

of Lake Mead. On May 11, I saw an Osprey as it preened on a high, somewhat horizontal dead branch of a cottonwood tree; the bird was seen at a point on the future northern shore line of Lake Mead, three miles south of Overton.

Census counts of aquatic birds were taken on every possible occasion in two localities: Lake Mead and Kaolin Lake—the latter a 40-acre reservoir 3 miles south of Overton. The following table represents seven bird counts.

	Lake Mead			Kaolin Reservoir			
	Mar.	Apr.	15	13	9	7	14
White Pelican (<i>Pelecanus erythrorhynchos</i>).....			1				
Double-crested Cormorant (<i>Phalacrocorax auritus</i>).....			65				
Great Blue Heron (<i>Ardea herodias</i>).....	3		14				1
Black-crowned Night Heron (<i>Nycticorax nycticorax</i>).....							3
Mallard (<i>Anas platyrhynchos</i>).....			6				
Baldpate (<i>Mareca americana</i>).....		5			21		
Pintail (<i>Dafila acuta</i>).....	60			6	4		1
Cinnamon Teal (<i>Querquedula cyanoptera</i>).....				4			2
Shoveller (<i>Spatula clypeata</i>).....				8	29		
Ring-necked Duck (<i>Nyroca collaris</i>).....							1
Bufflehead (<i>Charitonetta albeola</i>).....					4		
Ruddy Duck (<i>Erismatura jamaicensis</i>).....				6	20		2
American Merganser (<i>Mergus merganser</i>).....			9				4
American Coot (<i>Fulica americana</i>).....	2		1	10	55		25
Killdeer (<i>Oxyechus vociferus</i>).....	1			2			1
Spotted Sandpiper (<i>Actitis macularia</i>).....							4
Avocet (<i>Recurvirostra americana</i>).....					14		
Black-necked Stilt (<i>Himantopus mexicanus</i>).....					12		6
Wilson Phalarope (<i>Steganopus tricolor</i>).....							4
Gull (<i>Larus</i> sp.).....	12			8			
Black Tern (<i>Chlidonias nigra</i>).....							1
Belted Kingfisher (<i>Megaceryle alcyon</i>).....			1				

I wish to thank staff members of the Museum of Vertebrate Zoology for suggestions during the preparation of this discussion.

Berkeley, California, February 17, 1937.

A COMPARISON OF BEHAVIOR OF CERTAIN NORTH AMERICAN AND EUROPEAN SHRIKES

By ALDEN H. MILLER

An article by Theo. Schreurs, appearing in the last volume of the Journal für Ornithologie (vol. 84, 1936, pp. 442-470), gives an account of the natural history of two Old World shrikes, the Red-backed Shrike (*Lanius collurio*) and the Woodchat Shrike (*Lanius senator*). It is well known that there are certain instincts common to different kinds of shrikes, most spectacular of which is the impaling instinct. Schreurs' paper affords a convenient assemblage of facts, especially about *L. collurio*, which seem worth comparing with information which I have gathered pertaining to the Loggerhead Shrike (*Lanius ludovicianus*) of North America (see Univ. Calif. Publ. Zool., vol. 38, 1931, pp. 11-242). That Schreurs has interpreted action in many instances in accordance with my own views is especially significant because his con-

clusions were drawn independently, apparently without reference to any literature on American species.

Although the impaling instinct is the principal subject of Schreurs' study, much significant information along other lines also is presented. The Red-backed and Woodchat shrikes hold breeding territories comparable to those of the Loggerhead. The migration of these European species precludes their holding territories throughout the year as is done by many resident shrikes of California. The sizes of breeding territories (roughly translated into acres) are in both *collurio* and *senator* 4 to 8 acres. In the Loggerhead they are 11 to 15 acres, in desert areas 13 to 40 acres. It would appear that the smaller territories of *collurio* and *senator* consist of less open terrain than those of *ludovicianus*; such a correlation also exists within the latter species.

Vegetation in regions so remote as California and western Germany hardly can be compared in detail. But the following general aspects of the breeding territories are strikingly similar: open areas with lookout posts around them; frequent, if not invariable, presence of roadways or streets, the surfaces of which are hunted for insects; some form of scattered bushes or trees, but no solid stands of timber; *senator* avoids large tracts of bushes, and in this respect it is like *ludovicianus*, whereas *collurio* tolerates more cover; special perches, lookouts or headquarters at which droppings, insect wings and pellets accumulate and at which a majority of the daylight hours is spent.

Territories are the same from year to year. If in *collurio* a nest is destroyed, the pair moves to a new place near by. In *ludovicianus* this definitely is not so; pairs regularly nest again in the same territory, although often not in the same bush or tree.

Nests of all three species tend to be well concealed and they are placed at heights of 2 to 25 feet. Those of *collurio* average somewhat lower (4 to 6 feet) than those of *ludovicianus* and *senator*. A preference for woolly materials for the nest is shown by all, but *collurio* does not use these materials in the lining as does *ludovicianus*; the linings of *collurio* nests consist of small rootlets.

Schreurs found the number of eggs to be either 5 or 6. Sets of 7 and 8 are reported by other observers. For *Lanius ludovicianus gambeli* sets of 5 and 6 are normal, and those of 4, 7, and 8 are uncommon. Only in the Lower California shrikes, among North American forms, is the number known to be significantly smaller, usually only 3 or 4. With respect to nest regime, many traits are common to Old and New World species: only the female incubates; the female is fed frequently by the male while she is on the nest, or she may leave the nest to meet the male when he is bringing food; no parasitism by cuckoos or cowbirds, as the case may be, is tolerated; the nest often is vigorously protected, but there is much individual variation in the boldness of the defense.

Much, if not all, of the song of *collurio* Schreurs ascribes to mimicry. Similar interpretation frequently has been placed upon the songs of *ludovicianus*, but careful study of the continuous, primitive song of *ludovicianus*, the type of song most likely to be called an imitation, has convinced me that there is no true mimicry. Schreurs' descriptions suggest that the song pattern of *collurio* in general is similar to the primitive song of *ludovicianus*. It would be presumptuous for one unacquainted with *collurio* in the field to disclaim mimicry in this species, yet I suspect the statement that the Red-backed Shrike's song is mimicry, exclusively, is exaggerated. Any primitive song that is not of stereotyped pattern will contain trills and phrases remindful of the notes of other birds.

The period from the date of the first egg until the young leave the nest is 31

days in *collurio*, 41 days in *ludovicianus*. Young of the latter species occasionally leave the nest in less than 21 days, which is the time I estimate to be the average nestling life, but even so, incubation and raising of the young are accomplished in a distinctly shorter time in the smaller species, *collurio*.

A number of foraging habits are held in common: The prey usually is sighted from a distance on a roadway or piece of open ground, and the bird glides down to seize it; shrikes are not averse to foraging in a light rain; heavy prey, like a large mouse, may be carried in the bill, otherwise in the feet; the most available prey, with respect both to abundance and to ease of capture, make up most of the diet at any given period; food of different pairs is noticeably variable in accordance with facilities in their own territories and with the needs of their young; rodents are killed by a simple bite in the neck or back of the head.

Many types of thorns are used in impaling. *Collurio* prefers partly concealed locations in bushes. *Senator* and *ludovicianus* commonly impale in more open situations, both using barbed wire extensively. Schreurs presents little evidence of impaling on sharp twigs and in crotches, not uncommon practices in *ludovicianus*.

Agreement in interpreting the meaning of the impaling instinct is found in the idea, long ago expressed by Seebohm, that the feet of shrikes are ineffective in holding prey. The impaling is a means of holding large prey while it is being torn to pieces. Although Schreurs refers to impaling as storage, it is clear that there is no more storage practiced by the European species than there is by *ludovicianus*. Food merely is left hanging when a shrike is sated, and usually the edible parts are eaten at successive feedings. Impalings as a rule are eaten within 24 hours after capture. Only in this restricted sense is there storage; it is not like the storing activities of certain rodents.

Schreurs gives a number of reasons for the occurrence of deserted impalings. Briefly, these are: (1) Subsequent death or injury to the shrike that impaled the prey; (2) destruction of the nest so that the cycle of instincts is upset and the routine of returning to the prey is interfered with; (3) sudden departure of a brood of young from the vicinity of the nest and from the impaling; (4) lack of fixity in territory shortly after arrival in the spring; (5) disturbance by other shrikes along territorial boundaries, or in a foreign territory, when prey has been captured and is being butchered. These factors might well apply to any species of shrike of similar impaling habits. To these I would add that prey may be left because it becomes spoiled or dry. Also parts of animals, or even entire animals of certain kinds, are less desirable, and if more preferable prey can be obtained, these poorer kinds of food may be deserted. Supporting this idea is Schreurs' observation that skin and jaws of mice often are left on the thorns; I have presented comparable evidence.

In striking parallel, all three species have been found to leave prey more often when the pressure for food for nestlings or for a brooding female is lacking. The shrike cleans up the scraps in his butcher shop less carefully when there is plenty for himself and dependents.

Still to be explained is the action of shrikes that kill and impale without eating any part of their prey. Schreurs suggests this problem in his questioning of the meaning of a shrike's killing an insect one minute and leaving it impaled, while a minute later it captures and eats another insect of the same kind. I again resort to the explanation offered earlier that the bird at such a time is not especially hungry. The instinct to pursue and capture is strong and always is present. Only when the prey is captured is the internal stimulus too weak to complete the chain of instincts in the swallowing act. The shrike, rather than drop an insect in which there is only casual interest, places it on a thorn; this is the most natural way of getting rid of it for

the moment. There is little merit in the idea that impalings serve to attract other animals or that they become "tasty" by hanging. That a shrike's inability to eat is caused by a pellet that is ready for ejection, may be, as I have learned from caged birds, a reason for impaling without immediate feeding.

Shrikes prefer to pull small bites from impaled prey. The same thorns to which they have become accustomed are used repeatedly, but, in the course of handling a large object, the position of the prey may be changed and different thorns used. Prey is impaled through various parts of the body, but heads of birds and mammals often are removed and impaled separately; commonly they are eaten first. Schreurs found that *collurio* will impale insects so that they remain alive on the thorn. *Ludovicianus* may do this, but he claims that *senator* always kills an insect. Interesting is the attempted defense of impalings by *collurio* when a human approaches. Little of this is noted in *ludovicianus* and *senator*, but in captive Loggerheads it is pronounced. Probably in the wild the shyness of these two species overcomes the urge to defend.

Schreurs' statement that the impaling instinct is in operation throughout the year is fully borne out by observations upon permanently resident shrikes both in America and in the Old World. The instinct may be an important element of the breeding cycle, but it must be remembered that it develops independently of this and makes its appearance in young captive birds that have been separated from their parents at an early age. It is vital to the existence of the shrike at all seasons.

The significance of similarities in behavior pattern in distinct species of the same genus lies in the strong evidence they afford for common descent and for adaptation to similar modes of life. The characteristics of shrike behavior are as constant and as obvious as many structural features that relate the three species of *Lanius* under consideration. The inherited behavior is no less conservative in evolution than the structure. The differences between the species consist of relatively small modifications of the behavior pattern. Tolerance of dense floral habitat, degree of aggressiveness, and concealment of impalings are items typical of specific differentiation; they might all be termed "quantitative" differences. Probably there is more dissimilarity in voice, in temperament and in details of movements than has thus far been brought out. In final analysis, the more prominent features of behavior ascertained through a study of natural history prove to be generic or even of family significance.

Museum of Vertebrate Zoology, Berkeley, California, February 5, 1937.

SUBSPECIFIC APPRAISAL OF RED-BREASTED SAPSUCKERS

By JOSEPH GRINNELL

Ideas and pertinent materials have accumulated slowly until they have reached a stage which seems to warrant my offering some statements concerning the racial status of some of the birds resident in extreme northwestern California. It will be recalled that this part of the State includes a segment of the "northwest humid coast strip" of North America, and that in this strip many birds are represented by strongly marked subspecies—some forms even being of full specific rating. Furthermore, as is well known, within the full length of this strip, which roughly extends from Prince William Sound, Alaska, to Monterey Bay, California, there is further differentiation of some of the humid-coast forms into minor races, less pronounced but nomenclaturally recognizable. Thus, of the Chestnut-backed Chickadee there are four races, of the Hermit Thrush at least three races, of the Steller Jay four races.