

(Natural History) and investigations on ambergris, on pyridine recovery and on the deterioration of cellulose nitrate film, the Department has carried out long-term investigations for Service departments, such as a fundamental study of certain aspects of gas absorption. Since 1914 the chemical work of the Geological Survey has been carried out by the Department in the Survey's own laboratory. The Physical Methods Division, which is a service division for all other Divisions of the Department, is organized in five sections: spectrochemical analysis; X-ray diffraction; infra-red spectrophotometry; polarography; and photography. The forensic work of the last-named section continued to increase during the year, and both spectrographical and X-ray methods were employed in an investigation for the British Museum to determine whether or not pieces of pottery found on the site of an ancient British homestead some two thousand years old were made from local clay. Work continued on the crystal structure of 1:4-dithian and on the structural relations of oleic and elaidic acids.

## BAT-BANDING IN DEVONSHIRE

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SINCE the autumn of 1948, considerable work has been carried out by members of the Devon Speleological Society on the ringing of cave-dwelling bats in south Devon; a detailed account of this work has been published elsewhere<sup>1</sup>. Approximately nine hundred bats have now been ringed and these have been handled in thirty caves, twelve mine adits and five buildings lying in an area between Exeter and the Cornish border. Approximately 78 per cent of these bats have belonged to the species *Rhinolophus ferrum-equinum* (greater horseshoe bat), and large colonies of this species have been found in a disused copper mine in the Tavy valley, in the caves in the vicinity of Buckfastleigh and in the caves at Chudleigh. All bats found are being banded on the forearm with numbered aluminium rings, similar to those used for small birds. Details of the bats ringed at the time of writing are as follows:

Species	No. of males	No. of females	Sex not determined	Totals
<i>R. ferrum-equinum</i>	377	315	5	697
<i>R. hipposideros</i>	90	79	3	172
<i>Myotis nattereri</i>	9	6	—	15
<i>Plecotus auritus</i>	2	2	—	4
<i>Pipistrellus pipistrellus</i>	2	7	—	9
			Total	897

For *R. hipposideros*, a recovery-rate of 30 per cent is being maintained, and for *R. ferrum-equinum*, 388 bats have been found again out of the 697 ringed, that is, a recovery of 55.7 per cent. Many of these 'refinds' have, however, reappeared a number of times; for example, 227 greater horseshoe bats have been re-found twice, 60 have been re-found as many as five times and one bat has been handled no less than fourteen times since it was first ringed.

Observation of ringed bats has established the following facts.

(a) Greater horseshoe bats in Devon sometimes sleep as solitary individuals and sometimes in closely packed clusters, which may vary in number from half a dozen bats to as many as 300. They show no constancy in this, and a bat found in a large cluster one week may very well be found a few days later hanging alone or in an entirely different cluster. Bats in a given cluster do not move around together.

(b) When the bats are hibernating in a cluster, there is no evidence of segregation of the sexes. The compositions of three typical colonies of *R. ferrum-equinum* are tabulated below.

Date	No. in cluster	No. examined	No. of males	No. of females
Feb. 20, 1949	23	23	14	9
Dec. 2, 1949	30	26	8	18
Oct. 28, 1950	34	34	19	15

(c) Although individual greater horseshoe bats sometimes apparently show a preference for a definite cave or passage, they are equally likely to use other caves as well, and these may often be several miles away. When hibernating in large groups, however, these bats do appear to have certain favourite haunts. Thus, in Baker's Pit Cave, at Buckfastleigh, which has approximately a mile of passages, there are six hibernacula which have been used intermittently by large colonies for many years, although it would be thought that in such an extensive cave there would be numerous suitable roosts.

(d) The movements of the greater horseshoe bats are very widespread, and four flights of seventeen miles have been recorded. Many of their long flights have taken place during the winter months, as may be seen from the following table in which the column headed 'Winter' refers to the five months November-March, inclusive.

Flights recorded, longer than 1 mile, for *R. ferrum-equinum* in Devon

Distance (miles)	Number of flights	
	Total	'Winter'
1.0-2	164	79
2.1-5	51	20
5.1-10	14	2
10.1-17	13	4
Totals	242	105

The information in this table, coupled with the facts that such bats are commonly seen on the wing even in the coldest months and change their sleeping quarters at intervals of a week or less, confirms previous observations<sup>2,3</sup> that their hibernation is far from deep. One greater horseshoe bat is known to have flown fourteen miles, from Buckfastleigh to Yealmpton, between December 24 and 29, 1949, and two bats which flew eleven miles, from Buckfastleigh to Chudleigh, did so between the beginning of January and mid-February (1950).

It is certain that owing to the impossibility of maintaining an adequate check on the many bat roosts in Devon, much information concerning the movements of ringed bats is being lost. If, therefore, any reader of *Nature* should hear of the discovery of any ringed bats in Devon, or even in the adjacent counties, it would be very much appreciated if relevant details could be sent to the address at the head of this article. The aluminium rings used are stamped with a number, and all rings subsequent to No. 144 also bear the initials of the Society carrying out the work, namely, D.S.S. [Jan. 9.]

<sup>1</sup> Hooper, W. M., Hooper, J. H. D., and Shaw, T. R., *Naturalist*, No. 835, 149 (1950).

<sup>2</sup> Coward, T. A., *Proc. Zool. Soc., Lond.*, 2, 312, 849 (1907).

<sup>3</sup> Burbank, R. C., and Young, J. Z., *J. Physiol.*, 82, 459 (1934).