in the shore-seines, but the only adults caught in traps among reeds were spent females, some with young. Of Lidole, from the end of January to the beginning of May the inshore methods used caught 120 (recorded) spent females, some with young, and only four males, none in breeding condition. No specimens were recorded with eggs in the mouth, and it is possible that until the fry hatch the parents may remain together near the 'nest'.

The habits of Saka and *T. karongæ* are still undescribed, but Miss Lowe has been studying these fishes in the field for eighteen months, and her results should advance our understanding of this problem.

A pair of species paralleling Lidole and Chambo was described in Lake Victoria by Graham[4,5]. Morphological and colour differences between these are more pronounced. As well as the specific colour, there is evidence of breeding isolation in that in one species the male has the genital papilla elaborated into a brightly coloured tassel at breeding time, in the other it has not; and that breeding females, or spent females with young in the mouth, are trapped in fences across creeks and inlets in the case of one species, but not the other. Graham[5] records that the offshore species "incubates the eggs in her pharynx and no doubt shelters the young", but of the inshore species, although females sheltering young in the mouth were recorded, none was found with eggs in the mouth.

There is no doubt that the detailed study of the specific characters, ethological as well as morphological, of the Cichlidæ of the African lakes offers a unique and fruitful field for the student of evolution.

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Copper in Diatoms

THE communication on this subject in *Nature* of May 10, from Mr. N. I. Hendey[1], raises a number of points which require some comment.

The reported values of the concentration of copper in sea-water vary from 0 to 30 mgm./m.^{3}, and Mr. Hendey's figure of 0·007 mgm./l. (7 mgm./m.^{3}) lies within this range. Taking an approximate mean value of the copper content of diatoms given by Mr. Hendey as 100 μgm./gm. and even assuming they contain only 10 per cent dry matter, the concentration factor for copper is of the order of 1,400. The magnitude of this value in relation to the small reported figures for the concentration of copper in sea-water would suggest that copper might play an important part in the economy of diatom outbursts, if this element is a vital constituent of the diatom cell and if planktonic forms have copper contents of this order.

However, the diatoms analysed (samples 3–11) were taken from Group 1, namely, those living in frondose colonies of mucous filaments, and it appears possible that the copper was largely contained in the embedding mucus. It has been shown repeatedly here[2] that mucous films absorb large quantities of copper from sea-water, when exposed to this element either under culture conditions, or even when in proximity to raft-exposed anti-fouling compositions releasing copper.

Further, Mr. Hendey suggests that the diatom slime film which develops upon underwater surfaces may be considered as a potential reservoir of copper, and so may play an important part in preventing the settlement of other fouling organisms. A considerable amount of evidence has now been accumulated which indicates that anti-fouling action is dependent upon the rate of loss of poison from the surface; for effective action this rate should exceed a critical value[3,4]. Mr. Hendey does not present any evidence which suggests that the copper associated with the diatom slimes is capable of release; indeed, the reverse is suggested by the implication of his speculations on the form in which the copper is contained.

Studies of the fouling settlement which occurs on surfaces releasing copper certainly confirm the fact that some diatoms are relatively insensitive to this poison; but no evidence has been obtained, in the course of many thousands of assessments of anti-fouling compositions, that the slimes associated with such diatom settlements can act effectively as anti-fouling surfaces.

If a composition which is capable of maintaining an effective leaching-rate for a period is immersed in the sea, it usually acquires a covering of diatoms (due to their relative insensitivity); this settlement may persist for some time, during which period the diatoms are in contact with a surface at which the concentration of copper is far higher than that of sea-water. These conditions would therefore seem much more favourable for uptake of copper by the diatom slime; yet, in our experience, such a slime immediately gives place to more sensitive fouling organisms once the leaching-rate of the paint drops to a value which allows their settlement.

A cuprous oxide anti-fouling composition containing 10 per cent copper (that is, containing 10^5 μgm./gm.), when applied at a normal weight per unit area, has a very short anti-fouling life (of the order of 100 days) and is not easy to formulate so that the copper is being most economically used. It would therefore be surprising if a diatom slime film containing 164 μgm. copper per gm., the release of which is a matter for speculation, could be more effective than even this type of composition.

It is, of course, possible that the copper contained in the diatom slimes is bound in such a way that it could only be released when another organism came into contact with the slime. Such a condition would represent an advance of the first magnitude in the search for an effective anti-fouling surface; but we suggest that such an action should be sought in a surface considerably more stable and permanent than a diatom slime.

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