

REPRODUCTIVE ACTIVITIES OF ROSY FINCHES, WITH SPECIAL REFERENCE TO MONTANA

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THE Gray-crowned Rosy Finch (*Leucosticte tephrocotis*) is found throughout the higher mountains of western North America and is one of the few species of birds which breed in the alpine (Arctic) zone. Few detailed nesting records of the species exist because most of this high, rugged country is inaccessible by road and all of it has a short summer season. However, Logan Pass in Glacier National Park, Montana, offers a unique opportunity to reach this alpine habitat via a paved road. The Park's one million acres are characterized by large U-shaped glaciated valleys and high arêtes and horns. Peaks run from 8,000 feet to 10,500 feet in elevation. Many glaciers and permanent snow fields occupy cirques in the higher portions of the mountains.

Logan Pass was the focal point of a four-year study (1958–1961) of the breeding activities of the race *L. t. tephrocotis*, while I was employed as a ranger-naturalist. Unless otherwise indicated, all comments refer to this race and this area. Although this race of rosy finch inhabits an extensive range extending from the Brooks Range of northern Alaska southward through the higher mountains to northwestern Montana (A.O.U. Check-list, fifth edit., pp. 564–565, 1957), only one nest has previously been reported in the literature (Macoun and Macoun, 1909: 466) and no detailed nesting observations have been published.

The present observations supplement recent studies of *L. atrata* by French (1959b) and earlier studies of *L. t. dawsoni* by Twining (1938, 1940). References made to these authors throughout the paper refer to the respective forms indicated here unless otherwise stated.

The A.O.U. Check-list (1957) separates the genus *Leucosticte* into three species: *L. atrata* (Black Rosy Finch), *L. australis* (Brown-capped Rosy Finch), and *L. tephrocotis*. The last includes six races: *L. t. umbrina*, *griseonucha*, *littoralis*, *tephrocotis*, *wallowa*, and *dawsoni*. French (1959a: 21) considers all American forms of *Leucosticte* to be included in the species *Leucosticte tephrocotis* and Vaurie (1959: 623) further states that the American forms are conspecific with the Asian *L. arctoa*. The A.O.U. nomenclature has been adopted here since the taxonomic arrangement may not be fully resolved.

NEST SITE

Seven nests were found, at elevations between 6,400 feet and 7,600 feet. Three nests were on Mt. Clements, one each on the Garden Wall and

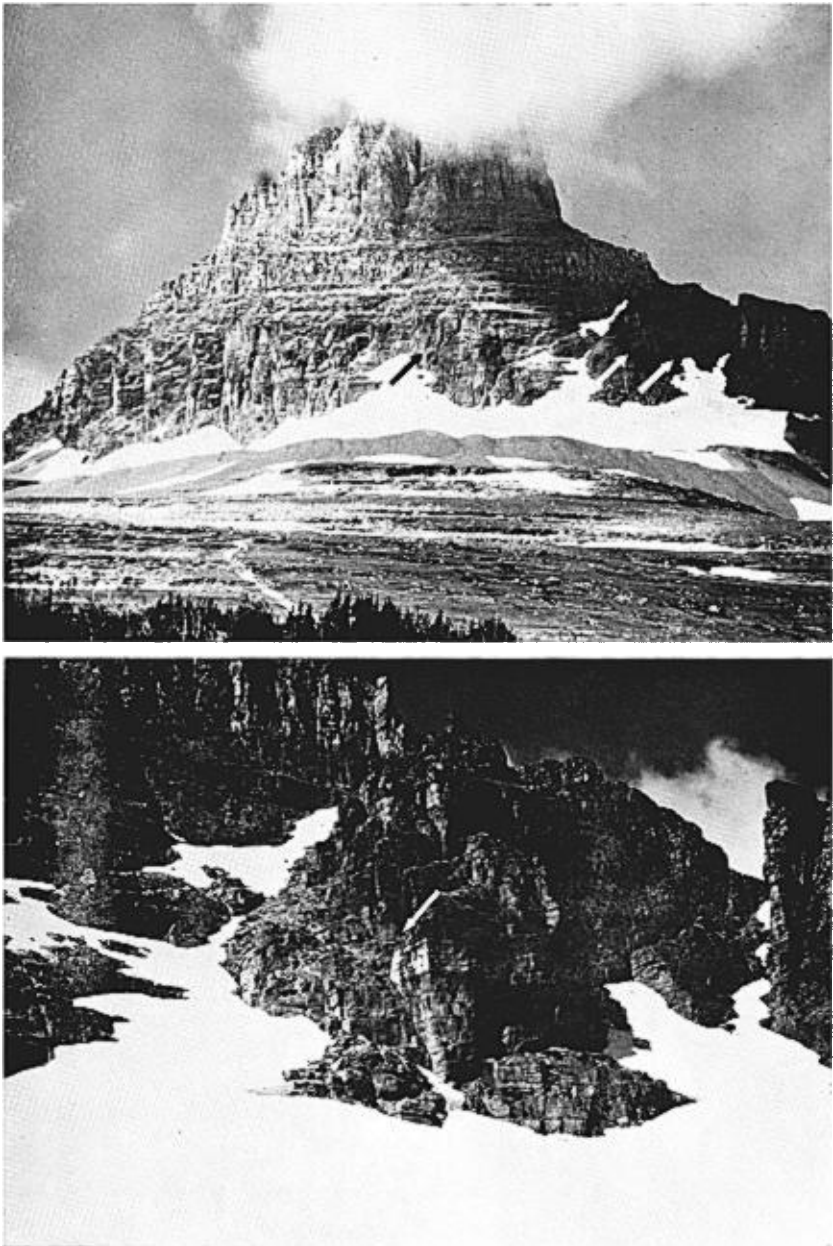


Figure 1. A (upper). Cliffs above permanent snow field on Mt. Clements, Glacier National Park, Montana (locations of nests of *L. t. tephrocotis* in 1959 marked with arrows). B (lower). The same cliffs, closer view (location of a nest of *L. t. tephrocotis* marked with arrow).



Figure 2. Eleven-day-old *L. t. tephrocotis* (right) and seven-day-old nest mate (fell from nest site while being examined). Photographed on 24 July 1959.

Pumpelly Pillar, and two above the south end of Crypt Lake, on the Canadian border.

Six of the seven nests were located in cliffs overlooking large permanent snow fields or glaciers, which served as feeding areas during the nesting period. The seventh nest faced west overlooking a dry slope; however, the adults were observed making regular feeding trips between the nest and Grinnell Glacier, which was located over the ridge behind the nest and less than one-quarter mile away.

Six of the seven nests were placed in cracks or holes in cliffs, which offered protection from all approaches except the entrance. At five sites, overhanging rocks above offered additional protection. One nest was exposed on a small ledge but was located under an overhanging rock, which offered protection from above. Of the five nests observed closely, two were four to five inches in from the edge of the entrance, two were two feet in and one was on the small ledge mentioned.

Lloyd P. Parratt (pers. comm.) located a nest in a small hole under a rock slab at 8,500 feet elevation on the Sperry Glacier headwall in Glacier National Park in July, 1949.

TABLE 1
NEST SITE IN SEVEN KINDS OF ROSY FINCHES

Cliff	Ground	Building	Reference	Cliff	Ground	Building	Reference
		<i>australis</i>				<i>littoralis</i>	
1			27		1		2
		3	9	2			12
(1)		(3)		3			33
				6			42
		<i>dawsoni</i>		(11)	(1)		
	4		38			<i>tephrocotis</i>	
9	1		10				
9	1		11	12			6
	1		45		1		Parratt ³
18			13	7			Johnson ³
		1	40, 41	1			Weeden ³
	1		39				
21	3		49	(20)	(1)		
1	3		51			<i>griseonucha</i>	
6			43				
(64)	(14)	(1)		1			8
				1			3
		<i>atrata</i>				1	4
4			32	(2)	(1)		
7	1		18			<i>umbrina</i>	
	1		Johnson ¹			1	14
	1		Choate ²	2			36
(11)	(3)			1			44
				1		1	19
				(4)		(2)	
Totals				113	19	7	

¹Nest containing five young found by the author on 22 July 1962 in a talus slope in the Highland Mountains south of Butte, Montana.

²Nest with four young located by Thomas S. Choate on 29 July 1962 in moraine of Grasshopper Glacier in the Beartooth Mountains of southern Montana.

³Records published in this paper.

Robert B. Weeden (pers. comm.) located one nest on 8 July 1960, containing three or more newly hatched young in a cliff above Peters Lake in the Brooks Range of Alaska; however Feinstein (1958: 11-12) has referred birds of the Brooks Range to the new race *L. t. irvingi*.

Comparative data and discussion.—Rosy finches in many areas have been known to nest on the ground and in old buildings as well as in cliffs. Table 1 summarizes the published nest records by race where a description adequate to determine the type of nest site chosen was published. Only for *L. t. dawsoni* are there sufficient data to draw conclusions at the racial level; 81 per cent nest in cliffs, 18 per cent on the ground, and 1 per cent in old buildings. For all races, 81 per cent nest in cliffs, 14 per cent on the ground, and 5 per cent in old buildings.

Cliff nest sites were the most secure against rodent predation, but some locations were such as to allow entry from one direction. Shaw (1936: 142–144) found one nest of *L. t. littoralis*, near the top of a cliff, that was accessible from above. Twining (1940: 72) found 21 nests in cliffs, only two of which were “accessible to climbing animals and both were raided,” and he suggested that chipmunks limit breeding to the higher cliffs.

On the Aleutian and Pribilof Islands nests were located on cliffs above the beach line (Dall, 1873: 27; Elliott, 1884: 127–128; Hanna, 1922: 90–91; Krog, 1953: 301) and were often on the lower portion of the cliffs below the rookeries of pelagic birds (Hanna, 1922: 90–91).

All seven nests that I found were inaccessible to rodents and, with one exception, the nests were 75 feet or more up the cliff face. I observed a golden-mantled ground squirrel (*Citellus lateralis*) stalking an adult male finch on the ground, at the base of the nest cliff, 25 feet below the one low nest. The finch kept a safe distance ahead and slowly led the squirrel to a distance of 50 feet from the nest cliff.

The nest located by Parratt was surrounded by meadow and more vulnerable to predation by rodents.

All nests on the ground were protected from above by one or more rocks. The size of the rocks and degree of protection vary widely. Though the majority of nests occurred in talus slopes and moraines, Wheeler (1940: 136–139) found one nest of *L. t. dawsoni* in a cave formed by boulders in a boulder slide.

Old buildings would probably be used more often if they were available in the alpine zone. Only in Alaska does civilization coincide with the range of the rosy finch. While few specific nests were recorded, both Hanna (1922: 90) and Kenyon (1961: 324) indicated that buildings were commonly used in Alaska by *L. t. griseonucha*. Nests of *L. t. griseonucha* were found in window sills (Cahn, 1947: 81–82) and on rafters (Kenyon, 1961: 324) and a nest of *L. t. umbrina* was found under the eaves of a church (Elliott, 1884: 128).

The southern forms have also nested in buildings where mining activities have penetrated high into the alpine zone. Nests of *L. australis* were found on rafters (Davis, 1960: 220) and one nest of *L. t. dawsoni* was found in a rock wall (Sharsmith, 1937a, 1937b). Some of these locations were probably accessible to rodents.

Kenyon (1961: 324) noted that nests of *L. t. griseonucha* on Amchitka Island (including nests in buildings and on cliffs) were generally inaccessible to rats, which since their introduction in World War II have exterminated the Song Sparrow (*Melospiza melodia*) and the Winter Wren (*Troglodytes troglodytes*).

Nests of *L. t. griseonucha* were apparently placed on the ground in tundra grass on Amaknak Island (Cahn, 1947: 81-82) without any protection.

Data from several authors suggested that the rosy finch was colonial on its cliff nesting sites (Dixon, 1936: 8; Clarke and Cowan, 1945: 101; Krog, 1953: 301; Sumner and Dixon, 1953: 232). Although I found three nests on the east face of Mt. Clements and two on the cliffs above the southwest corner of Crypt Lake, they were too far apart for the nesting to be considered colonial or even semicolonial. Each of the other two nests located was apparently far from any other nest. The majority of the published records do not allow analysis of this matter. Perhaps the same reasons for occasional semicolonial nesting are operative here as were found in the House Finch (*Carpodacus mexicanus*) by Thompson (1960: 399), where localization of optimum nesting sites and specialization in feeding produced nest proximity. Optimum alpine nest locations for rosy finches would appear to be on high cliffs protected from rodents, overlooking snow and ice fields where the birds may feed on the snow surfaces and snow margins.

NEST MATERIALS

Nests had a coarse exterior of moss, lichen, grass, and sedge and a fine interior of fine grass, plus porcupine (*Erethizon dorsatum*) hair, mountain goat (*Oreamnos americanus*) wool, and White-tailed Ptarmigan (*Lagopus leucurus*) feathers. The external nest shape conformed to the opening of the crack or hole and had a maximum width of 165 mm and a minimum of 70 mm. The outside depth of the nest was about 75 mm. The inside cup was quite uniform at 65 mm wide and 50 mm deep.

NEST DATES

No nests were found before hatching. Of the five nests watched daily the earliest fledging date was 23 July 1959 and the latest 3 August 1960. Nest building probably occurred in the middle of June.

Nestlings were dated by working backward from the fledging date and assuming an 18 day nestling period (as approximated from data for other forms given below). French (1959b: 165) found the nestling period at one nest of *L. atrata* to be 18 to 20 days. One nest of *L. t. littoralis* watched by Shaw (1936: 148) showed a 14 day nestling period. The nestling period of *L. t. dawsoni* was found to be 18 days by Twining (Carter, 1937: 48) and 10 [?] days by Dixon (1936: 8). The latter record may actually have been 14 days, judging from the data presented (Dixon, 1936: 3, 6-7). Wheelock (1920: 211) gave 21 days as the nestling period of *L. t. dawsoni* but records no specific nests or dates.

TABLE 2
CLUTCH SIZE IN SEVEN KINDS OF ROSY FINCHES

Number of nests containing						Ref- erence	Number of nests containing						Ref- erence
2 eggs	3 eggs	4 eggs	5 eggs	6 eggs	Mean		2 eggs	3 eggs	4 eggs	5 eggs	6 eggs	Mean	
<i>australis</i>						3.5	<i>littoralis</i>						4.4
	1					27			1			2	
	2	1				9		3				33	
										1		42	
<i>dawsoni</i>						4.3	<i>tephrocotis</i>						4.3
		1				38			1			29	
		4	3			10			1			Parratt ¹	
		4	3			11						John- son ¹	
	1					45		3	2				
		2	1			13							
		1				39							
		1				49							
		1	2			51							
<i>atrata</i>						4.3	<i>griseonucha</i>						4.5
		2	1			32			1			8	
	1	2	2			18						4	
			1			John- son ¹						28	
						Choate ¹			44	1		30	
		1							2	1		36	
							1					44	
								1				19	
Totals								1	6	27	66	2	

¹ Records published in this paper.

² Race determined by pers. comm.

CLUTCH SIZE

Since no nests were observed prior to hatching, it is only an assumption that no eggs were infertile or damaged and removed from the nest prior to observation. Only one nest contained an unhatched egg, and this was not disturbed by the parent birds. Of the five nests observed closely, three contained four young (counting the infertile egg) and two contained five young. The nest located by Parratt contained four young. The only nest previously reported in literature was found by William Fear (Macoun and Macoun, 1909: 466) at Banff National Park, Canada, and contained four eggs. This small sample yields a mean estimated clutch size of 4.3.

Comparative data and discussion.—Data from published records for all races, arranged geographically from south to north, have been collected in Table 2. It was necessary to accept some records without evidence of a complete clutch in order to obtain a significant number of nest records.

The table shows an apparent increase in clutch size from south to north. Of the three forms (*L. australis* and *atrata*, and *L. t. dawsoni*) found entirely south of the Canadian border (49th parallel), 37 nests have an aver-

age clutch size of 4.24. Of two races (*L. t. griseonucha* and *umbrina*) found on the Aleutian Islands and the islands of the Bering Sea, 53 nests have an average clutch size of 4.92. This difference is significant at the .005 level using the Chi-square test. One nest of *L. t. griseonucha* (Bent, 1912) with two fully fledged young was excluded because it seemed likely that other young had already left the nest.

While the correlation at first appears to be with latitude, it should be noted that nests of the two northern races were taken from cliffs along the beach line of islands, whereas the southern races nest entirely in the alpine zone of the higher mountains. The two remaining races (*L. t. littoralis* and *L. t. tephrocotis*), which have wider geographic ranges than do the foregoing, also nest in the alpine zone and data from 12 nests indicate a clutch size of 4.33, similar to that of the southern races.

Moreau (1944) has shown that clutch size in many species increases in either direction from the equator and Lack (1947, 1948) has related the ultimate cause of clutch size to food supply and nest security. He considered clutch size to be determined by the average maximum number of young for which the parents can collect food. Day length increases toward the poles during their respective nesting seasons and more food can be collected for the young. This may be the ultimate cause for more young near the poles, assuming food availability is equal in all locations. However, availability of food probably differs between the beach and the high mountains. Data from the northern portion of the range of *L. t. littoralis* and *L. t. tephrocotis* would make it possible to determine whether northern mountain birds are similar to northern shoreline birds or to southern mountain birds and therefore whether day length or habitat is correlated with clutch size in this species.

Lack (1948: 29) postulated that in birds with secure nest sites one would expect selection to work toward larger broods and slower development than in less secure sites. As previously discussed, cliff nesters are safer than ground nesters. Data from all nests (33 cliff and 11 ground) where both nest site and clutch size were known were analyzed by race and in aggregate and clutch size proved to be the same in both types of sites. This was to be expected since it was unlikely that two distinct populations would have developed side by side within one race. It should be noted, however, that no ground nests have been recorded for *L. t. griseonucha* and *L. t. umbrina* (with the possible exception of records reported by Cahn, 1947). If these races are entirely cliff nesters, their larger clutch size may be explained by reduced mortality and slower nestling development. The only data available on incubation period indicates a longer period in the north. Elliott (1884: 128) reported 20 to 22 days for *L. t. umbrina*, Wheelock (1920: 211) 14 days for *L. t. dawsoni*, French (1959b: 164) 12

to 14 days for *L. atrata*, and Shaw (1936: 148) about 14 days for *L. t. littoralis*. Data on nestling period were listed in the preceding section, but no data from the northern races were available. However, birds with long incubation periods usually have long nestling periods (Lack, 1948: 33) and therefore we might guess the northern races also have longer nestling periods. Thus the data on clutch size, nest security, and developmental rate of young agree with Lack's thesis, but these data are too fragmentary to be conclusive.

Lack (1947: 308–309) also reported a reduced clutch size for many species on islands as compared with continental Europe. This situation is reversed in the present species, the island forms having larger clutch sizes than the mainland forms.

In summary, the clutch size of the mountain races is smaller than that of the beach races and this may be correlated with latitude (day length) or with habitat (food availability). Data from the northern portion of the range of the mountain races may clarify these relationships. Whether this variation may also be related to nest security is not clear.

TERRITORY

Breeding territory.—Fighting between males in the vicinity of a female indicated a territory without topographic reference centering around the female as described by Twining (1938: 246–247) and French (1959b: 161–162). Conder (1949: 651–653), in a general paper, has referred to this type of territory as a mated-female territory. This activity diminished as the nesting season progressed.

No careful nest observations were made prior to the seventh day after hatching, but during the period of observation both adults fed the young and at times appeared at the nest together. All young were fed at each visit in the manner described by French (1959b: 166).

On many occasions the adults would return to the nest cliffs together and the female would feed the young and then leave, the male remaining behind, perched above the nest at some distance, and apparently guarding the nest. It was on one of these occasions that the previously described encounter with the golden-mantled ground squirrel occurred. Similarly a male chased several Pine Siskins (*Spinus pinus*) to a distance of 30 feet from the nest site and then returned to his perch. At two of three nests studied during the evening hours, the male returned to a definite roosting perch each night after sunset. Evening observations, however, were made only during the seven-to-nine-day nestling period of the young. In both cases the perch was within 20 feet of the nest and protected from falling rock by an overhang above the perch.

This suggests that, as the breeding activities reach their final stages, the male shifts some of his attention away from defense of the female to defense of the nest with active young. The male does continue to accompany the female to and from the nest on some of her feeding trips, but more often their trips are made separately. This shift may accompany the onset of feeding of the young by the male midway in the nestling period, mentioned by French (1959b: 166).

French (1959b: 161) found that the most vigorous defense came when the female was at the nest site. This further suggests that both female and nest site are defended but that their relative importance changes as the season progresses. Once the young are partly grown the adult female is no longer the critical link in the breeding cycle (French, 1959b: 162) and defense of the young is of greater survival value.

Conder (1949: 651-653) suggested that mated-female territories may come into being in two situations: (1) it may be a substitute for breeding territory where breeding territory as such is an impossibility; and (2) at the time of pair formation it may be a stage between routine maintenance of individual distance and establishment of a later breeding territory.

Both of these situations occur in the rosy finch. The majority of nests are on cliffs where a conventional breeding territory would be difficult to maintain. In January, the males become more quarrelsome and their individual distance increases until pairing, when the mated-female territory is established (Leffingwell and Leffingwell, 1931: 146). Midway in the nesting period the mated-female territory shifts to a combination of both mated-female territory and breeding territory. However, the transition to a breeding territory with elimination of the mated-female territory does not occur.

Other territoriality.—*L. t. littoralis* has been observed to defend roosting sites (Leffingwell and Leffingwell, 1931: 146; Shaw, 1936: 14) and feeding areas (Shaw, 1936: 14; Gross, 1937: 396) in winter, and Twining (1940: 70) observed *L. t. dawsoni* defending feeding areas in the summer. Dixon (1936: 5) also mentioned that a male *L. t. dawsoni* defended a feeding area but the female was present and he probably was defending her. On 13 August 1959 I observed a male *L. t. tephrocotis* drive away both of a pair of Water Pipits (*Anthus spinoletta*) that were attempting to return to their nest in a heather mat where the finch was feeding.

A close parallel to the rosy finches is found in the House Finch, which defends an area around the female in the spring until the nest is completed and also defends the nest sporadically and weakly (Thompson, 1960: 247-248). The House Finch also shows agonistic behavior at roosting sites and feeding stations.

RATE OF FEEDING

Assuming an 18-day nestling development period, the interval between feeding trips to the nest by each adult at two nests (5 young each, 1959) averaged 23.4 minutes for the period from 7–9 days. Therefore, each adult made feeding trips to the nest 2.5 times per hour. A third nest (4 young, 1960) was observed over the last four days (days 15 through 18) and averaged 66 minutes between visits; each adult visited the nest 0.9 times per hour. If this is typical, the birds showed a marked decrease in rate of feeding in the later part of the nestling period.

Comparative data and discussion.—Nice (1943: 232–233), in summarizing the rate of feeding data available for many passerines, stated that for birds remaining in the nest until ready to fly, such as the rosy finches, the rate levels off toward the end of the nestling period after a rapid increase in the earlier period. Several species showed a decrease similar to that found in the present study.

Dawson (1923: 175) reported a similar decrease in *L. t. dawsoni*. Feeding trips by an adult of this race to the nest at the height of the growth period were found by Twining (Miller, 1941: 72) to average once every 45 minutes, an interval nearly twice that found in the corresponding period (7–9 days) in the present study. In Montana the nest sites were close to the snow fields used for feeding, whereas in California Twining (Miller, 1941: 72) observed they were often far from the feeding locations, perhaps explaining the difference in feeding intervals. Since average clutch size for the two races was very nearly the same, longer feeding intervals might be reflected in a larger buccal pouch or in a longer nestling period, but no data are available to test these hypotheses.

NEST SANITATION

Fecal sacs were removed by both adults and dropped in flight 325 feet or more from the nest. All but one nest was clean when the young left the nest, and the nest contained one fecal sac. The nest had been evacuated just prior to observation and no check was made the next day to see if the remaining sac was removed.

On one occasion an adult picked up a sac just outside the nest on a ledge and carried it off. The sac had been present since before the feeding visit and this suggests that the sight of the sac induces response without observation of the act of defecation.

Taylor (1923: 66) reported a similar occurrence in *L. t. dawsoni* where a young bird removed from the nest defecated just outside the nest hole and a parent later carried the fecal sac away.

FOOD

Insects frozen in the snow were commonly taken throughout June, July, and August. Some live insects were also caught in tree branches and in the air. During July finches were observed feeding on moist meadows and particularly at the retreating snow line, presumably on seeds. However, one bird watched at the snow line fed on nothing but cutworms, a process described by Twining (1940: 67).

In late August and September the finches ate seeds and were seldom observed taking insects. In contrast to French (1959b: 172), I found seeds were commonly taken directly from the seed heads of plants on the meadows and high, dry slopes. On 14 August 1959 one finch took seeds from a small Whitlow grass (*Draba* sp.) plant on the side of Reynolds Mountain. On 26 August and 4 September 1960 seeds from willowweed (*Epilobium anagallidifolium*) were taken by the bird tilting its head and bill sideways and pulling upward on the slender seed pods. As the bill slipped over the pod, the seeds were forced out.

On 27 August, 3 September, and 6 September 1959, finches took seeds from spring beauty (*Claytonia lanceolata*) plants and often pulled so hard that the plants were uprooted from the moist ground. Rosy finches showed a definite preference for spring beauty seeds in August and early September and completely ignored the more abundant sedge (*Carex tolmiei*) seed clusters growing on the same meadows. Perhaps sedge seeds are taken when preferred seeds are not present. Twining (1940: 69) lists sedge as the main food after the middle of July in the Sierra Nevada Mountains of California.

On 19 September 1959 a flock of 60 finches was perched on bear grass (*Xerophyllum tenax*) stalks feeding on either insects or seeds.

The finches drank water in the meadows and also drank water running over the cliffs while hovering in flight with the bill placed up against the cliff. Similar observations were made by Leffingwell and Leffingwell (1931: 147) for *L. t. littoralis*. Water is apparently sought from the snow also. On 2 September 1959 finches pecked in freshly fallen snow which careful observation showed to be insect free. Shaw (1936: 14) observed *L. t. littoralis* to pause while feeding to eat snow crystals in the winter.

FLEDGED YOUNG

On several occasions two or three sets of young were seen feeding on the meadows approximately 90 feet apart a short time after fledging. The adult returning to feed the young flew low over the group and landed about 10 feet away. The young flew up and followed, crowding around the adult, but only one was fed on each trip.

After the feeding the adult flew away, leaving the young behind. However, if I was within 200 feet, they would all fly an additional 200 feet or more away and then the adult would fly away leaving them behind. French (1959b: 166) described the tendency of the young to follow the adult while begging for food and suggested that this had survival value in leading the birds to safety.

On 13 August 1959 I had approached the young to a distance of 6 feet when the adult returned. It flew low over them and they all flew 300 feet away before the adult stopped to feed the young.

Therefore, at 200 feet or more the adult had no apparent response to possible danger (an observer), while at very close range the adult responds immediately by leading the young away. At intermediate distances the possible danger produces a weaker stimulus than that to feed the young, but feeding is followed by a retreat to safety after the stronger stimulus is satisfied.

FLOCKING

Flocks of 30 to 70 birds form in late August and move from the meadows up to high rocky mountain slopes and mountain tops to feed. During storms they descend to the meadows and their flock structure appears to break up somewhat. They continue to feed, scattered over the meadows, during storms of wind-blown rain and snow, but seek shelter in niches in the rocks when wind-driven hail occurs.

PREDATORS

Rodents probably limit nesting to the higher cliffs in many areas, as discussed under "Nest Site." French (1955: 61–62) found the Clark's Nutcracker (*Nucifraga columbiana*) to be the chief predator of *L. atrata*. Shaw (1936: 12) thought that raptors were the most common and dangerous enemies of *L. t. littoralis*. There are numerous records for several races of rosy finches treating raptors as enemies (Taylor and Shaw, 1927: 194; Leffingwell and Leffingwell, 1931: 143; Presnall, 1932: 2; Twining, 1940: 71) and there are records of rosy finches in the stomach contents of raptors (Hanna, 1922: 89; Kenyon, 1961: 318, 322). Hanna reported that migrant Gyrfalcons, normally absent on the Pribilof Islands, in the winter of 1916–1917 nearly wiped out the rosy finch population. Other islands had resident hawks and fewer finches. It seems likely that raptors are limiting factors in some areas. In Glacier National Park small raptors were seldom seen in the alpine zone, but they were invariably mobbed when encountered by the finches.

SEX RATIO

Although no banding of flocks or collecting was done from which the sex ratio might be closely determined, there can be little doubt from sight

observations that the males outnumber the females, probably somewhere near the ratio of four males to one female.

In Glacier National Park food, water, and nest sites of the quality of those studied abound, and the effect of enemies appears negligible. It seems likely, then, that the proportionately small number of females is the critical factor in population growth, a conclusion also arrived at by French (1959b: 175-176).

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SUMMARY

The nesting behavior of the Gray-crowned Rosy Finch (*Leucosticte tephrocotis tephrocotis*) was studied at Logan Pass, Glacier National Park, northwestern Montana, from June to September for four years. Seven nests were located in sites in cliffs offering protection from falling rock and from rodent predation. Nests contained from three to five young, four being most common.

Additionally, examination of over 400 references dealing with seven North American races indicates that, of 139 nests, 81 per cent were on cliffs, 14 per cent on the ground, and 5 per cent in old buildings. These data were inadequate to reveal significant differences between races, but clutch size does seem to be significantly larger in the northern races, as a group, than in the southern ones.

The male defends a territory around the female until midway in the nestling period when it shifts some of its attention from defense of females to defense of the nest with active young and this may be correlated with the onset of feeding of the young by the male. A roosting perch near the nest may be occupied by the male bird.

The rate of feeding at the nest was found to decrease toward the end of the nestling period. Fecal sac removal by an adult is not conditioned by observation of defecation by the young.

Adults and young move up from the breeding grounds to the mountain tops in late August, and return to the meadows near the nest sites only during storms.

Site records indicate a sex ratio near four males to one female.

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