditions were warm and sunny, good for butterfly flight. In addition, twice a week for two weeks prior to our survey, Bruce Robinson visited the grassy knoll on the north side, inside and outside of the cone. He also checked the same site three times during the week and a half following our survey.

On 11 May 2004, SC, KJ, Bruce Robinson, and Sarah Wood (New Mexico State Parks) surveyed on Little Horse Mesa at Sugarite Canyon State Park. Surveys were conducted in the morning under windy conditions, along transects traversing the mesa. On 20 May 2004, SC, KJ, and Bruce Robinson surveyed at Johnson Mesa from approximately 1230h until 1430h, then returned to CAVO park headquarters to update butterflies in the CAVO reference collection. On 21 May 2004, SC, KJ, LP, and Bruce Robinson surveyed from 0900h-1130h at Sierra Grande.

When we encountered Alberta arctics, we either captured a subset using standard aerial insect nets or observed them where they rested. We took GPS readings of all sites where butterflies were detected. Maps were created in ArcGIS and the chart in MS Excel.

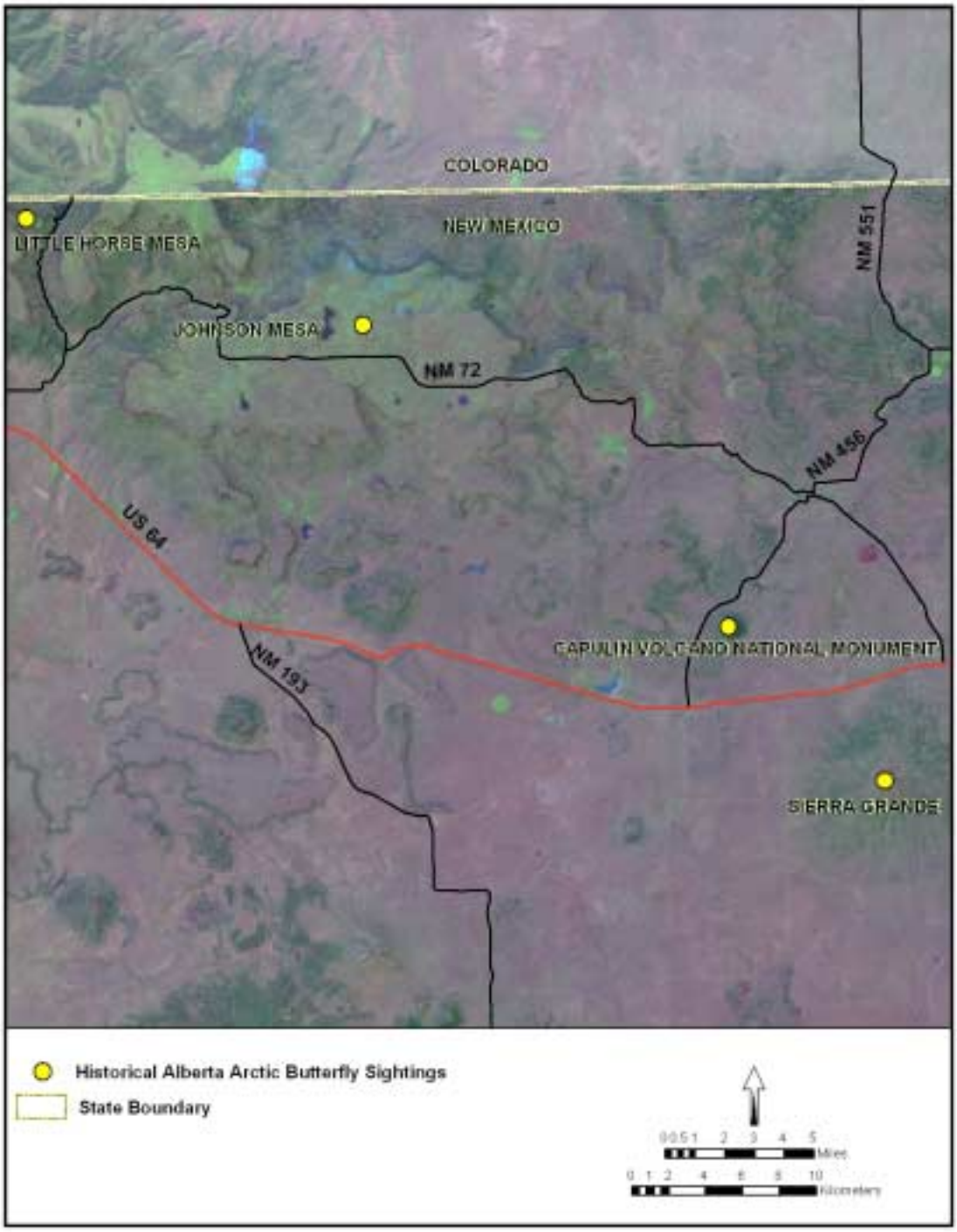

Figure 1. Historical locations of Alberta arctic butterflies in northern New Mexico.

Results and Discussion

CAVO

In 2003, we found no Alberta arctic butterflies at CAVO on either day. The weather was sunny and breezy, but warm; thus, if butterflies were present they should have been flying. Failure to find any adults prompted speculation about what may have caused this result. Park staff noted that a strong hailstorm occurred at CAVO between 10-14 May. If butterflies had been flying when the storm occurred, they could have been killed. Alternatively, a mild winter and early spring may have prompted the arctics to fly earlier than usual, and adult activity may have ceased by the last week of May. However, some butterflies were active at nearby Johnson Mesa (see below), which suggests that survey timing was appropriate. In 2004, the cone at CAVO was checked during the weeks of April 26 (BR), May 3 (BR), May 10 (SC, KJ), and May 17 (BR), and still no Alberta arctics were detected.

Capulin Alberta arctic butterflies were reported from CAVO on at least 10 occasions between 1969 and 1989; no data were found for the period between 1989 and 2003 (Appendix 1). Judging from literature accounts, the areas of suitable habitat at CAVO were quite small, in the neighborhood of a few hectares, and the population of arctics must have been quite small also.

Our two surveys, along with Robinson's searches, suggest that Alberta arctic butterflies may no longer be present at CAVO. Grasses of the genus *Festuca* still occur there, particularly on the outside slope of the cone's north rim, but those few hectares of bunch grasses are small and sparse compared to the arctic's habitat at Johnson Mesa. It is possible that the small population at CAVO is now extirpated. However, butterfly populations are notoriously variable from year to year, responding to a variety of environmental factors. Before concluding that the butterfly is extirpated from CAVO, we recommend regular surveys during May in each of the next several years.

Johnson Mesa

On 27 May 2003, we captured one Alberta arctic at Johnson Mesa and observed four others. The next morning we observed 22 adult arctics, mainly in patches of *Festuca* (Figure 2). The butterflies appeared to be more abundant at the lower edges of north-facing slopes, in wetter, greener vegetation.

On 20 May 2004, we found one female Alberta arctic butterfly resting on a *Clematis hirsutissima* plant and another individual resting in a clump of warm-season grass. We detected no other Alberta arctics at Johnson Mesa in 2004. Alberta arctics have previously been reported at Johnson Mesa on three occasions between 1990 and 2000 (Appendix 1). In previous years, SC has observed larger numbers at this site than we found in either 2003 or 2004.

Variable numbers observed by researchers can have many causes, including causes not related to the actual number of adult butterflies in the population (i.e., sampling bias). They include the timing of observations relative to diurnal activity periods, weather conditions, and seasonal phenology in that year. Butterflies like the alberta, which have small populations and fly in only one generation per year, are notoriously difficult to get a handle on. This difficulty can be exacerbated by variable spring weather conditions. Some species can simply stay in pupal diapause for multiple years if climate conditions are poor. Alberta arctics also may be biennial, requiring two years to mature and flying every other year. Most such populations usually have even-year and odd-year cohorts; extirpation of one cohort may leave the other intact. Given these features of Alberta arctic butterfly biology, the best approach would be for someone to be on site from late April to early June for several consecutive years, to capitalize on conditions suitable for the butterfly.

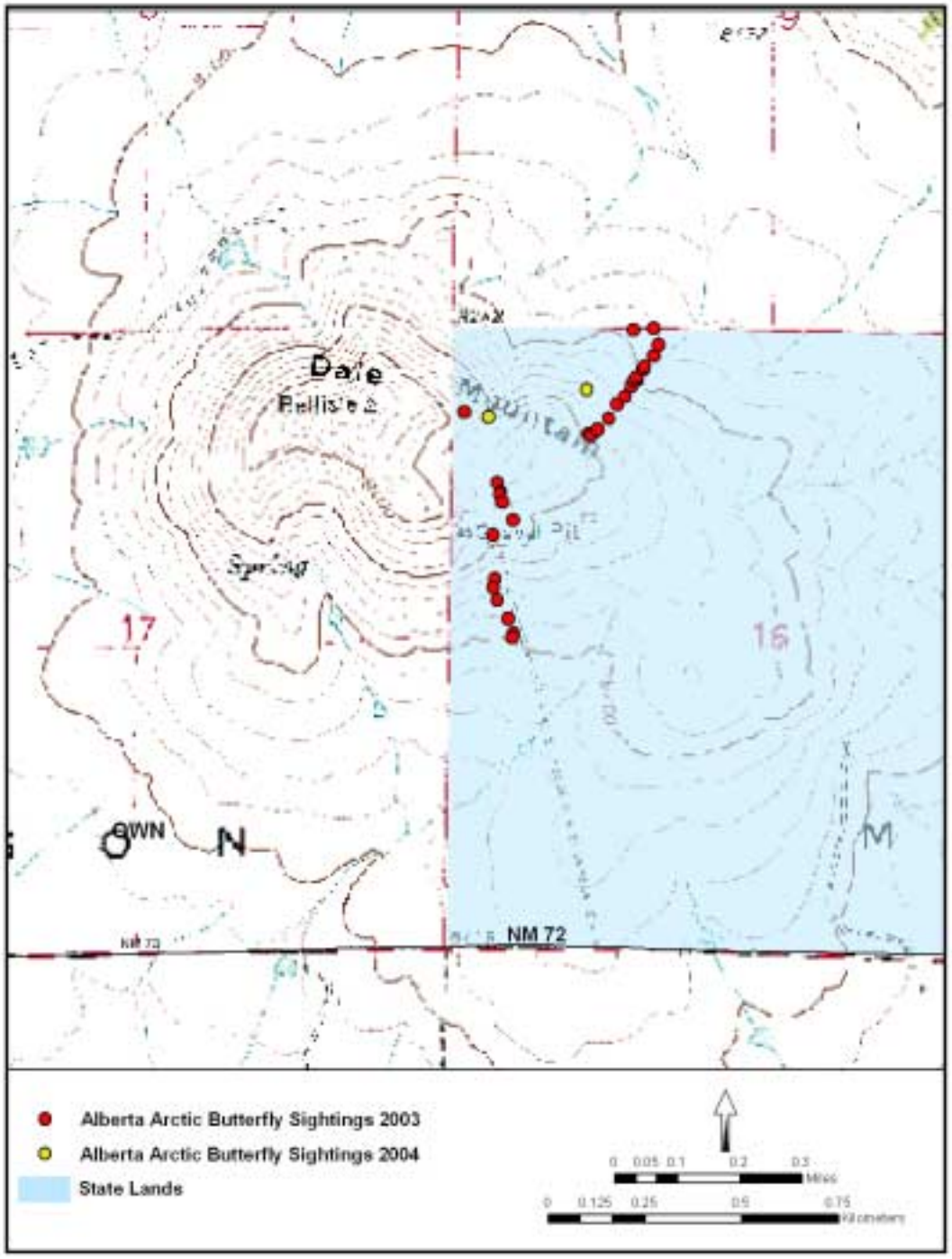

Figure 2. Alberta arctic butterfly sightings at Dale Mountain, Johnson Mesa, 2003 and 2004.

Little Horse Mesa

In 2004, SC detected one butterfly that appeared to be an Alberta arctic, but he was unable to capture the animal. Therefore, we cannot conclude that we encountered any Alberta arctics on that survey, perhaps due to the windy conditions on the day we surveyed. The butterfly was certainly extant on Little Horse Mesa in 2004, however, because D. Edwards found it there on 21 May.

Alberta arctics were previously reported on Little Horse Mesa in 2000 (Appendix 1). Our limited survey under less-than-optimal conditions does not allow speculation regarding current population size. Regular monitoring of Alberta arctics on Little Horse Mesa would provide a more sound foundation for understanding this species. It has been suggested that the grassland on Little Horse Mesa has grown senescent, perhaps due to absence of wildfire.

Sierra Grande

Although four people spent a total of six person-hours searching for the butterfly on Sierra Grande in 2004, we detected none. Conditions were suitable, as we observed individuals of several other butterfly species flying during the survey. It is possible that their flight period occurred earlier in May, but we cannot offer firm explanations for their absence in 2004. Alberta arctics were found on Sierra Grande on several occasions throughout the month of May during the 1990s (Appendix 1). Given their persistence at the site in recent years, we expect that repeated surveys during May would detect them.

Conclusions and Future Work

Reports in the literature and our surveys (Appendix 1), provide a sketch of the flight period of the Capulin Alberta arctic butterfly in New Mexico (Figure 3). Data are scant and unevenly distributed over more than two decades and several sites. All except four of the 22 dated records are from the last three weeks of May, with the peak flight period between 11 and 20 May. All our surveys occurred in the last three weeks of May, but the 2003 surveys were outside the peak period (27-28 May), and the 2004 surveys occurred at the beginning and end of this peak period (10,11, 20, and 21 May).

It is possible that timing of our surveys explains the small numbers of butterflies encountered. We doubt this explanation, however, because the absence or small numbers of individuals occurred at all sites and at all dates. Intensive survey at the four known sites over the next few years would strengthen knowledge of its occurrence at those sites.

It is premature to offer reasons for this butterfly's decline until further field work convincingly documents falling numbers or expiring colonies. However, it is appropriate to identify potential threats that Alberta arctics may face in the study area. Those threats may include grazing by domestic livestock (e.g., at Johnson Mesa). Suppression of fire may lead to senescent grasslands or to succession of grasslands to undesirable, non-host grasses (e.g., at Little Horse Mesa and CAVO). In a metapopulation, simple stochastic events like weather or climate may extirpate tiny colonies (e.g., at CAVO); eventual re-colonization of such sites is typical for metapopulations, but modern conditions may interfere with re-colonization. New Mexico populations of this species are relicts from earlier, colder climates. Global climatic warming might drive Pleistocene relict species uphill, but uphill movement is not an option at historical New Mexico sites. A combination of factors may threaten this species in New Mexico.

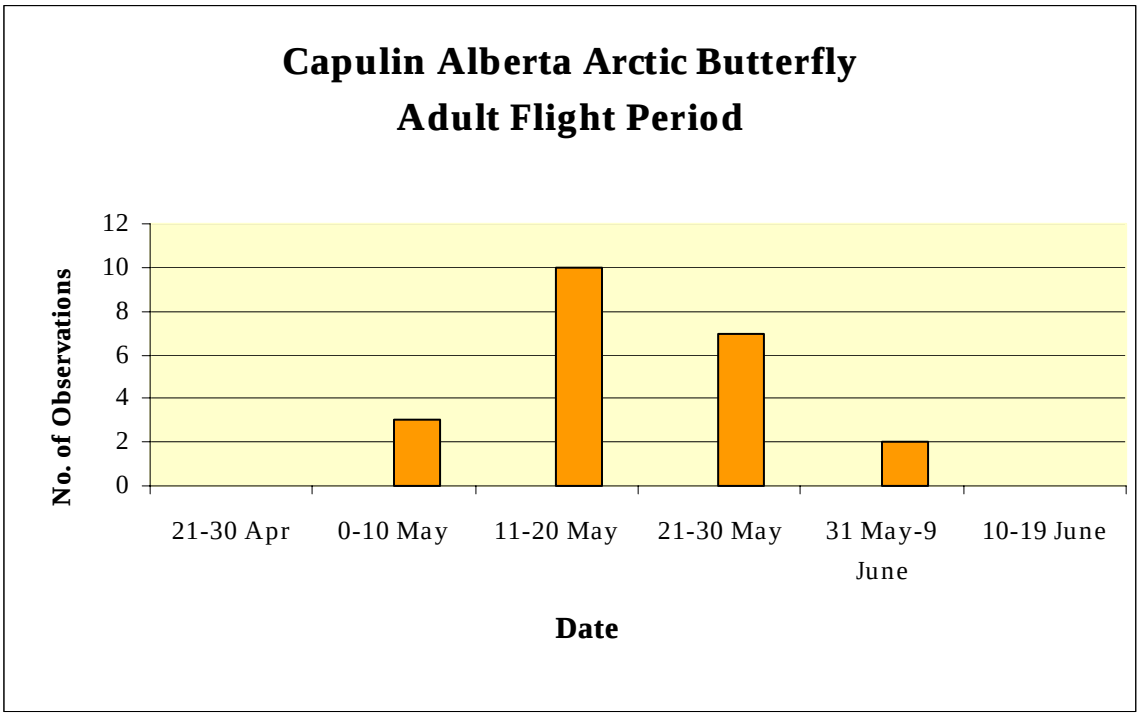

Figure 3. Flight period of Capulin Alberta Arctic butterfly in New Mexico, based on occurrences from the literature and this study.

It is a good time to increase understanding of this butterfly in the relict grasslands of the Raton mesa complex. We recommend systematic surveys at all historical sites, repeated throughout May in more than one year, to ascertain the status of the northern New Mexico population. Moreover, the Raton Mesa

complex offers many other potential Alberta arctic colony sites that have not been investigated. Investigation of these lands would help describe the full extent of this butterfly in the study area. If larger numbers of this subspecies can be located, research on the natural history of the species should suggest strategies for conservation and habitat management.

References

Brown, F.M. 1970. *Oeneis alberta* in New Mexico, a new subspecies (Lepidoptera: Satyridae). Journal of the New York Entomological Society 78:134-138.

Brown, F.M. 1971[1972]. A preliminary list of butterflies found at the Capulin Mountain National Monument, Capulin, New Mexico. Mid-Cont. Lepid. Series 2. 28: 1-8.

Cary, S.J. 2001. Definitive Destination: Sugarite Canyon, New Mexico. American Butterflies 9(3):4-15.

Cary, S.J. and R. Holland. 1992 [1994]. New Mexico butterflies: checklist, distribution, and conservation. Journal of Research on the Lepidoptera 31:57-82.

Parmenter, R.R., D.C. Lightfoot, and W. L. Gannon. 2000. Capulin Volcano National Monument: listed and category species inventory. Report to US Department of the Interior National Park Service.

Scott, J.A. 1986. The Butterflies of North America. Stanford Univ. Press. Stanford, CA.

Toliver, M.E., R. Holland, and S.J. Cary. 1994. Distribution of butterflies in New Mexico (Lepidoptera: Herperioidea and Papilionoidea). 2nd edition. Published by R. Holland. Albuquerque, NM.

Appendix 1. Historical records of the Capulin Alberta Arctic butterfly in NM.

PC=personal communication with SC.

Location	Date	Observer/Source
Capulin Volcano NM, Union Co.	17-May-69	F. M. Brown (1971[1972])
	18-May-69	F. M. Brown (1971[1972])
	23-May-70	F. M. Brown (1971[1972])
	30-May-69	F. M. Brown (1971[1972])
	3-May-72	J. A. Scott (PC)
	30-May-70	M. E. Toliver (PC)
	5-Jun-71	M. E. Toliver (PC)
	20-May-81	F. & J. Preston (PC)
	21-May-81	F. & J. Preston (PC)
	25-May-89	J. A. Scott (fide FJP)
Raton Mesa E of Raton Pass, 8800', Colfax Co.	3-May-72	J. A. Scott (PC)
Near Raton	19-May-86	T. Kral (PC)
Sierra Grande, Union Co.	May-93	M. Fisher (PC)
	3-May-97	S. J. Cary
	31-May-97	S. J. Cary
	17-May-98	S. J. Cary
Johnson Mesa, Colfax Co.	20-May-90	F. & J. Preston (PC)
	12-May-96	S. J. Cary & R. Holland
	12-May-00	S. J. Cary
	28-May-03	S. J. Cary & K. Johnson
	20-May-04	S. J. Cary & K. Johnson
Little Horse Mesa, Sugarite Canyon State Park, Colfax Co.	12-May-00	S. J. Cary
	21-May-04	D. Edwards (PC)