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## SOME FLOCKING HABITS OF THE CALIFORNIA QUAIL

WITH ONE ILLUSTRATION

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The California quail (*Lophortyx californica*) is one of the common residents of the Stanford University campus where it is protected and has become quite tame and fairly easy to observe. During the two school years of 1927-28 and 1928-29 the writer made a study of the local movements and habits of some of the birds of the Stanford campus. In the first year most of the work was done with the zonotrichias, but in the second year the quail were observed on an average of about an hour a day.

The first thing noticed was the well known fact that quail are usually seen in flocks or coveys and this suggested the following problems:

Do the quail form definite flocks or is each covey a haphazard group of birds changing from day to day?

Does a flock have a definite territory or range, with a definite roosting place?

Does a flock remain the same size throughout the winter season?

Do the same individual birds remain in the same flock or do they change from one flock to another?

Do birds change flocks from year to year?

What happens to the flock during the breeding season?

**Methods of study.**—For observation a pair of 6-power Leitz field glasses was used. Many of the observations were made from a parked automobile. The Stanford campus is intersected by many lanes, and the birds did not seem to fear an observer in a car as they did one on foot. The use of the automobile also enabled the observer to cover more ground and study several flocks in the time required for a foot observer to locate and count one.

In order to study the movements of individual quail, it was necessary to mark them so they could be distinguished. This was done by banding and by staining with distinctive colors the feathers of the birds.

Ever since 1923 bird banding has been carried on by various persons on the Stanford campus, although not many quail were captured before 1927. The writer is indebted to the previous workers at Stanford for some of the results, showing the ages of birds captured.

Banding birds has the disadvantage that the bird must be recaptured to have the band read. The stain on the feathers, on the other hand, enables one to dis-

tinguish birds with field glasses in the field. The stain used was originated by Mr. Wilbur K. Butts (*Auk*, XLIV, 1927, p. 329) at Cornell University. It is made by dissolving artist's oil colors in carbon-tetrachloride. It was applied to the light feathers of the neck and head of the quail with a medicine dropper, and apparently did not do any injury, as several birds stained were recaptured in good condition the following year. The other quail did not persecute the stained ones in any way, and the

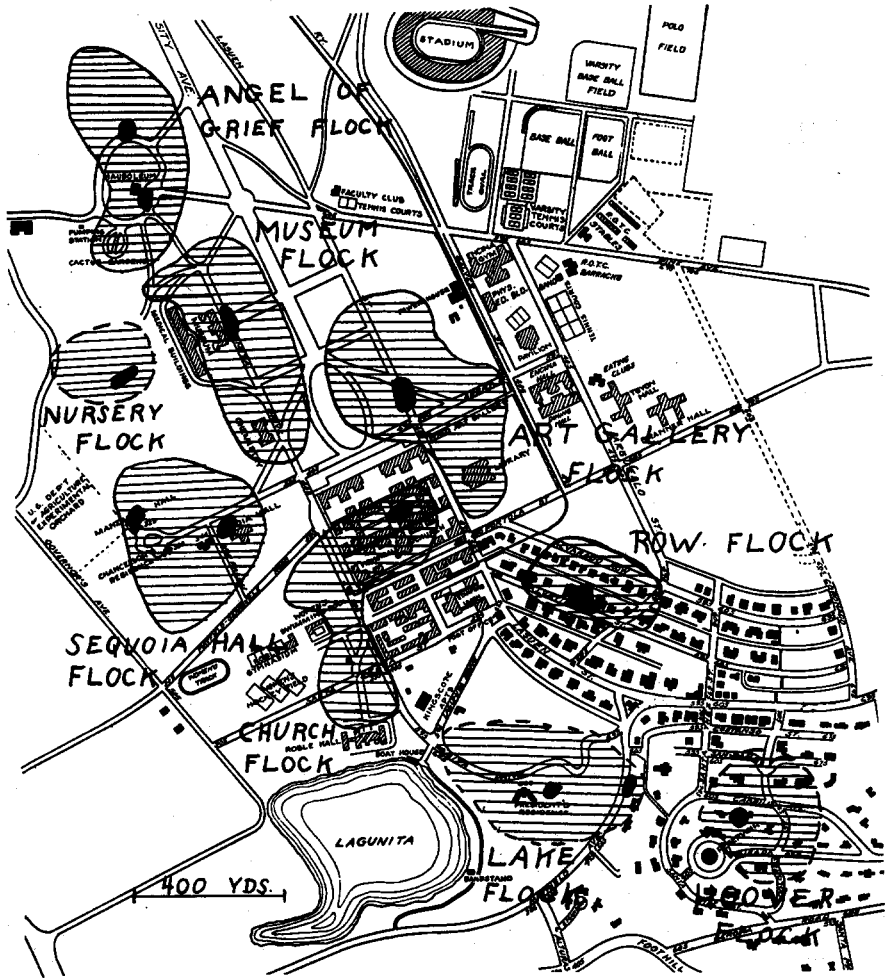


Fig. 1. LOCATION OF TERRITORIES OF QUAIL FLOCKS ON THE STANFORD UNIVERSITY CAMPUS FROM OCTOBER, 1928, TO FEBRUARY, 1929. THE ROOSTING TREES ARE SHOWN IN SOLID BLACK AND THE TERRITORIES OF THE FLOCKS BY PARALLEL LINES.

color could be distinguished for a month and a half; and in the case of one quail the color was clearly visible 74 days after being applied.

**Results of the work.**—Nine separate quail flocks were found on the campus (see fig. 1). It was soon noticed that each flock roosted in the same group of trees night after night. Most flocks preferred date palms, although a few used oaks or cypress trees. With a definite roosting place each flock was given a label which is

shown on the map. The writer got up before sunrise eighteen times during the last year to observe the flocks coming down from the trees, and he watched them go to roost forty-six times. At various intervals during most days he would make the rounds of the campus in the car and note where the quail were and what they were doing. During the months of October to February, inclusive, the flocks of quail were always to be found inside the limits of their own ranges as shown on the map. They were never seen outside, and two flocks were never observed to mingle together.

Each day the quail follow an elastic program. On a typical winter day the actions and movements of a flock at Stanford are as follows: About twenty to ten minutes before sunrise the quail start to chatter in the roosting trees. Then one will fly at a sharp angle to the ground and start feeding. The others soon follow one by one, and within ten minutes the whole flock is on the ground near-by.

In half an hour, more or less, the flock starts walking to other parts of the range, feeding on the way. During the middle of the day the quail remain quietly resting under bushes or up in trees. At this time the flock spreads out to some extent and is difficult to observe, but it can always be located by one familiar with its range.

In the middle of the afternoon the flock reassembles and resumes its feeding and gradually walks back (or in the case of the Church flock flies as a unit) to the ground in the vicinity of the roosting trees, reaching there about half an hour before sunset. About a quarter of an hour after sunset two or three birds will fly up to the trees. Others follow, and soon afterwards the main body of the flock (sometimes going in two sections) flies up, leaving only a few stragglers left on the ground. These follow suit, and the birds quiet down for the night. On March 20, 1929, however, the quail were heard at 9 p. m. in the palm tree by the museum, calling softly in the moonlight.

The above program is not rigid by any means. On a cloudy day the quail are slower in coming down from the trees and go to roost earlier than usual. Sometimes a flock (especially the museum flock) will split into two separate divisions in the morning and does not reunite until evening. The Sequoia Hall flock roosted in two places (the palm trees by Sequoia Hall and the cypress hedge by Dr. Jordan's residence) but fed together during the day. The Angel of Grief flock changed its roosting place during the season from one group of palms to another and in the spring changed back again, but in spite of these exceptions the movements and actions of the quail were remarkably standardized; and each flock was always to be found in its own range of about 120,000 square yards.

Counting the numbers in a flock is a difficult matter, as the birds are fond of staying in the underbrush. However, enough counts were made of the flocks throughout the year to show that the size of each one remained almost constant during the winter season. The sizes of the flocks were as follows:

Church flock	76	Row flock	70?
Lake flock	100?	Nursery flock	100
Angel of Grief flock	30	Sequoia Hall flock	114
Art Gallery flock	112	President Hoover's flock	50?
Museum flock	114	Total	766?

The question naturally arises "Do the same individual quail remain in the same flock during the season?" Banding and staining were resorted to, to decide this question, which was answered in the affirmative. Fortunately the quail are hungry early in the morning. Grain was scattered under the roosting trees for

several days, and the quail soon formed the habit of eating it the first thing after coming down from the trees. It was a simple, though cold, matter to place a drop-trap under the trees before sunrise and pull the string as soon as a portion of the flock was under. In this way twenty or more quail could be captured at once.

The birds in the museum flock were stained orange on the head and breast; those in the art gallery flock were stained yellow on the head; and those in the church flock (trapped in the evening instead of the morning) were stained red on the head. These colors were distinctive, and with field glasses there was absolutely no danger of confusing the quail from one flock with those of another. Many observations were made of the flocks with the following results.

Flock and color	Number stained	Number seen in same flock	Number seen in other flocks Oct.-Feb.	Number seen in other flocks Mar.-May
Museum (orange)	65	216	5	7
Art Gallery (yellow)	34	57	none	1
Church (red)	44	137	1	6

The above results of stained birds seen in the field only show those cases where an accurate count was possible. Sometimes when watching a flock some stained birds would be seen; but, as the quail were darting in and out of the bushes, it was not possible to tell just how many colored birds there were. In the notes they were recorded as "some" and were always seen in the same flock from which they were stained. The church flock had 13 such extra records; the museum flock 10; and the art gallery 1. From the above it is evident that as a rule individual birds remained in the same flock, but that there was some shifting from flock to flock in the spring.

Some results were obtained by trapping that seem to indicate that the quail often remain in the same flock year after year. In the 1928-29 school year 18 quail were captured that had been banded at Stanford in previous years. The following table shows that most of them were still in the same flock they were banded from.

Year first banded	Number captured 1928-29 in same flock territory	Number captured 1928-29 in other flock territories
1923-1924	1	none
1925-1926	1	none
1926-1927	5	none
1927-1928	8	3

In 1927-28, 54 quail were banded by the writer at Stanford. The next year 11 of these were recaptured, or over 20 per cent, which is a high return for banded birds. In contrast with this there is the case of a female quail, number 286191, which was banded at Stanford on March 12, 1928, and recaptured there on October 28, 1928. On February 20, 1929, she was reported by the Biological Survey to have been found dead at San Jose, California, about 19 miles southeast.

In March, 1929, the flocks became more extended in their ranges and more loose in their organization. The first nest, containing three eggs, was found on April 14 in an area outside the winter territory of any flock. The first young of the season were seen on May 4. The writer expected that the flocks would entirely break up during the mating season, but such was not the case. During the whole season about half the winter numbers of the flocks could be seen going to roost in the regular roosting trees. (Some sections of the flocks were also seen roosting

in other trees outside the winter territory.) Those present for the most part were in pairs, with some single males.

In some cases, at least, the young were brought to the flock before they could fly. One pair had a young one that took three days to learn to fly to the palm with its parents. The first two nights, after many vain attempts to reach the tree, the female led it to a nearby bush where the two spent the night on the ground. The male of the pair roosted in the palm tree. The other adult quail often pecked at the young one but did not seem to hurt it much.

One pair of quail had a nest in the bushes by the English Building. In the evening the two birds would walk across the lawn together, the female would enter the bushes always at the same place which was some distance from the nest and spend the night on it, while the male would fly to the roosting palms of the art gallery flock about 100 yards away.

Only one female was captured on the nest, in the east oval (with a net at night), on May 15, 1929. She proved to be number 440124, banded on March 20, 1928, by Mr. Hugh Israel from a trap by the Stanford Library. She also had been recaptured on March 25, 1929, with the art gallery flock, so it will be seen that this bird spent at least two years with the same flock and nested in the same area.

The writer had hoped to continue this work with the quail the following year by staining birds and moving them from one flock to another in order to see if they would return to the original flock. However, it was not possible to finish the work, but it is hoped that it will be completed at some later date.

#### CONCLUSIONS

The California quail is resident at Stanford and forms definite flocks which nearly always roost in the same groups of trees throughout the winter season.

Approximately the same number of quail is found in each of these flocks during the winter season.

In the winter season each quail flock has a definite territory or range, of about 120,000 square yards. The birds do not move out of it.

The same individual birds stay in the same flock during the winter season, and there is very little interchanging of birds among the flocks. The quail often remain in the same flock for several years.

In one case a quail left the Stanford campus and was found dead in San Jose, 19 miles southeast, 4 months after last being captured at Stanford.

During the spring the quail are often found outside their winter territory, and there is some interchanging among the flocks. But even during the breeding season of 1929, about half the strength of the flock roosted in the usual trees, and in some cases, at least, the young were brought to these trees as soon as they were able to fly.

*Glendale, California, June 3, 1930.*