

FORAGING BEHAVIOR AND SURVIVAL IN THE SIERRA NEVADA ROSY FINCH

WITH FOUR ILLUSTRATIONS

By HOWARD TWINING

A tendency among naturalists today is to select for study animals which inhabit distant regions or those that are found only in inaccessible places. Remoteness adds appeal; the greatest treasures seem to exist in far off places. The author, realizing that some of the most common and accessible birds are often the least known, still yielded to this inclination, and selected as a subject for study the Rosy Finch (*Leucosticte tephrocotis dawsoni*) of the Sierra Nevada of California.

Virginia Canyon, where these observations were made, is situated in the northern part of Yosemite National Park. It is just west of the crest of the Sierra, about thirteen miles north of Tuolumne Meadows, four miles west of Green Lakes Lodge, and fifteen miles south of Bridgeport. A stream, Return Creek, runs through it, first southward and then westward to join the Tuolumne River about fifteen miles east of Hetchy Reservoir. The greater part of this study was confined to the region of a great cirque which forms the extreme upper end of Virginia Canyon. In this report the term "Virginia Canyon" refers only to the Hudsonian and Arctic-Alpine zones of the canyon, of which the major part is included in the great cirque.

The cirque is bordered on the east by Virginia Pass (10,600 feet) over which supplies were back-packed from our base at Green Lakes Lodge. The remoteness of the country and the difficulties of transportation were partly compensated for by the relief from human interference with the birds and their surroundings.

The east side of the canyon is a single steep slope covered with *Artemisia tridentata* and other plants which are representative of the Great Basin flora. The west side is more typically Arctic-Alpine. The slopes here are broken by rock outcrops, small sedge-covered meadows, occasional moraines, and small lakes. Timberline follows the lower edge of the cliffs. The trees are stunted white-bark pines (*Pinus albicaulis*), and are concentrated on the small ridges and other high spots on the floor of the cirque. During the early part of the year these stand out like islands surrounded by a sea of snow. The cirque contains several small lakes and one larger unnamed one, about two acres in extent, which we called "Leuco Lake." This lake is located on a shelf on the southwest side of the cirque.

Observations in Virginia Canyon extended from June 14 to July 31, 1936, and from June 14 to July 25, 1937. A reconnaissance of about thirty miles of the crest of the Sierra Nevada north of Virginia Canyon was made from May 23 to 31, 1936. Four days of the same year, between August 15 and 19, were spent in Virginia Canyon. In 1937 a ski trip into Virginia Canyon was made from May 16 to 18 to observe the activity of the birds early in the season. During the first two weeks of January of both 1935 and 1937, I searched for birds on the mountains surrounding Echo Lake (7500 feet) in Eldorado County, but was unsuccessful. Two short trips in late fall were taken into the high country east of Yosemite to observe the habits of the birds at that season.

My brother, Wilbur Twining, was my constant companion throughout the two periods of summer observations. Without his assistance this study would have been much more difficult, perhaps impossible.

The rosy finch is an opportunist, living throughout the year on whatever happens to be the most abundant and readily obtainable kind of food. The food supply varies with the season and locality, and an analysis of rosy finch food habits must take these matters into consideration.



Fig. 19. Virginia Canyon, Yosemite National Park, California, showing "Leuco Lake"; July 3, 1936. Receding snow banks at this season continually uncover new supplies of food for rosy finches.



Fig. 20. Head of Virginia Canyon, showing condition of snow and ice on June 21, 1937.

Grinnell and Storer (1924, *Animal Life in the Yosemite*, p. 432) report that the contents of crops of ten rosy finches collected in August consisted ninety-one per cent of small seeds and nine per cent of insects. This proportion is what would be expected at this time of year when the most abundant food is the ripening seeds of sedges and other low alpine plants. Earlier in the year, when there are still extensive surfaces of insect-covered snow, and when insects are hatching in trees and on lake shores, a larger proportion of insects probably is obtained.

During the early part of the nesting season when snow covers most of the food at higher altitudes, rosy finches concentrate either at comparatively low altitudes on patches of bare ground just above the dense stands of lodgepole pine, or at very high altitudes where winds, snow-slides and rapid melting have cleared the snow from the ridges and cliffs. Between the forest border and the mountain tops scattered birds may be found foraging, either on the rocky promontories which are first to clear of snow, or on the surface of the snow.

During May and early June there seem to be many more insects on the snow than there are later in the season. Smooth unbroken stretches of snow on the north-facing slopes are littered with dead insects, often numbering as many as twenty-five or thirty to the square yard. Despite this bountiful supply the rosy finch is usually found gleaning last year's sedge seeds on the open ground.

Many of the insects on the snow surfaces are not indigenous to the immediate region, but have been swept up to high altitudes by strong westerly air currents and dropped on the snow to become paralyzed, and eventually killed and preserved by the cold.

Rosy finches foraging on the snow usually advance into the wind. They obviously make selection from the variety of insects spread before them. On July 11, 1936, a bird was watched that took on the average one from the snow surface in every three or four feet, even though there were about two insects to the square foot. Small soft-bodied forms, especially dipterans, seemed to be preferred. Lady-bird beetles, although numerous, were never eaten, but small beetle elytra were often found in droppings. Lepidopterans and hymenopterans also seemed to be disregarded.

When snow is rapidly clearing from the timberline area, rosy finches congregate along the thawing edges of snow patches where food that has not been exposed since the previous fall is being uncovered. In the middle of June, the distance that certain snow patches receded in a day was found to vary from one foot to as much as thirty feet. The newly exposed areas expand much more rapidly than the food from them can be utilized by the rosy finches. Why, then, do the birds prefer to forage within a few inches of the edge of the snow, when there are great expanses of meadowland which have not been touched or have been gone over only superficially? This strip always insures a fresh supply of seeds which cannot have been extensively worked over. Perhaps for this reason the birds forage in the area of recognized abundance and disregard the rest.

There are, however, certain differences in the freshly uncovered food at the edge of the snow and the food that has been uncovered for some period of time. Seeds at the edge of the snow have been moistened by the melting snow and may be more palatable for that reason. Rosy finches that forage away from the edge of the snow usually are found on moist ground where they feed on damp seeds. Also, sedge seeds begin to sprout when still covered with many inches of snow, and when the snow melts they may have roots that already are several millimeters long. A day or more after the snow has receded most seeds have become so firmly rooted in the soil that they cannot easily be extracted. In order to find seeds with sprouts that are short enough so that the morsel is of manageable size, the birds must forage along the areas that are recently exposed.

Sedge seeds are usually worked in the bill momentarily before swallowing. The chaffy seed coat is separated and dropped, but usually some of it adheres to the sides of the bill, and this is occasionally wiped off on bristly sedge tufts.

Seeds of plants other than the sedge are eaten. A bird was observed eating seeds from the dried stalk of a cinquefoil (*Potentilla glandulosa*); another fed for ten minutes exclusively on the sprouting seeds of *Eriogonum ovalifolium*. A female industriously digging into soft earth was found to be feeding on the bulb of a young *Lewisia*. Another fed for three minutes on the tender young shoots of this plant.

The seed of the common *Erigeron compositus*, which is only found at very high altitudes, offers a readily obtainable supply of food for incubating female rosy finches that may leave the nest only for a few minutes. Uncovered by avalanches or winds, the seeds of this plant undoubtedly become an important part of the winter food supply.

As the season progresses, the supply of insects on the snow is reduced, for it is now late summer in the great valley to the west whence many of them came. The insect diet is maintained by indigenous insects which are hatching in abundance at this time. July 3, of both 1936 and 1937, was the earliest date on which I saw rosy finches foraging in white-bark pines. Here they were gathering a minute white scale insect (*Chionaspis pinifoliae*) from the bases of the needle clumps. Occasionally one would be seen picking insects from under the bark scales of these trees.

Sometimes rosy finches were seen picking small gnats from the foliage of sedges. They also pulled out large cutworms from the bases of sedge clumps. Before swallowing these they pressed out and discarded the intestines, which were filled with compact green masses of bits of sedge blades.

On July 5, 1936, rosy finches first gathered at the shore of Leuco Lake to feed on caddis flies. On that day the last bits of floating ice cleared from the lake. The caddis flies collected on the lower sides of rocks that overhung the water's edge, and the birds, by elaborate maneuvering, managed to pick off a few of them. Most of these insects, however, were captured in the air as they flew out over the lake.

The most active foraging began when mayflies first emerged in numbers. Along the lake shore, birds were seen catching these insects in flight, swallow style. They captured them at the water's edge, ouzel style, and in the meadows, pipit style. Nearby, rosy finches fed at the edge of the snow and on the surface of the snow.

The predominant method of feeding changes as the day progresses. In the early morning mayflies emerge, remaining for a while on the rocks, or on the water supported by the surface tension. During this morning period most captures are made by birds standing on half-submerged rocks, where they pick the insects that are being blown toward the shore from the surface of the water. Some of the more active birds fly over the water and gracefully pick the mayflies by the wings from its surface. This is a common method of feeding when there is no wind, and mayflies are resting motionless on the surface of the water, wings held vertically.

When the sun is high and the air has become warm, the insects start rising from the surface of the water and from crevices between partly submerged rocks. Rosy finches quickly gather around these centers of insect activity. Most of the captures are then made in the air. A mayfly seldom was seen to rise higher than twenty or thirty feet before it was caught, but occasionally a rosy finch would have to spiral upward for a hundred feet or more to make a capture. When mayflies are rising in numbers, a bird will sometimes make six or seven captures in one erratic flight far out and high over the lake. The captures in the air always involve a direct flight toward the insect and an upward swoop as the capture is made.

A mayfly is usually brought back to the rocks of the shore, where it is manipulated in the bill until both wings, and occasionally the cerci, are snipped off. The rest of the insect is swallowed. On long flights the insect is swallowed before the bird returns.

When a light breeze is blowing across the lake, masses of drowned insects float to the shore. In the shallow water near the shore, rosy finches work through this accumulation and pick out the palatable insects. Mayflies are preferred, and if these are drowned and water-soaked they are eaten wings and all. Small soft-bodied insects, such as gnats and mosquitoes, are also eaten. Rosy finches were observed foraging in a manner similar to this typical lake-shore method from the rocks and banks of a slow-moving stream

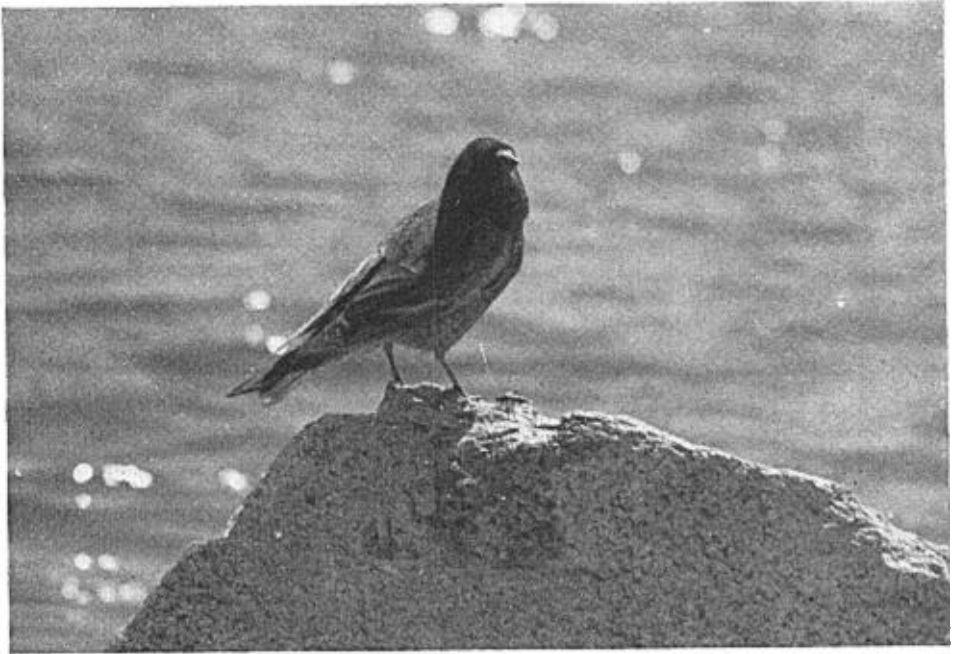


Fig. 21. Sierra Nevada Rosy Finch on shore of "Leuco Lake," showing throat bulging with food.

near McCabe Lakes. Here they were obviously competing with rainbow trout, for the fish of the stream were feeding on the same sorts of insects as were the birds.

Rosy finches were seldom seen drinking. Occasionally one did drink from Leuco Lake in a typical passerine fashion. One bird drank several times from water which was covered with a yellow scum of pollen from the white-bark pine. This pollen is a strong cathartic; a small amount will make a human being violently ill.

During the feeding at the lake shore, rosy finches seemed to alternate regularly between the lake shore and the edges of near-by snow patches. There is evidently a desire to include at least a small amount of vegetable matter with the insect diet that the birds get at the lake.

Occasionally a bird with bulging throat would fly from the lake shore diagonally up the slope toward the nesting cliffs. Several times I watched an individual alight near the shore of the lake and wipe a fecal sac from its bill onto a rock. Examination of these sacs disclosed a predominance of hard parts of insects, and some husks of seeds.

Between 10:30 and 11:00 a.m., the number of mayflies rising from the lake diminishes, and by noon of each day these insects practically disappear. Rosy finches would leave the lake during this period, and in the afternoon only occasional vagrant birds would be found there. On July 21, 1936, this exodus took the form of an organized flight from the lake. At 10:30 a.m. three birds arose from the lake shore uttering the *peww* call. As this group circled over the lake, it received additions from all parts of the lake shore. After circling four times at a height of about a hundred feet, the flock, now numbering close to twenty individuals, flew far out over the valley, then turned and headed up the valley. During the afternoon, after the flight from the lake, rosy finches were exceedingly hard to find. They seemed to have split into small groups that were widely scattered over the valley.

Toward the end of the breeding season, rosy finches became numerous on the artemisia-covered, west-facing slope of Virginia Canyon. On July 13, 1936, a flock of about seventy-five rosy finches was observed on the slope north of Shepherd Crest. They were capturing minute insects from the foliage of the artemisia. They gathered these while standing on the ground, or while perching unsteadily on the tops of the flattened bushes. Occasionally a bird on top of a bush lost its balance and temporarily supported its body with its wings until it could regain its footing.

The main food of the rosy finch after the middle of July is the ripening seeds of the hair sedge. Most birds were found during this time in the small mountain meadows picking these seeds directly from the clusters at the ends of upright stalks. Rosy finches deserted the lake completely by the first week of August when the supply of mayflies was exhausted.

Rosy finches retain the flocking habit throughout the year. In the nonbreeding season they are at their numerical peak. During the nesting season the birds continue to assemble on the feeding grounds, but the groups then are noticeably smaller. In Virginia Canyon on July 27, 1936, I saw a flock of 200 adults, and on August 17, 1936, a flock of about 50 young and adults. On September 28 near Cathedral Peak I found a flock of about 35. On October 10, 1937, I saw 200 or more on the steep north face of Mount Clarke. A few flocks observed after the nesting season were small, but the large-sized flocks are, I believe, most characteristic of fall and winter.

Flocks in the breeding season are ephemeral groups, constantly fluctuating in numbers of birds, and continually breaking up and reforming. A twittering *whit-whit* usually is uttered continually by a few members of the flock and may serve to keep the birds together. A nasal *tee* or *peww* is given when a flock flies and seems to serve as a sort of rallying call. When this call is given by members of a flying flock, lone birds often will stop foraging, utter the same note, and either resume foraging or fly to join the flock. A bird when alone appears to be more wary than when it is one of a flock, although there seem to be certain birds in every flock which are more sensitive to danger than others, or that act as sentinels to warn the flock of the approach of an intruder.

When several birds forage successively along the edge of a snow patch, the last bird seems to find just as much food as the first. Rosy finches never seem to exhaust the supply of food before moving on. Frequent flights for no obvious reason are characteristic of rosy finch behavior. Is this necessary in the economy of existence? Perhaps rosy finches must move this frequently in the winter months when food is scarce and cannot adjust themselves to fewer movements in the few months when food is more plentiful. Otherwise this must be attributed to an "outlet for excess of vigor," a supposition all too frequently used to cover ignorance of the meaning of bird action.

Despite the abundant food supply of the summer months, two foraging birds often quarrel when they approach each other. On June 21, 1936, in the snow-filled cirque west of "the pinnacles," this distance between birds was five to ten feet. In the course of normal foraging on damp ground at the edge of the snow the distance was usually about a foot. Pursuits occur regardless of sex, but the males seem the more irritable.

If a bird finds an especially good feeding ground, it may defend it against intrusion. A male feeding around a hole in the ice of a lake once routed three other birds that attempted to alight nearby; but it left after feeding for only about four minutes, even though succeeding birds seemed to find plenty of food there. On other occasions the defender may be routed. One male, that foraged with four other males, seemed to have found a good spot in a damp patch near the edge of the snow whereupon one of the others flew straight toward him. He lowered his head and flattened his body, but flew just as the other bird seemed about to strike. About ten seconds later a third bird usurped the same area without meeting resistance.

Occasionally two males engage in short pursuits for no obvious reason. On June 30, 1937, I was observing two males foraging near a waterfall just below Leuco Lake. One pursued the other from grass to rock to snow, back and forth for seven or eight flights. Then the pursued became the pursuer and the flights continued. The flights were obviously not hurried, and at no time did either bird *ever* strike the other. Occasionally, when both birds alighted on the same rock, one would run head down across the rock, driving the other off. Once, a pursuit ended abruptly after three minutes and the two then fed in perfect harmony, often within a foot of each other. Five minutes later the pursuits were continued and lasted two minutes more before the birds again resumed feeding.

The Sierra Junco (*Junco oreganus thurberi*) is probably the bird most commonly associated with the Sierra Nevada Rosy Finch. Juncos have been observed foraging along the edges of receding snowbanks early in the season at a time when rosy finches depend almost entirely on these border areas for their food supply.

On July 21, 1936, a male rosy finch was catching mayflies in the air above the north shore of Leuco Lake. A junco in juvenal plumage was performing almost identical actions. The two would leave the rocks at about the same time and head for the same insect. As the rosy finch caught the insect, the junco would feint at it, then both would return to the rocks. This performance continued for about half an hour before the rosy finch left for the opposite side of the lake. It may be that the young juncos learn this method of catching insects from the rosy finches. On other occasions I saw flocks of young juncos mixed with rosy finches on the lake shore, catching insects in a similar way.

White-crowned Sparrows are found in the same area as rosy finches, but their forage ground is in or near the clumps of dwarf willow where rosy finches seldom feed. A pair of Water Ouzels fed regularly along the lake shore. With the bill or the entire head submerged they captured small insects just below the surface of the water. Rosy finches seemed to overlook or ignore this underwater food, for a Water Ouzel often would feed for a minute or two along the edge of a small rock where several rosy finches had passed a short time before without making a capture.

As the snow melts in June and July, much food is uncovered at high altitudes. Many species of birds move up from lower altitudes to take advantage of this abundance, and they stay while insects hatch and seeds of plants mature. While these birds are present there, the food problem is not important; there is plenty for all, and especially for the rosy finches, for they can adapt themselves to several sources of supply, any one of which probably could sustain the entire rosy finch population.

In the winter when the food problem becomes a serious one, other birds migrate to lower levels. What happens to rosy finches in the winter months is still a puzzle. I have found only one record of rosy finches in the high Sierra in mid-winter. On January 8, 1935, Stewart Kimball saw a flock of fifteen foraging on the snow high on the west slope of Mount Lyell. I have received several reports of flocks seen in the desert country of Inyo and Mono counties east of the Sierra. It is possible that rosy finches move to lower levels only as a temporary retreat from winter storms.

A region that supports few birds would be expected to have few animals that prey on birds. This is true of Virginia Canyon. Occasionally a Sparrow Hawk approached the nesting cliffs and was pursued by one or several rosy finches until it left. One Goshawk and one Cooper Hawk were seen in our stay at Virginia Canyon. Late in the year a group of fifteen rosy finches was observed pursuing a Sharp-shinned Hawk as it circled over a flock of two hundred rosy finches on Mount Clarke. I have seen Prairie Falcons in other parts of the high country, but not in Virginia Canyon. Horned Owls were never seen or heard above timberline.

Rosy finches probably suffer desultory attacks from all of these birds, but I doubt if any of them is common enough to affect seriously the rosy finch population. Dixon (Condor, vol. 38, 1936, p. 4) considers the Clark Nutcracker the most important predator on rosy finches in the Mammoth Pass region of the Sierra Nevada. He has observed nutcrackers which seemed to be actually searching the cliffs for rosy finch nests. In Virginia Canyon, however, I saw no indication that the nutcracker was predatory on rosy finch eggs or young. The only nutcrackers I ever saw in the nesting area were merely passing by or had stopped to rest. I never saw one searching for a nest; but, they seem to be regarded as enemies, for occasionally a passing nutcracker would be pursued by one or several rosy finches.



Fig. 22. Pinnacles at head of Virginia Canyon in which rosy finches nested.

Of the smaller predatory mammals, weasels and chipmunks were the only kinds encountered. The least weasel was occasionally seen in the high meadows of the upper part of the valley, and the larger mountain weasel was seen once, near timberline. Weasels are doubtless a menace to ground-nesting birds, but I never saw them leave the meadows, where meadow mice, ground squirrels, and chipmunks are abundant, to forage on the relatively barren cliffs above.

The alpine chipmunk (*Eutamias alpinus*) was probably the most common mammal in the timberline area of Virginia Canyon. Circumstantial evidence marking this animal as a nest robber has been accumulating through two summers. By watching its unceasing activity it can be seen how few nests on the ground can escape its ultimate detection. I was never able to observe a chipmunk actually raiding a nest, but after watching many nests day after day, only to discover clutches of eggs suddenly missing or the young lying dead and half-eaten, I was forced to conclude that only the chipmunk could be responsible for such widespread damage.

White-crowned Sparrows evidently suffered heavily from chipmunk attacks in Virginia Canyon. In 1936 I found five nests of the White-crowned Sparrow, all located on the ground near timberline. Two of these were robbed of eggs; the other three, at some stage of development, were found with badly mangled and partly eaten young.

Chipmunks are found commonly on the barren rocks and cliffs from timberline to the tops of the mountains and here they are good but cautious climbers. The rosy finch usually protects its nest from climbing animals by building it in a niche surrounded by smooth rock or by placing it below an overhang. In 1936 eleven nests, all on cliffs, were well protected and none was destroyed. In 1937, of ten nests on the cliffs, two were in sites that were obviously accessible to climbing mammals and both were raided. One of these was protected from below by a wall of snow, but the very day the snow melted sufficiently to allow a chipmunk room to squeeze around it, the four young were carried off. One of these was found badly mangled among the rocks below the nest. Indisputable evidence of the chipmunk's presence at the nest that day was found in the form of chipmunk excreta in the cup of the nest.

The three nests found in moraines in Virginia Canyon were situated high on mountain slopes far from vegetation. The danger of discovery by prowling mammals was thus reduced to a minimum. In spite of this precaution, two of these nests were robbed of their eggs.

Other regions may have different animals that are important predators on rosy finches, but in Virginia Canyon it appears that predation by the chipmunk not only tends to limit breeding rosy finches to the vicinity of the highest cliffs, but also it is the most important factor in the mortality rate of eggs and nestlings.

Oakland, California, November 10, 1939.