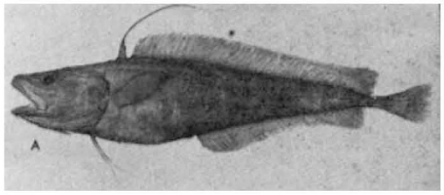
so that no young are weaned in the dry season (January to March) when food is short. Although *M. nigricans* is polyoestrus and it breeds continually from January to September, the males unusually show a resting phase in the spermatogenic cycle from October to December.

Gestation in *M. nigricans* lasts for 50 to 60 days and like most species of *Myotis* there is only one young per litter. The young are naked and remain so for a week. They seem to remain attached to their mother for the first 2 to 3 days after birth, but on the third or fourth day they remain in the roost while the mother feeds. During this time they remain clustered together in large groups and the mother is able to pick out her own baby when she returns to the roost from feeding about an hour before sunrise. Weaning occurs at 5 to 6 weeks, by which time the bats are able to fly, and many of the young, particularly the males, leave the roost at this time to fly to other roosting sites. Wilson found that numerous small roosts on the island are composed almost entirely of subadult males, which suggests that males are territorial to some extent and form roosts to which females are attracted.

DEEP SEA FISH

# North Atlantic Morids

from our Marine Vertebrate Correspondent



*Lepidion guentheri* from Madeira, standard length 413 mm (from *J. Fish. Res. Bd Canad.*, **27**; 1970).

THE morid fishes are often known as the deep sea cods, an apt term for they are related to the cod fishes which are so abundant on the continental shelf, but supplant them in the deep sea, especially close to the sea bed. It is principally because of their bathymetric distribution and their relative sparsity in biological collections that the taxonomy of deep sea cods has become confused, and little is known of their biology. For this reason the careful analysis of one of the more common North Atlantic genera, *Lepidion*, by Wilfred Templeman (*J. Fish. Res. Bd Canad.*, **27**, 457; 1970) is most welcome for it has cleared up a considerable body of confusion among the species occurring in this area.

Templeman's interest in the genus was stimulated by the capture of several specimens between 1953 and 1969 from Labrador to the south-eastern Grand Bank area. These were the first *Lepidion* to be taken in the western Atlantic. The problem then became one of finding the correct name from a plethora of synonyms applied to eastern Atlantic *Lepidion*, and of deciding if the new specimens were the same species as those already described. Following a careful analysis of the new material and of the collections in a number of institutions, Templeman has concluded that his western Atlantic specimens are identical with *Lepidion eques*, a species known otherwise from the Bay of Biscay northwards along the Atlantic continental shelf to Iceland and east Greenland. It has only been found in numbers in depths of between 500 and 1,300 m.

A second, and closely related, species, *L. lepidion*, is found in the northern part of the west Mediterranean basin in depths ranging from 600 to 2,230 m. A third species, *L. guentheri*, is known only from the west coast of the Iberian peninsular, Madeira and the Azores, and although this name has been widely used for specimens of the genus in the Mediterranean and northern Europe, Templeman regards them all as having been misidentified. The fourth species of north Atlantic *Lepidion* is, however, still enigmatic. Captured on deep water long lines in the Bay of Biscay in 1966 and 1967, they were described by G. R. Forster of the Plymouth Laboratory (*J. Mar. Biol. Ass. UK*, **48**, 479; 1968) as *L. guentheri*. The problem with these two fish was simply the size, for both were more than a metre in body

# Ice Nuclei at Hawaii

OBSERVATIONS at Hawaii of so-called storms of ice nuclei are reported by Hobbs, Fullerton and Bluhm in next Monday's *Nature Physical Science*. A knowledge of the concentration, nature and mode of action of ice nuclei is of importance to the cloud physicist because much of the world's precipitation is formed by the so-called Bergeron–Sindeisn process in which ice particles play a central part. Because small droplets of water do not freeze spontaneously until a temperature as low as −35 to −40° C is reached, many clouds in the atmosphere are composed largely of supercooled droplets with temperatures below 0° C. In the Bergeron–Sindeisn precipitation forming mechanism a small proportion of these supercooled droplets freeze and, because the equilibrium vapour pressure over ice is significantly lower than that over water, the ice particles so formed grow by sublimation at the expense of the surrounding water droplets. Once they have grown to such a degree that their fore speeds are greater than those of the water droplets their growth is accelerated by collision and coalescence with the droplets. The ice crystals can also collide with each other to form snowflakes. As they descend below the 0° C atmospheric level, the ice particles melt and become rain drops.

For this mechanism to be operative, a small fraction of the supercooled cloud droplets must freeze at much higher temperatures than those expected from spontaneous freezing. This is brought about by small particles which when incorporated in, or brought into contact with, the supercooled droplets cause them to freeze. These particles are called ice nuclei or freezing nuclei. Attempts to increase rainfall by the introduction of artificial ice nuclei, such as silver iodide, into suitable clouds have been made chiefly on the basis that there is a shortage of ice nuclei in the atmosphere. In the Soviet Union, extensive "cloud seeding" is also undertaken to increase the number of hailstones falling from a cumulonimbus cloud and so reduce the size of the stones and the damage done to crops.

With this background in mind it will be appreciated that a vast literature has been built up as the result of work in many countries on the nature, sources, concentrations and mode of operation of ice nuclei. The observations by Hobbs and his co-workers on the variability and concentration of ice nuclei at ground level at Hawaii over a limited period of five weeks during the summer of 1969 do not make a particularly exciting contribution to that literature but they do typify the difficulties of interpreting observations of this nature. The reported concentrations of about 700 ice nuclei $m^{-3}$ at −21° C during the peaks of the so-called storms is well within the range of median concentrations of nuclei found at some forty-four places around the globe in a survey by Biggs and Stevenson (*J. Rech. Atmos.*, **4**, 41; 1971) during the first three months of 1969. The mean value at all stations in this survey was 600 $m^{-3}$ or 1,900 $m^{-3}$ at −20° C depending on the counting method used. The diurnal variations at Hawaii are no greater than the short term fluctuations found elsewhere. For instance, in Europe and Japan, air containing high concentrations of ice nuclei often seems to have passed over areas of heavy industrial activity so the concentrations are clearly very sensitive to wind direction and atmospheric stability.