

scarcely any more are taken freely pelagic.² At any rate, *E. lineata* has obtained the full efficiency of its sucking disc when it has reached a length of 5 cm. (inclusive of the long caudal fin that makes about three-fourths of its total length).

The distribution of the post-larvæ is given on the accompanying map (Fig. 1), from which it will be seen that the two species—particularly *R. remora*—have chiefly been taken in the Sargasso Sea—where most of the fishing was done; very few have been taken north of 30° north latitude, and none at all have been taken in the precincts round the Caribbean islands, where the fishing chiefly was carried out during the months of November–April. The above-mentioned

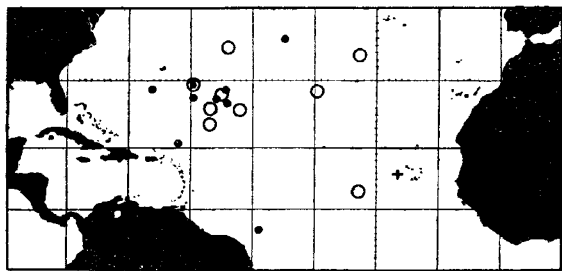


FIG. 1.—Distribution of post-larval stages of sucking-fish in the North Atlantic. ●, *Remora remora* L.; +, *Remora clypeata* Gthr.; ○, *Echeis lineata* Menzies.

species in this way appear to be typical oceanic spawning species. A very striking fact is the total absence of stages of the most common sucking-fish in the West Indies, *E. naurcrates* L. I therefore draw the conclusion that this species, so numerous along the coasts, spawns near these in shallow water and most likely in the warmest season, at which time of the year little fishing has been undertaken by Danish ships in the West Indian seas. The correctness of this conclusion seems to be confirmed by Delsman's find in the Java Sea. In the Atlantic north of the equator we shall surely be able to find this species, particularly in the shallower parts of the Caribbean Sea in high summer.

As to the species inhabiting the Mediterranean, the spawning places, season, etc., is, so far as I know, still quite unknown.

A. VEDEL TÅNING.

Carlsberg Laboratory,
Copenhagen,
June 10.

Chromium-plating and Resistance to Corrosion.

THE statement made by H. C. H. C. in NATURE of July 2, p. 6, on the subject of the protection afforded by electro-deposited chromium, as mentioned in Mr. U. R. Evans's book, "The Corrosion of Metals," seems so definite that, in view of the contrary experience of several workers specialising in electro-deposition for the prevention of corrosion, it seems desirable to direct attention to the fact that, so far, preliminary tests have indicated that electro-deposited chromium cannot be looked upon as a reliable protection of iron and steel from corrosion.

Much depends on the thickness of the deposit: comparatively thin deposits have given disappointing results. Thus, a thickness of 0.0013 cm., which gives ample protection in the case of a zinc deposit and fair results with nickel, is not sufficient in the case of chromium, which rapidly breaks down in the salt-spray corrosion test; but, as I have already pointed

out elsewhere, the hygroscopic corrosion product which is formed may have a marked influence in accelerating the corrosion. The salt spray corrosion test may, however, be taken as a particular simulation of marine conditions.

The behaviour of chromium as a corrosion preventive seems to vary, some specimens having been found to resist corrosion far better than others. The explanation is probably to be found in the inherent tendency of chromium to become passive, in which condition it presumably acts cathodically to the iron, actually accelerating the process of rusting.

Further, the statement that chromium does not adhere well when deposited directly on steel is not in accordance with the experience of most workers. On the contrary, it adheres much more readily to iron or steel than is the case when a coat of nickel is first deposited. Certainly, stripping troubles are much more prone to occur in the latter case.

The deposition of chromium has a certain future before it on account both of its hardness and resistance to tarnish, and it is also being applied in certain special processes (for example, fine line engraving). But, so far, its use as a protection of ferrous metals from corrosion has not yet been definitely demonstrated; zinc and cadmium deposits are far superior to chromium in this respect.

S. WERNICK.

Woolwich, S.E.18.

MR. WERNICK has performed a service in stating his experience on the degree of protection to be expected from electro-deposited chromium. Much of what he says is quite true, and indeed there is no disagreement between his experience and the guarded statements on this subject made by Mr. Evans in his book, and in my review of it to which he refers. Thus Mr. Evans states (page 208): "Chromium-plated articles which are now being manufactured in this country are said to withstand sea-water and tarnish"; and again, "The problem has been attended by many difficulties, some of which have not wholly been overcome as yet." In my own review I wrote, "It is stated that plated articles manufactured in this way withstand corrosion. . . ." Mr. Wernick seems to assume that Mr. Evans and I have expressed an opinion in favour of chromium more definite than is actually the case.

It must, however, be emphasised that several workers who have tested chromium-plating have published the view that, if the plating is satisfactorily performed, it does give considerable resistance to corrosion. References to these are given in footnote No. 2, p. 208, of Mr. Evans's book. Some of them may not be entirely unprejudiced, but taken as a whole they cannot be neglected. No doubt the results, as Mr. Wernick says, are somewhat variable. This is true of any new process. In the July issue of *Industrial and Engineering Chemistry*, Killifer has published an article in which he definitely recommends chromium-plating as a means of combating cases of corrosion which are encountered in the chemical, oil, and paper industries. In the course of this he states that the unsatisfactory results obtained with early samples of chromium-plating were due to pin-holes.

With reference to the question of the direct deposition of chromium on steel, Ollard, who has done so much work on the question of the adhesion of many sorts of depositions, stated at the British Association in 1925 that "the best results were obtained if the steel was first coated with nickel or copper." If Mr. Wernick has obtained better adhesion by depositing chromium direct, he has achieved a considerable success, and it is to be hoped that he will publish his method in full, if he has not already done so.

So far as I have been able to ascertain, his statement

² A survey of the smallest known adolescent stages of the different species has recently appeared by E. W. Gudger (*Am. Mus. Novitates*, Nov. 17, 1926).