ded by a black line; apical border pale tawny; fringe alternately sordid white and grey: secondaries with the costa pale, fringe as in primaries: body blackish, collar black, prothorax and base of abdomen crossed by white belts. Under surface fuliginous, costa of primaries streaked and spotted with ochreous; a black oval spot in the cell, and a fusiform spot closing the cell, both bordered with creamy white; fringe as above. Expanse, ♂ 1 inch 1 line, ♀ 1 inch 4 lines.

Yokohama (*Jonas*).

152. *Capnodes cremata*, n. sp.

Shining slaty grey, becoming brown towards the borders, crossed by two central parallel sinuous lines of black spots; a discal series of white dots parallel to the outer line, and terminating near anal angle of secondaries in a white *W*-shaped character; outer margin undulated, black, spotted with white, and followed on the fringe by a continuous series of black crescents; fringe also blackish externally, particularly on primaries; costa of primaries irrorated with testaceous and crossed by four or five angular spots of the same colour, from the outermost of which (a >-shaped marking) runs a zigzag pale greyish, black-edged line across the disk: secondaries with a discal series of black-edged testaceous spots: body greyish brown, thorax slaty grey. Under surface fuliginous, crossed by two central angulated dusky lines; a pale discal line; outer margin dusky, fringe greyish; discocellulars blackish; primaries with three decreasing whitish spots on apical half of costal margin; tarsi black, banded with whitish. Expanse, ♂ 1 inch 3 lines, ♀ 1 inch 5 lines.

Yokohama (*Jonas*).

XXXIII.—*On Races of Herring observed in the Sound.*

By G. WINTHER*.

THE common herring occurs along the coasts of the Kattegat, through the Sound, the Belts, and a large portion of the Baltic, in several varieties, distinguished by the size and relative proportions of their body, as well as by their habits of life. In this respect the Sound offers some peculiarities on account of its constituting a connecting water between the Baltic and the North Sea, of which the Kattegat is a dependency. There are three distinct races of herrings in the

* Extract of a paper in the 'Nordisk Tidsskrift for Fiskeri' (Copenhagen, 1876).

Sound. One of them spawns in the spring, and corresponds in its habits so closely with other fish which are known to be stationary in the Sound, that in all probability it is stationary like them. This variety is the smallest of the three—a circumstance which is in good keeping with the supposition that it does not at any time leave this comparatively narrow and shallow basin. The other two varieties are migratory, and visit the Sound during the autumn for the sake of spawning—one of them coming from the south, the other from the north, both meeting in that part of the Sound which lies between the islands of Amager and Saltholm and the Swedish coast, and where a chain of shallows, intersected by winding channels, stretches right across. The southern kind of herring agrees with Nilsson's description of the "*Kiviksill*" (in *Skand. Fauna, Fiskar*, p. 496); this is in all probability peculiar to the western part of the Baltic, which differs not a little from the portion beyond Bornholm as to the saltness of the water &c. Every autumn large quantities of these herrings travel as far as the *Flinterende*, a channel, well known to navigators, between Saltholm and the Swedish coast, where they spawn, and from which they again return to the Baltic in the winter. Sometimes, but rarely, easterly winds and strong currents carry them further north after the spawning-season; but until then they do not ordinarily go beyond the *Flinterende*.

The second of the two varieties which spawn in the autumn arrives in the Sound from the *Kattegat*, and is intermediate between the *Kiviksill* and the *Kullasill* of Nilsson, or ordinary herring of the *Kattegat*. On account of its habits, this variety is called *Bundsild* or bottom-herring. Generally speaking it is very regular in its habits, keeping quiet near the bottom of the sea in the daytime, moving about in the deep from about an hour before sunset till an hour after sunset, or even as late as midnight if the moon is high, and then rising to the surface, where it remains until sunrise; but in the spawning-season these herrings move about irregularly, and may be caught at any time. On their journeys they follow the deepest channels, allowing themselves to be carried along by the current, and in stormy weather regularly seeking the lee coast. The temperature of the water in the Sound in the spawning-season is from 50° to 53°·6 Fahr. The principal spawning-ground of this kind is on a submarine plateau north of the *Flinterende*. After the spawning they usually take a turn south into the bay of *Kjöge*, and then return northwards to the *Kattegat*. The most remarkable circumstance in connexion with them is the periodicity which has been observed in the take of them. Herring-periods are known in

many foreign places; but in this case an explanation of the phenomenon can be given. In the Sound a herring-period lasts eight years. At the commencement the fish are few and small; but there is a steady increase in quantity and quality until the fifth and sixth years, which are the best, and are followed by two years of decrease in quantity, after which the large fish suddenly disappear; and in the ninth year only smaller herrings are taken, and the quantity is likewise deficient. How great the difference between the fish in the bad and the good years is, may be concluded from the fact that the length of the meshes of the nets used in 1874, when the last completed period terminated, was 56 millims., whilst in the nets used in 1867, when that period commenced, it was only 39·5 millims. In 1875, when a new period came on, hardly any large fish were taken, but only small ones; and the question naturally arises, What has become of the large breed, and where does the small breed come from? The former evidently have remained in the Kattegat; and the latter were of the southern or Baltic variety, which had spread over the excellent spawning-ground north of the Flinterende, which in ordinary years is occupied by the northern variety, but in that year was free. Having thus established themselves in the northern portion of the Sound, they have gone north into the Kattegat after the breeding-season, instead of returning to the Baltic, as this kind usually do. From the Kattegat they will now return every year to the Sound; and from living in a larger basin, and perhaps on account of the water being more salt there, they will increase in size until the Sound becomes too confined for them; then the shoals, led as they always are by the biggest individuals, will seek other spawning-grounds in the Kattegat, leaving the one north of the Flinterende untenanted; this will then be occupied by another instalment of Baltic herrings, probably in 1883. According to this view the Bundsild of the Danish fishermen is merely the Baltic herring, or Kiviksill, improved by emigration to more favourable localities, where it remains till the improvement has been carried still further; then they cease to return to the sound, but remain in the more open water of the Kattegat. Something quite analogous seems to hold good with regard to the herring in the Great Belt, and perhaps also with regard to other species of fish in these waters. It has not yet been observed whether the converse, a degeneration of races penetrating into the Baltic from the Kattegat, does not take place occasionally. In any case a similar explanation is very likely to afford the explanation of similar fishing-periods in other places.