

THE ALPINE BUTTERFLIES OF CASTLE PEAK, NEVADA COUNTY, CALIFORNIA

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ABSTRACT.—The west slope of Basin and Castle peaks and the ridge between them displays a wind-generated tree line below 8500 ft, with dry alpine fell-field vegetation above. The butterfly fauna, although depauperate compared to that of the High Sierra farther south, includes some truly boreal elements such as *Oeneis ivallda*, *Plebeius shasta*, and *Hesperia nevada*. These species commonly occur 1500 to 4000 ft higher in the southern Sierra.

The Sierra Nevada of California is about 360 miles long, from the Lassen Peak area in the north to Walker Pass in the south. Along the crest the summits become progressively higher southward—from 6000-8000 ft in Plumas and Sierra counties to 10,000 ft west of Lake Tahoe, 13,000 ft in Yosemite National Park, and 14,000 ft near Mount Whitney. The term "High Sierra" is properly applied to the region from slightly north of Yosemite to Cottonwood Pass. This area, averaging 20 miles wide over its 150-mile length, includes about 90 percent of the Arctic-Alpine life zone in California. Tree line drops below 10,000 ft from Pyramid Peak northward, reaching about 9000 ft on the north side of Lassen Peak (where it is ill-defined due to the rocky substrate), but there are few areas of alpine vegetation in the northern Sierra, and they have not been well studied by biologists. The most extensive of them south of Lassen Peak is on the west side of the andesitic mass forming Basin Peak (9015 ft), Castle Peak (9103 ft), and the ridge connecting them. Castle Peak is the second highest in Nevada County and in the Sierras proper, north of Donner Pass.

The Sierran Arctic-Alpine butterfly fauna is best known around Tioga Pass (9941 ft), where fell-fields are readily accessible in a day's hike from a good road. Tilden (1958) and Garth and Tilden (1963) have reported in detail on its composition and ecological characteristics. Another fairly well-known, though unpublished, alpine fauna is that of

Sonora Peak (11,429 ft), again because of its proximity to a road. Lepidopterists have visited other alpine areas including some to the north, but have not reported on their findings. Although Castle Peak (long known as Stanford Peak or Mt. Stanford) has been collected by botanists for over a century, I can find no record of its having been investigated for butterflies before 1972. This is surprising, since it is an easy day's hike from Interstate Highway 80 (formerly U.S. 40); perhaps the forbidding south face of the mountain, which gives it its name, has given it a more difficult reputation than it deserves (Fig. 1). Again, it has not been widely recognized that an alpine fell-field was present on this mountain; True (1973) states that the Arctic-Alpine life zone does not occur in Nevada County. This is a matter of interpretation, since so many organisms are distributed as if it does. The vegetation, as described below, demonstrates that the summit community is easily considered an alpine fell-field, and not even a very depauperate one. Smith (1973) notes that around Lake Tahoe "scarcely any of the lower peaks between 8500 and 9500 ft are forested at their summits and these support an illusion if not, in fact, the actual plant associations of summit scree and alpine fell-fields."

THE ALPINE VEGETATION

Tree line is developed only on the west side and is obviously related to the pre-

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vailing westerly wind. This was noted as early as 1921 by Smiley (p. 57). No meteorological data are available for Castle Peak, but its orientation and elevation far above the surrounding terrain, the persistent

pressure gradient across Donner Pass, and its location overlooking the great canyon of the South Yuba River predispose it to high winds. In my experience it is a very unusual day when the midafternoon wind on the

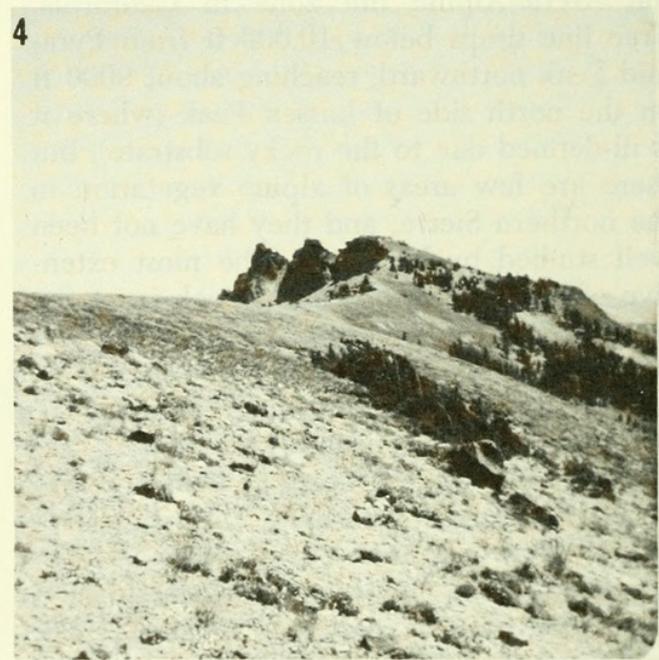
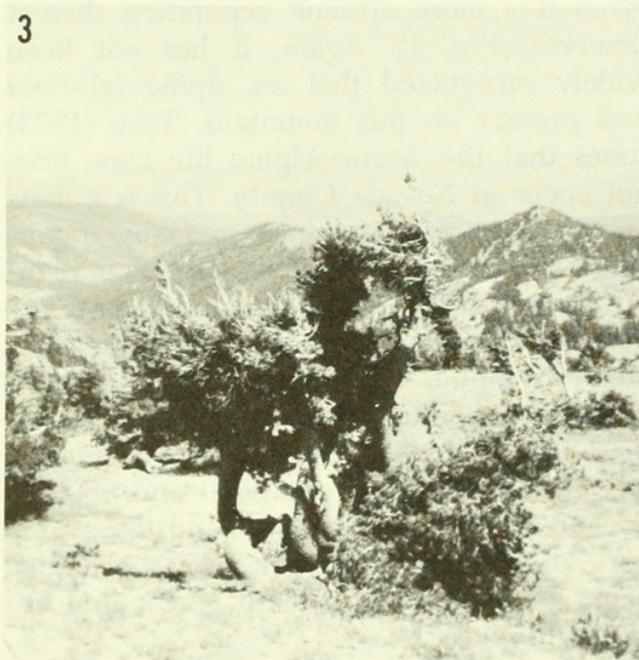
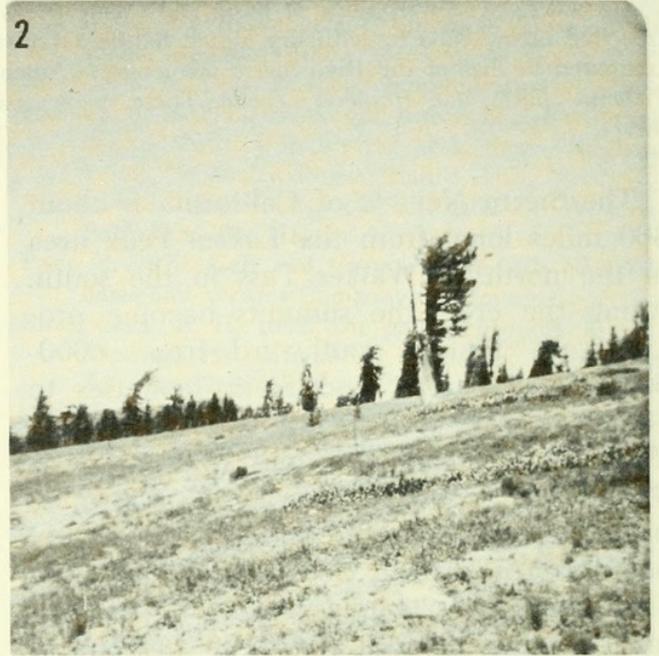
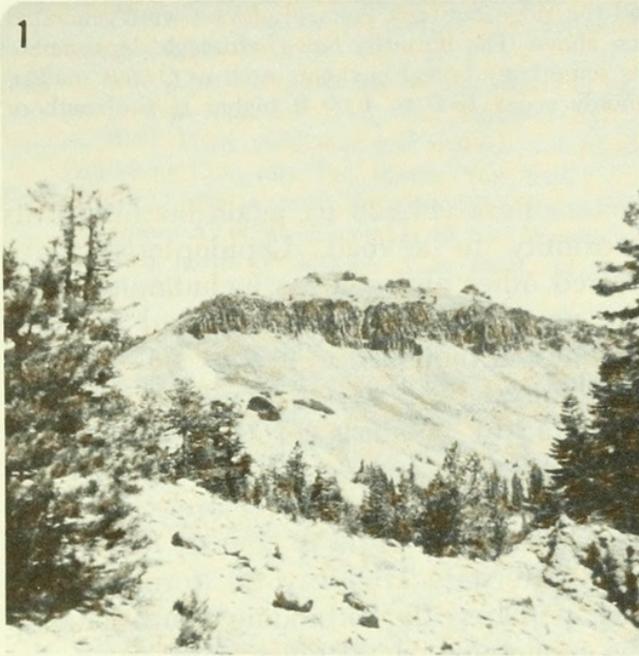


Fig. 1. Southwest face of Castle Peak seen from near Castle Pass, showing eroded "badlands" and unvegetated talus. This is the aspect of the mountain visible from the highway.

Fig. 2. Trees along the jeep trail below Basin Peak, showing shaping by prevailing westerly wind at about 8000 ft.

Fig. 3. Upper edge of subalpine forest belt, showing *krummholz* of lodgepole pine and mountain hemlock below the ridge top south of Basin Peak.

Fig. 4. Tree line is clearly visible on the west side below the ridge; note "crawling tree." Photographed from near summit of Basin Peak.

ridge top is less than 20 mph. The trees show abundant evidence of battering by the west wind (Figs. 2-4). Matted *krummholz*, consisting of *Pinus murrayana* Grev. & Balf., *P. albicaulis* Engelm., and especially *Tsuga mertensiana* (Doug.) Carr., occurs as much as 350 ft below the ridge top on the west side, and farther down the tops of the trees are commonly bent to the east. On the east side erect, pyramidal trees come almost up to the ridge top. A few nearly prostrate trees occur at low points along the ridge, and one large individual (known locally as the "crawling tree") is pressed almost flat against a 45 degree slope just below the crest.

The extensive treeless area which I am calling a fell-field (Figs. 5-8) includes about 100 species of vascular plants. Seventy of these are listed as alpine fell-field inhabitants by Munz (1970) and five are listed only from that community. Of the 24 "indicator" plants listed for alpine fell-fields by Munz (1970: 10-18), 6 occur on Basin and Castle peaks. Smiley (1921) lists some additional alpine "indicators" which occur on Basin-Castle peaks. The alpine flora includes the following distinctive taxa: *Artemisia tripartita* Rydb., *A. arbuscula* Nutt., *Railardella argentea* (Gray) Gray, *Haplopappus macronema* Gray, *Castilleja ambigua* Jones, *C. lemmonii* Gray, *Polemonium pulcherrimum* Hook., *Gentiana newberryi* Gray, *Primula suffrutescens* Gray, *Cassiope mertensiana* (Bong.) D. Don., *Epilobium obcordatum* Gray, *E. anagallidifolium* Lam., *Linum lewisii* Pursh., *Lupinus lobbii* Gray, *Astragalus whitneyi* Gray, *A. austinae* Gray, *A. bolanderi* Gray, *Ivesia gordonii* (Hook.) T. & G., *Potentilla drummondii* ssp. *Bruceae* (Rydb.) Keck, *Sibbaldia procumbens* L., *Purshia tridentata* (Pursh.) DC., *Saxifraga aprica* Greene, *S. bryophora* Gray, *Draba crassifolia* Grah., *D. densifolia* Nutt., *Erysimum perenne* (Wats.) Abr., *Ranunculus eschscholtzii* var. *oxynotus* (Gray) Jeps., *Silene sargentii* Wats., *Lewisia pygmaea* (Gray) Rob., *Oxyria digyna* (L.) Hill, *Eriogonum ovalifolium* var. *nivale* (Canby) Jones, *Salix anglorum* var. *antiplasti* Schneid., *Carex helleri* Mkeze., etc. In Table 1 the 232 species

of vascular plants collected by True (1973) and myself have been categorized by the plant communities in which they are recorded by Munz (1970). The boreal character of the vegetation emerges clearly from these statistics. Although only 18 plant species are shown as being of east-slope distribution, the Castle Peak alpine fell-field (like many in the High Sierra) shows a marked east-slope aspect, accentuated by the conspicuousness of *Artemisia* and *Purshia*. Much of the alpine flora of the Sierra is believed to be evolutionarily derived from the high desert (Chabot and Billings 1972). After snowmelt the thin, porous alpine soil dries out rapidly; occasional air-mass thunderstorms in summer temporarily replenish surface moisture. Such thunderstorms are rather more frequent on Castle Peak than in the surrounding area, presumably because its greater elevation promotes the growth of cumulus.

I have collected the Basin-Castle peaks area 13 times from 1972 through 1977. The entire area above tree line was collected on two dates: 28 July 1976 and 8 July 1977. The general Donner Pass region has been visited over 100 times since 1972.

THE BUTTERFLY FAUNA Family Satyridae

Oeneis ivallda (Mead).—The most characteristic Sierran alpine butterfly, *ivallda* occurs from about 7000 ft in the east end of Donner Pass (presumably as a stray) to 14,000 ft in the southern Sierra. Breeding

TABLE 1. Occurrence of the 232 plant species recorded from Basin-Castle peaks by plant communities recognized in the Sierra Nevada by Munz (1970). The mean number of categories (not communities) per species is 2.65.

Community	Number of Species
Sagebrush scrub (east slope)	18
Yellow pine forest	95
Red fir forest	138
Lodgepole pine forest	149
Subalpine forest	123
Alpine fell-field	70
Many communities (widespread)	22

colonies exist about 8000 ft on Mt. Judah and Anderson Peak in Donner Pass south of Interstate 80, but the one on Basin-Castle is the only colony known north of that road. There may be a colony on the smaller al-

pine summit of Mt. Lola (9143 ft) a few miles to the north. *Oeneis ivallda* was extremely abundant all along the crest on 8 July 1977, with 250 to 300 individuals seen. It was most numerous in the alpine sage-

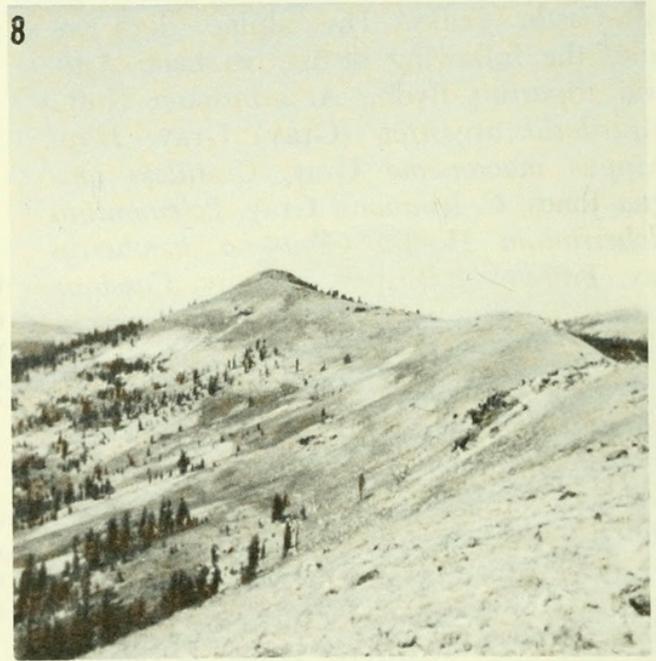
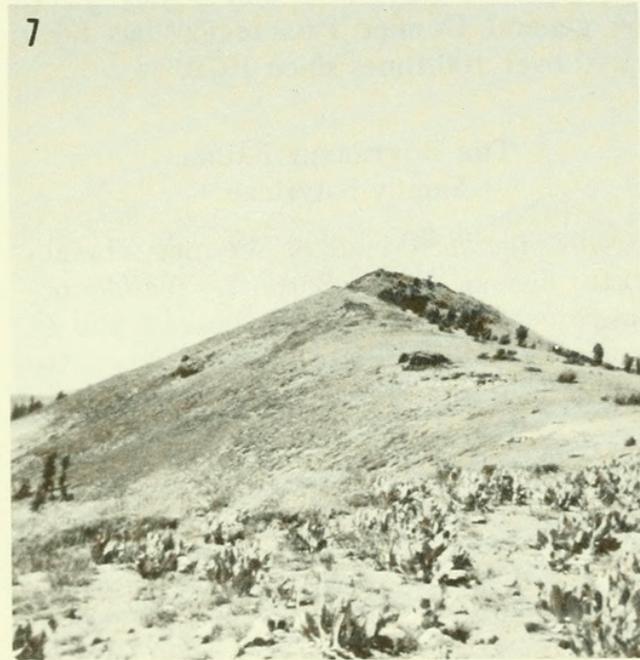
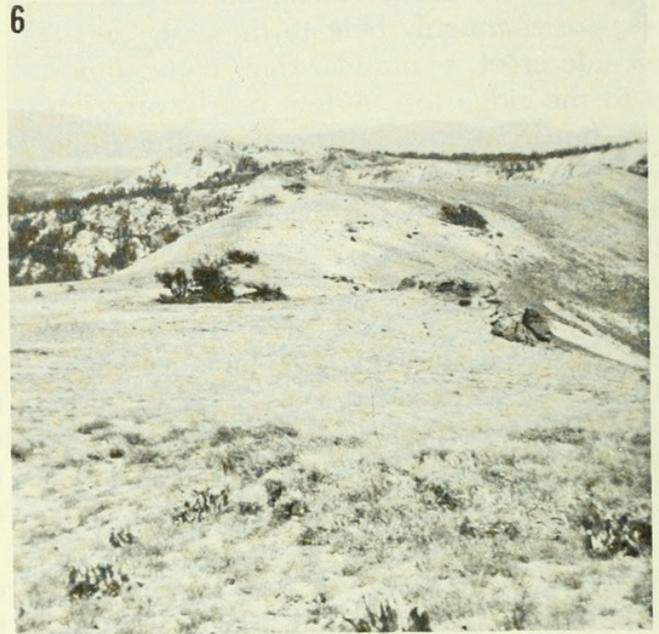
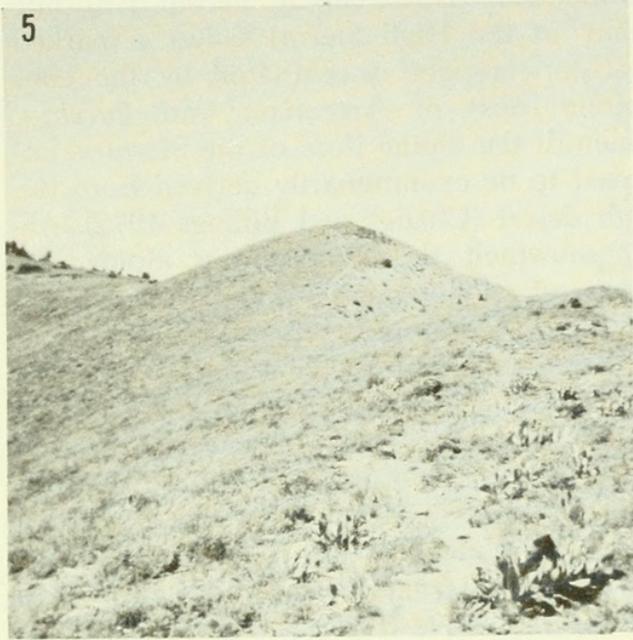


Fig. 5. Habitat of *Oeneis ivallda* just below summit of Basin Peak; turf of sedges, grasses, *Eriogonum* species, and *Astragalus whitneyi*.

Fig. 6. Habitat of *Oeneis ivallda* and *Hesperia nevada* in alpine sagebrush, grasses, and composites below Basin Peak.

Fig. 7. Ridge top showing trees on east side and alpine vegetation on west. Large-leaved plant in foreground is *Wyethia mollis* (Compositae).

Fig. 8. Ridge top looking northwest from Castle Peak, showing extent of area above tree line.

brush areas and around isolated rock outcrops. It is said to have a two-year life cycle and to be absent in many colonies in even-numbered years, but it was taken on Castle Peak in 1976. Variation is marked, especially in males. The host plant is unknown; 49 species of grasses and sedges are known from its habitat here.

Cercyonis oetus (Boisduval).— An east-slope element, this small brown Satyrid is common long after *Oe. ivallda* in the same places, flying mostly in August and on into early September after most other species have disappeared. It is presumably a grass feeder.

Family Nymphalidae

Speyeria egleis (Behr).— Males are abundant hilltoppers along the crest in July and August, but no females have been collected. This is the only silver-spotted fritillary seen in the alpine fell-fields, which are too dry for *S. mormonia arge* (Strecker).

Phyciodes campestris montana Behr.— Occasional, June to August, but not known to breed. Much more common on dry or moist slopes in the lower subalpine areas.

Polygonia zephyrus (Edwards).— Infrequent; worn specimens of both sexes (hibernators) on the crest in July. Breeding status unknown. This is a very common, widespread species around Donner Pass.

Nymphalis californica (Bdv.).— Occasional, especially in migration years. There are no *Ceanothus* (Rhamnaceae) on the ridge top, but several species used by this insect occur in subalpine areas below.

Nymphalis milberti (Godart).— Three seen (one taken) on the ridge top, apparently hilltopping, 8 July 1977. The host plants (*Urtica* spp.) do not occur above tree line. A female found on Basin Peak, 9 August 1977.

Vanessa virginiensis (Drury).— Occasional, July to September. Three potential host plants are recorded, but no larvae have been found.

Vanessa annabella (Field).— Occasional, July to August. A female was taken on 8 July 1977, and the usual host plant at Soda

Springs, *Sidalcea glaucescens* Greene (Malvaceae), occurs on Basin Peak.

Family Lycaenidae

Satyrium fuliginosum (Edwards).— Common all along the ridge top, second half of July. The butterflies scarcely fly at all unless disturbed, and they may be seen walking on *Eriogonum* and yellow composite flowers on windy afternoons. Four species of lupines occur on the summit, but I have been unable to establish an association.

Callophrys lemberti Tilden.— Frequent, mid-June to mid-July, among *Eriogonum* plants and, like the last species, seldom seen flying. The host is presumably an *Eriogonum*; eight taxa are recorded here.

Lycaena nivalis (Bdv.).— Occasional on the ridge top among the *Eriogonum* or on composites, but less common than in the subalpine areas along the trail to Castle Pass. Late June to early August.

Lycaena heteronea Bdv.— Frequent in "rock gardens," second half of July, presumably feeding on an *Eriogonum*. Females are quite dusky.

Everes amyntula (Bdv.).— In the northern Sierra and the Trinity Alps occurs a subalpine-alpine *amyntula* which is larger and duller than the montane coniferous forest populations associated with native *Vicia* and *Lathyrus* at 1000 to 5000 ft. This animal, which occurs at 7500 ft in Trinity County and above 8500 ft in the Donner Pass area (Mt. Judah, Anderson Peak, Basin-Castle) is associated with *Astragalus whitneyi* Gray (Leguminosae) and oviposits in the inflorescences. Like other lycaenids on Castle Peak, these animals seldom fly and may have to be scared up from the plants. They occasionally visit flowering *Eriogonum*. *Everes amyntula* is done flying before *Plebeius shasta* (Edw.) begins flying in the same places; its peak flight is in early July.

Philotes enoptes (Bdv.).— A single aberrant male was taken on 8 July 1977 along the ridge top. It was not associated with an *Eriogonum*. This species is so sedentary that a breeding colony must be assumed to exist.

Celastrina argiolus echo (Edw.).— Occa-

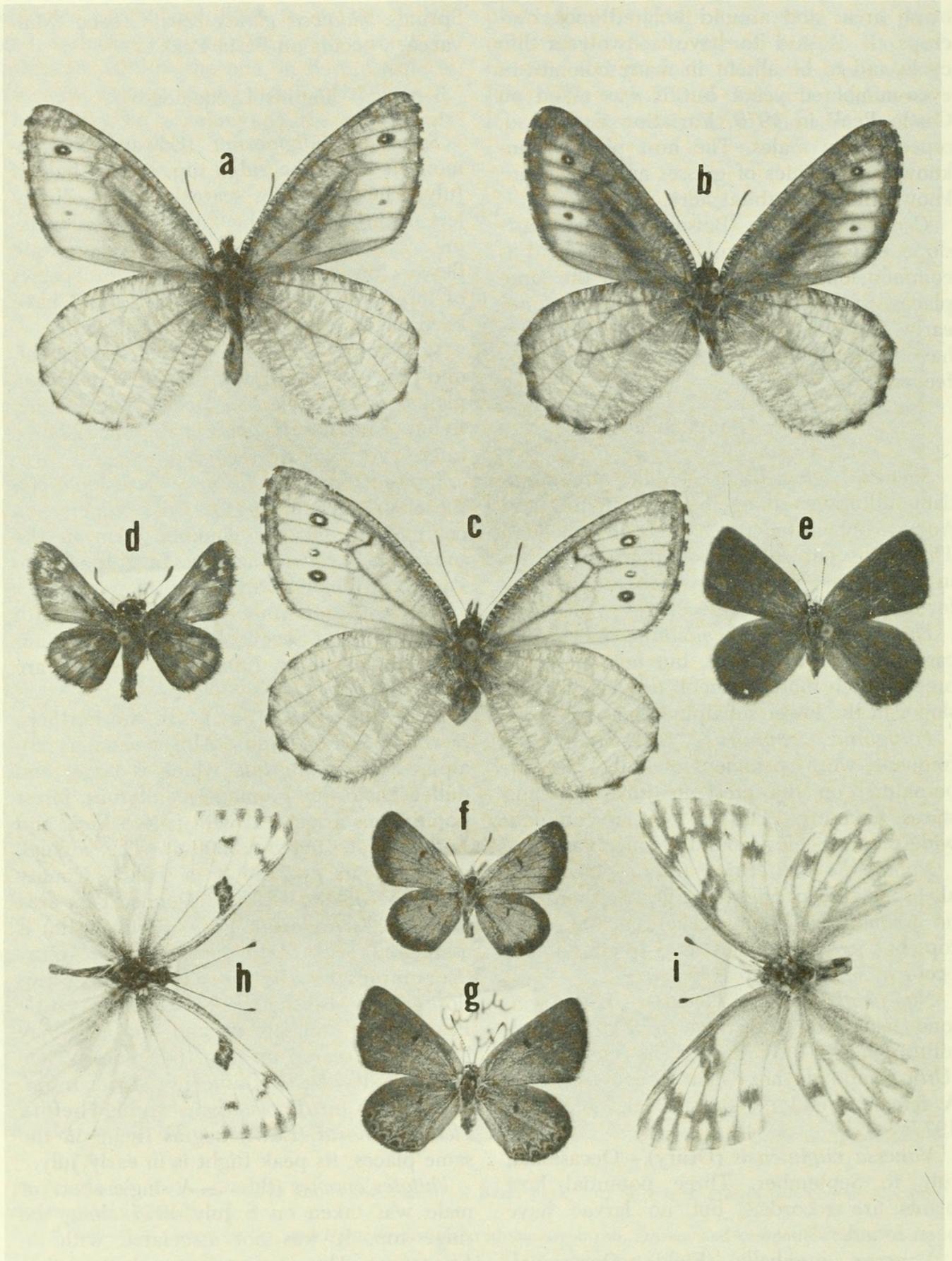


Fig. 9. Characteristic alpine butterflies from Castle Peak area: a, b, light and dark male *Oeneis ivallda*; c, female *Oe. ivallda*; d, male *Hesperia nevada*; e, female *Satyrium fuliginosum*; f, g, *Plebeius shasta* male and female; h, i, *Pieris occidentalis* male and female.

sional, June to mid-July, both sexes. Breeding status uncertain. Much commoner in the subalpine zone lower on the mountain, where its hosts (especially *Ceanothus*) are common.

Plebeius saepiolus Bdv.— Occasional, July. Two clovers (*Trifolium monanthum* Gray, *T. productum* Greene) occur on Castle Peak. This is one of the most common species in the meadow at Castle Valley.

Plebeius icarioides (Bdv.).— Common throughout July. On the ridge associated with *Lupinus arbustus* Dough. ssp. *silvicola* (Hell.) D. Dunn.

Plebeius shasta (Edw.).— Like *Oeneis ivalda*, this is a characteristic Sierran alpine butterfly. It is incredibly abundant from mid-July through mid-August, and very variable, although consistently larger than material from Inyo and Mono counties. It oviposits on pedicels of *Astragalus whitneyi* Gray, often on the same plants on which *E. amyntula* laid three weeks before.

Plebeius acmon (Westw. & Hew.).— This ubiquitous, weedy species occurs as a stray and may breed occasionally, but does not overwinter. Recorded from July to September.

Plebeius lupini (Bdv.).— Common in "rock gardens," where it is associated with *Eriogonum umbellatum* var. *covillei* (Small) Munz & Reveal, which is also the host plant in Donner Pass. Late June to mid-July.

Glaucopsyche lygdamus behrii (Edw.).— Resident but not common, late June to early July. Associated with *Lupinus polyphyllus* Lindl. ssp. *superbus* (Hell.) Munz. in a seep area on Basin Peak.

Family Pieridae

Colias eurytheme Bdv.— A common flyup, perhaps breeding but never overwintering; all season.

Pieris sisymbrii Bdv.— Frequent, late June to mid-July. Males hilltopping; females not seen, and breeding status uncertain; females have been collected in Donner Pass.

Pieris occidentalis Reakirt.— The most common butterfly on the ridge top, flying mid-June to September. Males hilltop, but

females are not uncommon. Very variable. Eggs and larvae have been collected on the following Cruciferae: *Arabis holboelli* Horn. vars. *pinetorum* (Tids.) Roll. and *retrofracta* (Grah.) Rydb., *A. platysperma* Gray, *Descu-rainia richardsonii* ssp. *viscosa* (Rydb.) Detl., and *Draba crassifolia* Grah. This is the only resident butterfly on Castle Peak that may be partially double-brooded (some years). (Note: *P. protodice* Bdv. & LeC. has not been seen on Castle Peak but was recorded in the subalpine zone in 1972 and again in 1977.)

Anthocaris sara stella Edwards.— Occasional as a hilltopper, males only seen; breeding status uncertain. Here, as in Donner Pass (Emmel and Emmel 1962, Shapiro, unpublished), occasional white males indistinguishable from *A. s. sara* Lucas are found. Eastward and lower, at Truckee, only the yellow form occurs. This situation deserves further attention.

Euchloe ausonides Lucas.— One male, 8 July 1977 on the ridge top. This small race of *ausonides* is about the same size as the next species, flies with and a bit after it, and is commonly confused with it. I have it from the Trinity Alps to Eldorado County, 5000 to 9000 ft. It may be recognized by the thinner bar at the end of the forewing cell; somewhat duller white color; less intense green mottling below; and more angular hindwing. It seems always to be rare.

Euchloe hyantis (Edw.).— A common hilltopper, mid-June to mid-July. It is not uncommon to find *hyantis*, *sisymbrii*, and *occidentalis* flying together around the same rocky crag on Castle Peak.

Family Papilionidae

Papilio zelicaon Lucas.— Common. Males hilltop, and females are occasionally encountered (especially on the ridge from Castle Pass to Castle Peak). Late June to early August. Host plant unknown; presumably one or more of the six recorded Umbellifers.

Papilio indra Reakirt.— Frequent. Males hilltop, and females are occasionally seen on the crest and also on the ridge to Castle

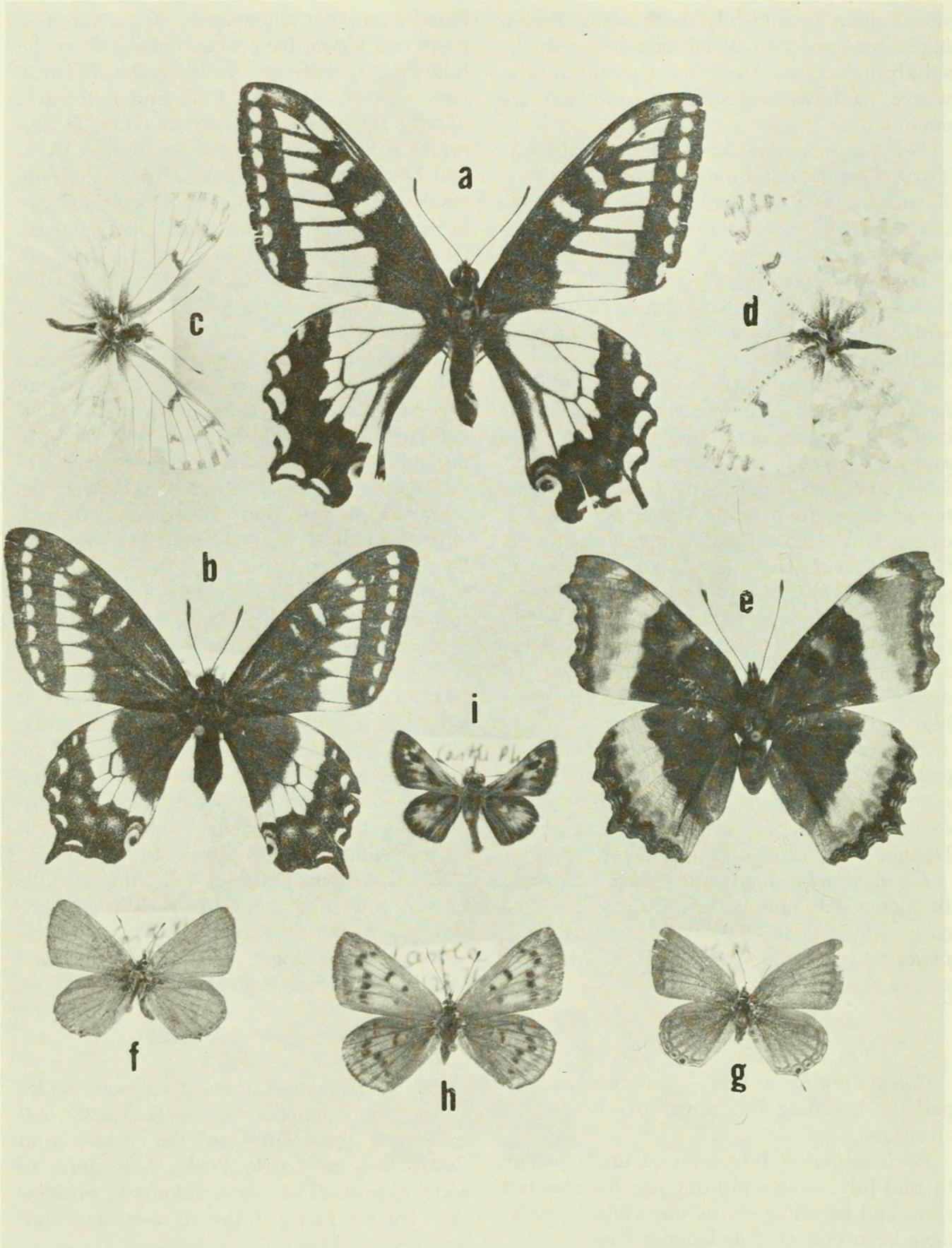


Fig. 10. Characteristic alpine butterflies from Castle Peak area: a, male *Papilio zelicaon*; b, female *Papilio indra*; c, male *Pieris sisymbrii*; d, male *Euchloe ausonides*; e, female *Nymphalis milberti*; f, g, *Everes amyntula* male and female; h, female *Lycaena heteronea*; i, male *Polites sabuleti tecumseh*.

Pass. Late June to mid-July. Oviposition observed on *Lomatium dissectum* var. *multifidum* (Nutt.) Math. & Const.

Papilio eurymedon Lucas.—Occasional male hilltopper, July; the host plants do not occur above tree line.

Parnassius clodius baldur Edwards.—Occasional, both sexes, July, probably flyups from the subalpine area where it is quite common.

Family HesperIIDae

Hesperia juba (Scudder).—Occasional, June and September; breeding status unknown. A very widespread species around Donner Pass.

Hesperia harpalus yosemite Leussler.—Only male hilltoppers thus far recorded, second half of July, occasional.

Hesperia nevada (Scudder).—Occasional on the ridge top and crags, both sexes, first half of July. This very dark, small, shaggy skipper is a true alpine species in the Donner Pass region. The Emmels (1962) found it on the summit of Mt. Judah (8243 ft).

Polites sabuleti tecumseh (Grinnell).—Infrequent, grassy area below ridge top, first half of July. Much more common in the subalpine meadows, where it oviposits on *Agrostis scabra* Willd. and perhaps other grasses.

Pyrgus communis (Grote).—Common, first half of July, ovipositing on *Sidalcea glaucescens* Greene (Malvaceae).

Pyrgus ruralis (Bdv.).—Infrequent; grassy open places on the ridge mid-June to early July. Host plant unknown.

Erynnis propertius (Scud. & Burg.).—Occasional hilltopper, males only. July. Common in subalpine areas.

Thorybes nevada Scudder.—Occasional on the ridge as a hilltopper, probably not breeding; late June to mid-July. Abundant in Round and Castle valleys.

COMPARISONS TO TIOGA PASS

Tilden's Tioga Pass study area is much more ecologically diverse than Basin-Castle Peak. It includes a spread of over 3000 ft in elevation, moraines, boggy areas, and wet

meadows above tree line. He records 43 species, as against 40 in the present study; 5 are alpine obligates, as against 3 at Castle Peak. Missing at Castle Peak are the alpine species *Chlosyne damoetas malcolmi* (Comstock), *Colias behrii* (Edwards), and *Hesperia miriamae* MacNeill. All of these are High Sierran endemics unrecorded north of Yosemite.

Some species found at Tioga Pass above tree line are strictly subalpine species farther north around Donner Pass. These include *Speyeria mormonia arge* (Strecker), *Lycaena editha* (Mead), *L. mariposa* Reakirt, *L. cupreus* (Edwards), and *Agriades glandon podarce* (Felder and Felder). One species, *Lycaena rubidus* (Behr), is a common member of the alpine fauna at Sonora Peak, occurs in Donner Pass, and may yet turn up at Castle Peak where at least one of its known hosts, *Oxyria digyna* (L.) Hill (Polygonaceae), occurs (see Johnson and Balogh, 1977). It is basically an east-slope animal. Another species found on Sonora Peak but unrecorded at either Tioga Pass or Castle Peak is the "alpine" member of the *Plebeius melissa* (Edwards) complex. At Sonora Peak and also on Gumboot Butte, far to the north in the Trinity Divide, it occurs on *Astragalus whitneyi* Gray, which is one of the most common plants on the Basin-Castle ridge top. Farther northwest, on Packer's Peak in the Trinity Alps, it is replaced on this plant by an ecotype of *P. argyrognomon anna* (Edwards), but in the Donner Pass region this insect occurs in subalpine marshy habitats on *Lupinus polyphyllus* Lindl. and has never been found at Castle Peak or on *Astragalus*. *Plebeius melissa* is predominantly an east-slope species. Multivoltine "Great Basin" *melissa* has been found in Donner Pass (Shapiro, unpublished). Another east-slope species, *Satyrium behrii* (Edw.), which occurs at Truckee and Donner Pass, has not been found on Basin-Castle although its host, *Purshia*, is common there; it is not usually an alpine butterfly in the northern Sierra.

The Donner Pass fauna as a whole is about 70 to 75 percent univoltine. Tilden claims that of the resident (as against colo-

nizing, nonwintering) fauna of Tioga Pass only *Polites sabuleti tecumseh* is bivoltine, but this claim is spurious (see Shapiro 1975). At Castle Peak one breeding resident (*Pieris occidentalis*) and one whose status is unknown (*Hesperia juba*) appear bivoltine. Both are probably bivoltine at least in the subalpine zone at Tioga Pass as well. Of the remaining 38 species at Castle Peak, about two-thirds are "early" season emergents (e.g., *Oeneis ivallda*, *Everes amyntula*, *Hesperia nevada*), appearing about three to five weeks after bare ground appears. The remaining third are "late" (*Plebeius shasta*, *Lycaena heteronea*, *Cercyonis oetus*). In the case of *E. amyntula* and *P. shasta*, which have the same host plant, this seasonal difference may facilitate coexistence. The flight season in a "normal" year is about 100 days, from late June to late September. Only one species, *Pieris occidentalis*, a famous hilltopper, covers most of that period.

One alpine species found elsewhere in the Donner Pass vicinity (*Parnassius phoebus behrii* Edw.) has not been found on Basin-Castle Peak, apparently because its host, *Sedum obtusatum* Gray, is extremely rare on the andesite substrate. It is common on granite, and the butterfly is thus effectively edaphically restricted. It ranges north to Plumas County, where it occurs at considerably lower elevations.

The isolated character of alpine "islands" in the northern and north-central Sierra makes them ideal subjects for biogeographic analysis. As Lepidopterists become less automobile-bound, increasing amounts of data may become available which will help in the eventual formulation of a biogeographic synthesis of the sources of our high-elevation fauna. In the meantime, the elevational and associational flexibility of so many Sierran butterflies underscores the applicability of the "individualistic" approach to their

distributions, rather than a rigidly "zonal" approach such as is commonly found in the butterfly literature.

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