

repugnatorial glands of the millipede, it seems worth recording, as F. G. Sinclair² refers only to the mandibular poison in the Chilopoda, which would seem to have, at least in the genus *Scolopendra*, a strong irritant in the paired appendages.

Suva,
Fiji.
Nov. 28.

R. A. LEVER.

¹ NATURE, 142, 796 (1938).

² "Cambridge Natural History", vol. 5 (1895).

Soil Erosion in England

DURING the past few years, the possibilities of soil erosion in Great Britain have been in question owing to the immense loss of good farmland in large areas of the United States, Canada, and many tropical countries as the result of the exhaustive systems of farming carried on during past years. The very heavy rainfall of exceptional intensity on two days this autumn in Devon has enabled us to obtain some idea of the possible intensity of soil erosion under the systems of cultivation of south-west England.

On August 4, 3.90 in. of rain were recorded at Totnes between 2.30 a.m. and 9 a.m. G.M.T., and on November 26, 1.24 in. were recorded between 6.15 p.m. and 7.35 p.m. G.M.T. and a further 1.67 in. between 11 p.m. (26) and 9 a.m. (27) G.M.T. The exact duration of the second storm is not known, although it probably lasted only about 1½ hours. Robinson¹ states that the rate of erosion of soil by running water depends principally on four factors, namely: (1) the amount and intensity of the rainfall; (2) the angle of slope; (3) the presence or absence of a vegetative cover, and, if present, its character; and (4) the nature of the soil itself. Under the conditions experienced in Devon, sheet erosion alone took place on most slopes up to about 1 in 10, while no gully erosion was found on slopes of less than about 1 in 6. The amount of possible erosion was restricted owing to the high proportion of grassland in this part of the country. Very good protection was also given by thick and high cover crops, such as wheat, oats and marrow-stem kale. Even a thin covering of weeds afforded quite good protection from erosion; but root crops gave little or none, and even appeared in some places to encourage gullying.

Severe gullying occurred on farms on the fringe of Dartmoor, while the most marked instances of soil erosion off the Moor were found on the red conglomerate soils derived from Permian breccia in the Paignton district and on a dark soil derived from Middle Devonian shales and tuffs.

The work of Bennett in the United States² tends to show that soils the clay fractions of which have high SiO₂/R₂O₃ ratios are erosive, and that there is a critical ratio at 2. The SiO₂/R₂O₃ ratios of the clay fractions of the surface horizons of the two Devon soils mentioned are 1.98 and 1.90 respectively. The average ratio for most of the cultivated surface soils in Devon is about 1.6, which tends to show that most of them have been eroded in past times and have now settled down under cultivation to a comparatively stable condition, as have those of North Wales, where the climate is very similar to that in south Devon³. The recent observations, however, seem to show that this state is due largely to the

type of agriculture practised in the region, and that a return to predominantly arable conditions in the hilly country might result in the impoverishment of soils by erosion.

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Dec. 15.

¹ Robinson, G. W., "Soils: Their Origin, Constitution and Classification" (Second edition. Murby 1936) p. 68.

² Bennett, H. H., *Soil Sci.*, 21, 349 (1926).

³ Robinson, G. W., *J. Agric. Sci.*, 20, 618 (1930).

A School of Whale Sharks in the Bahama Islands

FOR years I had received newspaper clippings and second-hand verbal recitals of whale sharks seen off the west side of the Bahamas. Much effort was made to verify these, but for a long time I had no evidence of scientific value. However, in July 1936, there came to me authentic data concerning a specimen seen off Bimini, and shortly thereafter I published a faunal record for *Rhineodon* in the Bahamas¹.

In my studies of the distribution of the whale shark, I have long had the aid of the U.S. Hydrographic Office. It has asked ships' officers for reports of their observations all over the world of this great shark. These reports can be very definitely made because of the great size of the shark, its broad head and terminal mouth, and the chequer-board arrangement of bars and spots on the sides makes its identification easy. The latest report to the Hydrographic Office was from Mr. E. R. Fenimore Johnson of Camden, New Jersey, U.S.A.

On June 3, 1938, Mr. Johnson, in his ketch *Elsie Fenimore*, ran into a school of about twelve whale sharks in lat. 24° 32' N. and long. 77° 37' W., about four miles east of Sugar Cay, in the "Tongue of the Ocean". The school was under observation for nearly an hour and, the sea being fairly smooth and the sharks close to the boat, Mr. Johnson made careful notes of the behaviour of the fish and took some 200 ft. of moving-picture film of various individuals as they swam around the vessel.

Being without fear, these sharks swam so close to the boat that "We could easily have jumped astride their backs"—an observation which parallels Dr. William Beebe's off Cape San Lucas, Lower California. Mr. Johnson adds, "We ran into one fish, but he did not seem greatly upset, and his efforts to get clear were quite sluggish". This also is what has been reported by many others. The fish has no enemies, and is not afraid of a man or a boat.

The school was made up of a dozen individuals ranging in length from about 18 ft. to about 31 ft. The school had no formation, but was spread out irregularly over an area of about a quarter of a mile square. The fish did not seem to be going anywhere, and an individual shark would swim over a small area and would turn and go over it again as if hunting for something. Mr. Johnson courteously loaned me the film showing this behaviour. Close study of it convinced me that the fish were feeding by swimming about with their wide terminal mouths partly open. When asked about this, Mr. Johnson gave me definite information.

These were engaged in feeding. A fish would swim for an interval of one or two minutes with its mouth open and with its upper jaw about even with the