RECENT COLONIZATION OF LASSEN PEAK, CALIFORNIA, BY THE GRAY-CROWNED ROSY FINCH

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The Gray-crowned Rosy Finch (*Leucosticte tephrocotis*) occurs throughout the Pacific states of North America in alpine habitat with suitable cliffs. One small "island" of such habitat, Lassen Peak in northeastern California, has never been reported to support the species despite considerable ornithological survey (Grinnell et al. 1930, Johnson 1975 and others). I and others have made a number of observations indicating that the species has recently colonized the Lassen area. This area is of particular interest because volcanism modified the habitat during eruptions between 1914 and 1921, and the area lies between the major ranges of the two well-marked subspecies *L. t. littoralis* and *L. t. dawsoni*. The purposes of this paper are to review previous surveys of the area, to report and discuss recent records, to document breeding status and subspecies identity, and to suggest causes of recent colonization.

STUDY AREA

Lassen Peak is the southernmost major peak in the Cascade Range, located in Lassen Volcanic National Park, Shasta County, California. The park forms a somewhat isolated area of high elevation habitat. Treeline elevation varies locally within the park. Approximately 31 km² of treeless terrain exist in the area mainly above 2580 m. Of this only 3.6 km² rise above 2900 m with 93% of this area on Lassen Peak itself. Precipitation averages 108 cm with 79% falling (mainly as snow) between November and April. Cliffs adjacent to permanent snowfields, similar to those described as preferred by rosy finches (Johnson 1965), are present on Lassen Peak and in a few other nearby locations. The very sparse vegetation in the alpine area consists of prostrate shrubs, forbs, sedges and grasses (Grinnell et al. 1930, Gillett et al. 1961). The peak was volcanically active during 1914 to 1921 when a series of small to moderate eruptions occurred. Impacts of the eruptions on local vegetation are not well documented, but some indirect evidence is available and will be discussed later. The area received intensive vertebrate survey by the Museum of Vertebrate Zoology, University of California, during the 1920s (Grinnell et al. 1930) and has received attention from ornithologists, park naturalists and numerous visitors since.

METHODS

I searched for rosy finches during 12 visits (36.5 hours total) to Lassen Peak and adjacent alpine areas from June to October in 1979 (4 visits), 1980 (7 visits) and 1981 (1 visit). I received records of sightings from files at the park headquarters and from notebooks used by editors of the Middle Pacific Coast Region of *American Birds*. Most observers were contacted directly to confirm identifications. I analyzed topography and amount of volcanic distur-

bance from photographs taken during the eruptive phase, historical records, USGS topographic maps and my own reconnaissance. Map areas were calculated using dot grids, without attempting to correct for slope.

It is not possible to distinguish the various brown-cheeked rosy finch forms in the field (N.K. Johnson pers. comm.). For convenience, in this paper I have assumed that the brown-cheeked form seen on Lassen Peak is *L. t. dawsoni*, since this is expected from current breeding distributional information (see Results). However, *L. t. tephrocotis* does occur during winter in lowlands 60 km east of Lassen Peak. Thus, it is possible but unlikely that the latter form is that occurring at Lassen Peak.

RESULTS

Evidence for former absence

Grinnell et al. (1930) conducted the first survey of the Lassen Peak area of sufficient intensity to assure accuracy with respect to presence or absence of rosy finches. They made many trips to the top of the peak and found no evidence of the species. Other records of absence result from less intensive and systematic work. Two visitor-oriented publications contain bird lists which do not include rosy finches (Stebbins and Stebbins 1953, Milne 1966). During 1957, R.E. Johnson (pers. comm.) spent many days on Lassen Peak and adjacent alpine areas and did not find rosy finches. During September 1973, he also spent a day searching the peak and did not find the species (Johnson 1975). (His 1973 visit was brief and late in the season; thus absence is not certain during that year.) Finally, no records of rosy finches appear in park observation files prior to 1966.

Records of occurrence

Table 1 summarizes all known records of Gray-crowned Rosy Finches in Lassen Volcanic National Park. All records come from Lassen Peak itself. Based on written descriptions and discussions with observers, I believe that all except one record are completely reliable. Roy's 1975 record simply states "seen 1 pair on top of peak by visitor"; I have included it for completeness only. Despite the non-systematic nature of such data, some conclusions seem warranted.

From the following details of observations in Table 1, it is apparent that a small breeding population has colonized the peak. I observed two birds that appeared to be defending a cliff in July 1979. Johnson observed a flock containing juveniles in August 1979. In August 1980, Showers and Showers saw adults feeding young. I also observed a juvenile in September 1980. In 1981 I saw a loose flock of 15-25 birds in 3-5 family groups; young in indistinct plumage begged vigorously from adults, although no actual food exchange was seen. The increase in breeding season records since 1975 may indicate that the population was established and breeding in that year. All first observations by different observers were made without knowledge of other records, except those of Laymon and Johnson; they visited the peak after hearing of records made by others. Although activity by birdwatchers has certainly increased during the last decade, it seems likely that this concentration of observations really signifies a recent arrival and continued presence of the species.

Table 1. Recorded observations of Gray-crowned Rosy Finches on Lassen Peak, Shasta, Co., California. See Methods section for comments on identification of *L. t. dawsoni*.

DATE	SUBSPECIES	DETAILS	OBSERVER
13 Jul 1966	—	Sm. flock: ads. and juvs.	S. H. Matteson
17 Jul 1975	—	2 indiv.	*fide* J. Roy
Summer 1976	—	1 indiv.	H. Gray
26 Nov 1976	*L. t. littoralis*	2 indiv.	D.A. Gaines
7 Dec 1976	—	1 indiv.	S.A. Laymon[1]
5 Jul 1977	—	1+ indiv.	H. Gray
4 Jul 1979	—	3-5 indiv.	D.A. Airola
14 Aug 1979	—	20+ indiv.; juvs. seen	R.E. Johnson
29 Aug 1979	—	Sm. flock	S.H. Matteson
18 Aug 1980	*L. t. dawsoni*	10 indiv. (est.); juvs. fed by ads.	M.A. and D.W. Showers[2]
29 Sep 1980	1 *L. t. littoralis* (ad.) and 1 *L. t. dawsoni* (juv.) identified	4-5 indiv. in 1 flock	D.A. Airola[2]
26 Jul 1981	2 *L. t. littoralis* (ads.) and 1 *L. t. dawsoni* (ad.) identified	15+ indiv. in 3+ family groups in a loose flock. Juvs. begged from ads.	D.A. Airola

[1]Winter and Erickson 1977
[2]Evens and LeValley 1981

Most intriguing is the 1966 record of adults and juveniles which suggests breeding, followed by an 8-year period during which no sightings are known. Two possible explanations exist: 1) the species colonized successfully in 1966 or earlier and was simply missed during 1967 to 1974; or 2) the species bred in 1966 but was absent in intervening years and did not become established until 1975 or thereabouts. Although the existing evidence does not rule out either possibility, I believe the latter to be more reasonable. The fact that 10 records were made by 8 observers during 5 of 6 years since 1976 suggests that had the birds been present during 1967 to 1974, they would have been recorded.

Interpretation of the status of birds observed in late fall 1976 is inconclusive because 1) *L. t. littoralis* regularly moves south to northeastern California, arriving in early to mid-November (AOU 1957, R.E. Johnson pers. comm.), 2) drought conditions during that year may have altered rosy finch distribution, and 3) the drought also permitted unusual late season access by observers to the peak by automobile.

Subspecies identity

Lassen Peak is of particular interest regarding subspecies identity of Gray-crowned Rosy Finches because it is an isolated mountaintop of alpine habitat occurring between the main bodies of the breeding ranges of *L. t. littoralis* and *L. t. dawsoni* (Johnson 1975). *L. t. littoralis* is reported to occur in the Cascades, from Alaska south to Mt. Shasta in California, and in various interior ranges in Oregon (AOU 1957, Johnson 1975). *L. t. dawsoni* is known from the White and Sweetwater mountains and the Sierra Nevada in California and Nevada, although distribution in the northern Sierra consists of disjunct populations on isolated mountaintops (AOU 1957, Johnson 1975). *L. t. dawsoni* is also present on Mt. Shasta, the only locale where hybridization of the two forms has been reported (Miller 1939, Johnson 1975).

All instances in which subspecies were determined on Lassen Peak are presented in Table 1. Showers and Showers made positive identification of *L. t. dawsoni*. Some birds showed the characteristic small gray head patch; others lacked gray altogether, a seasonal characteristic due to wear in *L. t. dawsoni* but not in *L. t. littoralis* (R.E. Johnson pers. comm.). I saw one adult *L. t. littoralis* and a juvenile *L. t. dawsoni* in first prebasic molt (showing the narrow gray head patch), both in the same flock in 1980. This observation extends the breeding season range of *L. t. littoralis* south by about 110 km from Mt. Shasta. In 1981, I identified two adult *L. t. littoralis* and one adult *L. t. dawsoni*, all with young. As noted earlier, no conclusions regarding status can be drawn from Gaines' late fall record of *L. t. littoralis*.

DISCUSSION

Reasons for recent colonization

Explanation of the recent colonization and establishment of the Gray-crowned Rosy Finch on Lassen Peak must consider why the Lassen area was not formerly occupied, and what changes have permitted the species to occur now. Grinnell et al. (1930:96) attributed the species' absence during the 1920s to an insufficient area and poor quality of the alpine habitat. The limited area hypothesis is inadequate in light of the recent records. Johnson (1975) expressed surprise that the species had not been recorded on Lassen. (He was not aware of the 1966 record.) He attributed its absence to the possibility that "too little time has elapsed for reestablishment of the alpine ecosystem since the volcanic eruptions of 1914 through 1921." Because of its dependence on alpine plant seeds and insects for food (Twining 1940, Johnson 1965), the species apparently could not survive on the peak until recently when the alpine vegetation had recovered sufficiently to provide adequate numbers of seed plants and their associated insects.

Evaluation of the extent of destruction of the flora by the Lassen eruptions and its possible subsequent recovery is made difficult by a lack of information. The flora by Gillett et al. (1961) lists species and locales, but provides little information on abundance. Alpine plant cover or abundance has not been systematically surveyed at any time before or after the eruptions. Still, an indication of the impacts of volcanic activity was derived from a variety of

sources. Types of alpine disturbance caused by volcanism on Lassen include 1) lava flow, 2) erosion from lava-melted snow, 3) ash and debris deposition, and 4) physical disturbance by eruption-generated winds. Of these, only 1) and 2) have left easily discernible evidence. I have calculated from early photos (Loomis 1926), USGS topographic maps and personal reconnaissance that a minimum of 43% of the area above 2930 m was heavily impacted by these two sources. Impacts of ash and debris deposition and winds are less evident. Volcanic ash depths of 7.5 to 12.5 cm were reported during the early eruptive period from the immediate vicinity of the craters, whereas depths of only 1.2 cm were found 0.8 km south of the summit (Loomis 1926, Abbey, n.d.). Ejection of larger debris destroyed a lookout station and its rock foundation 0.25 km from the crater and sent many large boulders tumbling down the slope of the peak (Loomis 1926, Abbey n.d.). Winds from the largest eruption, a horizontal blowout on the northeast side of the summit, blew mature timber down in a swath 0.8 km wide and up to 6.4 km away (see photographs in Loomis 1926). These disturbances surely had significant additional impacts on the alpine vegetation.

Most alpine plant destruction was concentrated on the west, north and east faces of the peak. The south face appears to have been considerably less damaged because the prevailing southerly winds reduced ash deposition on the south slope, and a small intervening ridge and a number of large emergent rock masses protected portions of the slope from rolling debris and lava-generated mudflows. In contrast to the timber destruction on the northeast slope, increment corings of White-bark Pines (*Pinus albicaulis*) now growing at 2930 m on the south slope 1.1 km from the summit craters show that the trees survived the volcanic period (unpubl. data). Plants on this slope may have served as a major source from which recolonization of the alpine flora occurred following subsidence of the eruptions.

The results of the preceding analysis are consistent with Johnson's (1975) original hypothesis that volcanic disturbance was responsibile for the absence of rosy finches. Additional botanical investigation is needed to quantify the degree to which vegetation has colonized heavily disturbed areas. Such work would be important in describing the extent of vegetation recovery and the minimum degree to which the alpine community must be developed to support rosy finches.

Although I believe the preceding scenario to be most consistent with the available evidence, it is remotely possible that a small population has occurred continuously or intermittently on Lassen Peak since the eruption and was missed by observers. A small amount of suitable habitat occurs in areas adjacent to Lassen Peak that did not receive significant volcanic disturbance.

Subspecies considerations

Except for the neighboring Mt. Shasta, Lassen Peak is the only breeding locality where both *L. t. littoralis* and *L. t. dawsoni* have been reported to occur. More work will be needed to determine if hybridization of the two forms occurs here as it does on Mt. Shasta. The fact that an adult *L. t. littoralis* type was found in the same small (family?) group as a juvenile *L. t. dawsoni* type in September suggests that hybridization may have already

occurred. The results of this natural experiment deserve closer monitoring to determine if 1) hybridization occurs freely between types, 2) proportions of each pure type or contributions by each type to the hybrid form vary over time, and 3) the situation on Lassen differs from that on Mt. Shasta with respect to the amount of hybridization and relative contribution by each form to the population.

CONCLUSION

A likely scenario explaining changes in rosy finch status on Lassen Peak is as follows. Although no documentation exists, it is likely that a small population of Gray-crowned Rosy Finches existed on Lassen prior to the most recent volcanic activity. The eruptions in 1914 to 1921 destroyed much of the birds' alpine plant food source and the species was not recorded until 1966. Establishment was not successful until approximately 1975, 58 years after the last major eruption in 1917, presumably when the alpine vegetation had recovered sufficiently to support a viable population.

Because of its unique setting as a recently disturbed alpine "island" existing between the ranges of the two well-marked subspecies *L. t. littoralis* and *L. t. dawsoni*, Lassen Peak provides an excellent setting for further studies of possible minimum habitat requirements of the species and of the long-term results of co-occurrence of both subspecies. An especially important need is for collection of a few specimens to absolutely determine the identity of the brown-cheeked rosy finch form on Lassen. The population appears to be sufficiently large to allow a few birds to be judiciously taken for this purpose.

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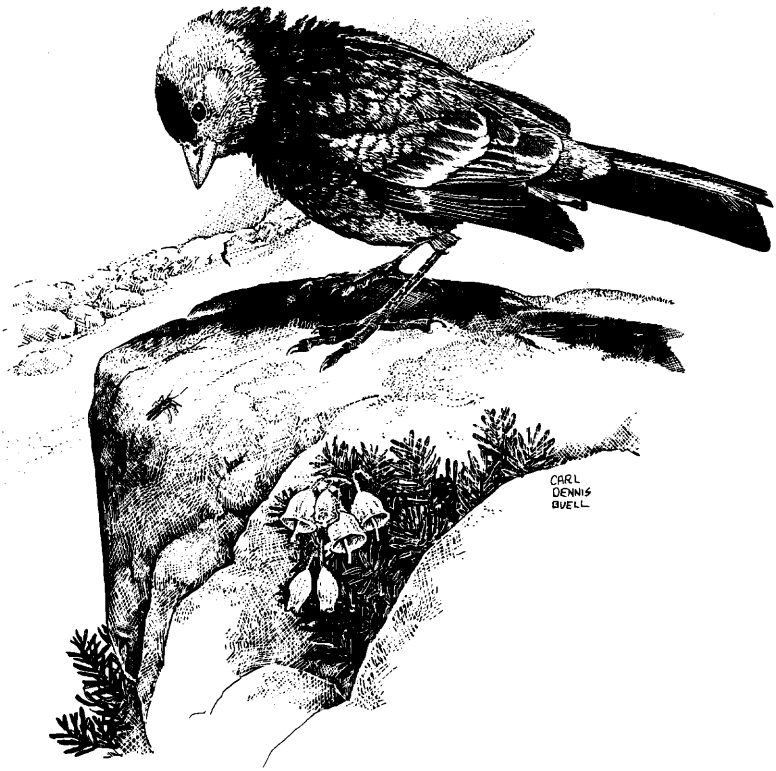

Gray-crowned Rosy Finch

Sketch by Carl Dennis Buell