# NOTES AND MEMORANDA.

## Some Notes on Plymouth Fishes.

**The Habits of the Cuckoo or Boar-fish.**—For some time after I arrived in Plymouth at the beginning of August I heard a great deal about "cuckoos." The trawlers were constantly talking of them, saying that their catches consisted almost entirely of them, and it was not long before I saw specimens of the fish which, among the fishermen, went by this avian name. Even before I saw a specimen I found, on referring to Day's 'British Fishes,' that the name implied the *Capros aper* of Lacépède, the boar-fish of Couch. I found specimens, soon after, knocking about the Barbican in numbers, floating about Sutton Pool and Cattewater, or cast up on the shores of these basins. Why the name cuckoo is applied to these fish I have not discovered, but Couch's name is due to a certain peculiarity in its snout. The lower jaw, when the mouth is closed, slants upwards and forwards and projects beyond the upper. When the mouth is opened, and the lower jaw depressed, a system of levers formed by bones at the sides of the mouth is moved and causes the upper jaw to be protruded forwards. The upper jaw is not firmly fixed to the skull, but connected with it by ligaments and membranes which are very elastic. Thus the depression of the lower jaw brings about a remarkable protrusion of the upper, so that the whole mouth, when opened, forms a narrow cylindrical membranous tube an inch or more in length. As soon as the lower jaw is closed the upper jaw is drawn back to its original position by the elasticity of its ligaments. Thus the mouth region of the "cuckoo," when the mouth is open, resembles somewhat the snout of a boar; hence the name boar-fish, and the specific name *aper*. The mechanism of the jaws in the cuckoo is an exaggerated development of an arrangement which occurs in the herring and other fishes, and it will be of great interest

to make an accurate examination of this mechanism of the mouth and carefully compare its condition in *Capros aper* with that found in other species. The protrusion of the jaws is doubtless of some importance in procuring food, but at present we do not know what peculiarity in the feeding of the cuckoo makes such a curious arrangement necessary.

On August 15th, when I went out in the trawler "Cambria" on one of her fishing trips, an enormous number of cuckoos came up in the trawl. The fish is absolutely worthless in the market, and this for two reasons: 1st, it is small, never exceeding seven inches in length, and 2nd, it is very thin and very bony, the bones of the head and the spines of the fins being extremely well developed. It is easy to understand, therefore, the feelings the trawler has for this fish when he has to haul up several hundredweight of it in his trawl and then throw it overboard again. I had ascertained previously, from information given me by the fishermen, and from examination of specimens picked up in the harbour, that the cuckoos were sexually ripe, and in the process of spawning. I therefore examined those which came up in the trawl of the "Cambria" with interest, and found, as I expected, that it was easy to squeeze ripe ova and milt from the fish. I obtained thus a sample of the fertilized ova in a bottle of sea-water, which I was able to carry ashore successfully. The ova were transparent and buoyant like those of so many other fishes, and of small size. I kept the ova alive two days on shore, and examined them with the microscope, making drawings which are reserved until material for a comprehensive account of the ova of the Plymouth fishes has been collected. The ova measures ·98 mm. in diameter, varying slightly from this standard. The yolk is perfectly transparent and homogeneous, and contains a single oil globule, which is near the surface of the yolk at the side opposite the embryo. I had a drawing of a pelagic ovum obtained by the tow-net in Whitsand Bay on August 11th, and found it was exactly similar in size and structure to the ovum of the "cuckoo." It was evident, in fact, that it belonged to that fish.

Specimens of the "cuckoo" had been found to contain

spawn by different observers in March and May, and in the Mediterranean in April. But no one had given an account of the character of the fertilized ova until Mr. Dunn stated that in July, 1880, many of these fish had spawned in his tank, and that the spawn floated in the water just below the surface. He did not keep the ova under observation, or give any description of their structure. There is only one other species of the family to which the "cuckoo" belongs (Carangidæ), whose ova have been described, namely, *Temnodon saltator*, Linn., the bluefish of the Atlantic shore of the United States. The ova of the bluefish are pelagic and transparent like those of the cuckoo, but they possess certain peculiarities not present in the latter.

Although the cuckoo is worthless in the market it is indirectly of economical importance, to judge from the fact that I found a specimen slightly digested in the stomach of a large turbot brought up in the trawl of the "Cambria."

Fishermen at Plymouth say that the great abundance of cuckoos in their neighbourhood is a somewhat recent phenomenon, and that they were scarce or unknown twenty years ago. As a matter of fact the first recorded capture on the British coasts took place in Mount's Bay in October, 1825. In 1843 a great abundance of them is recorded to have occurred at Plymouth, and the fishermen then stated that they had recently increased in numbers so as to become a pest. It is thus probable that, as with other fish, they may in one locality become more and more numerous for some years and then again become scarce. They are taken only in very small numbers in the winter, and it is evident that they approach the shore for the purpose of spawning in the season from May till October, but they are most abundant at Plymouth in July and August when spawning actually takes place.

**The Breeding of the Conger.**—Often when fishermen are asked at what time of the year a certain fish spawns they give a definite answer which is correct or approximately so. They can see the ripe roe in most kinds of fish when a specimen is cut open, and they can see the distension of the abdomen caused by the enlarged roe, while frequently the eggs flow

from the ripe fish when it is handled. But whenever I have inquired as to the spawning of the conger the answer I have received from fishermen is that nobody knows, and that no one ever saw a roe in a conger at all. A naturalist who is acquainted with the obscurity which for two centuries, in spite of earnest investigations, concealed the structure and functions of the generative organs of the eel family, cannot wonder at the confessed ignorance of the fishermen on the subject. No one has yet, I believe, seen the fertilized egg of either the eel or the conger, although the ovaries and testes have been recognised and described. When I took some conger and examined the internal organs I found no difficulty in recognising the roe or ovary. In a large specimen, four to five feet long, the ovary is seen as a broad white mass in the shape of a ribbon, running on each side along the body cavity; on the side towards the intestine the ribbon is smooth, but on the other side it bears a number of thin flat plates, attached to it transversely, and lying close to one another face to face like the leaves of a book. Each of these leaves is made up almost entirely of eggs, which are supported by a tissue consisting apparently of fat-cells. When this ovary is shown to a fisherman he says it is simply the fat of the fish, and evidently does not believe it has anything to do with spawn. The organ is of milky-white colour, and resembles fat closely in appearance, but the microscope reveals the eggs in it beyond all possibility of mistake; and lately, in a specimen four feet ten inches long, the separate eggs could be seen in every part of the ovary with the naked eye like grains of millet seed. There must be over a million eggs in each ovary, indeed, the number of ova has been calculated by different observers to reach several millions. Otto Hermes in Berlin estimated 3,300,000 in a pair of ovaries weighing twenty-two and a half pounds, while Mr. Jackson, at the Southport Aquarium, estimated over 6,300,000 eggs in a pair of ovaries weighing only seven pounds. Mr. Jackson's specimen died in June, and if its ovaries were ripe and ready for spawning, as we may presume they were, then we may conclude that it is probably in June that congers naturally spawn. Neverthe-

less, the condition of the last ovary I examined (on November 3rd) leads me to believe that spawning takes place earlier in the year, at all events off Plymouth.

A single specimen of the male conger was discovered by Otto Hermes ('Zool. Anz.,' 1881). It died in the Berlin Aquarium in June, 1880; it was two feet six inches long, and the testes were similar in position to the ovaries, but differed from these in being divided into lobes, and entirely surrounded by a smooth membrane, the seminal fluid passing to the exterior by a special efferent duct. The organs were ripe and contained mature, actively moving spermatozoa. I have opened altogether fifteen congers. Seven of these were chosen on account of their small size, two feet four inches to two feet ten inches in length; but every one of the fifteen was a female, and as yet I have not seen the male.

**The Spawn of the Pilchard.**—Up to the present I have not met with any pilchards in a sexually mature condition. Nearly all the available information concerning the breeding of this species is directly or indirectly derived from accounts of his own observations published by Mr. Dunn, of Mevagissey. One of these accounts is contained in the official report of Frank Buckland and Spencer Walpole on the British Fisheries, 1879, App. iii. It is there stated that pilchards spawn fifteen or twenty miles from land, and at or near the surface; that on May 28th, 1871, Mr. Dunn took a pilchard in the act of spawning twenty miles from land, and pressed out its spawn into a bucket of sea-water, when the eggs all floated separately at the top of the water, but died after two hours because they were unfertilised; when dead they sank to the bottom. But in a letter which Mr. Dunn kindly sent me recently in answer to some questions I put to him, he says that he is certain that some pilchards spawn late in December and early in January, because he has known shotten pilchards return to the bays as early as the 11th of January. It is thus possible enough that the pilchard has two principal spawning seasons on this coast, one in winter, in December and January, one in June and July, in summer. It is also possible that some of the fish may spawn somewhat earlier, and others somewhat later than

the months mentioned. On November 9th, in the product of a tow-net taken by me south-east of the Eddystone, there were a number of buoyant fish eggs, which hatched two days after in my workroom on shore. The young fish hatched from these exhibited three characters, which are also found in the newly-hatched herring: (1) The yolk, instead of being homogeneous as in most buoyant ova, was composed of a number of distinct yolk-spherules; (2) The notochord was unicolumnar, that is, contained a single linear series of vacuoles as in the herring, not several series side by side as in young flat-fishes and others; (3) The anus was separated by a long interval from the yolk, and placed near the end of the tail, as it is in the newly-hatched herring, while in most fishes it is immediately behind the yolk. It is possible enough that these buoyant eggs are those of the pilchard, in which case the close similarity of the fish hatched from them to the young herring would be explained, although the proof of the fact that the ova of the pilchard are typically buoyant and pelagic, while those of the herring are typically adherent ova, would be very surprising. I earnestly hope that during the present winter I may obtain some pilchards in spawning condition, in which case, by taking and fertilizing some ova, I should be able to decide the interesting questions implied in the above discussion. There are some grounds for saying that it is possible the ova of the sprat are buoyant, although it would be naturally expected that all the species of Clupea deposited adhesive eggs like those of the herring.

**Reproductive Organs of the common Sole.**—On November 12th I dissected four soles (*Solea vulgaris*, Quensel) in order to examine the reproductive organs. The soles were bought by the Laboratory attendant from a fish buyer, and therefore could not well have been selected in any way, except that they were all moderately large. Two were males and two females.

In one female, which was fourteen inches long, including the tail, I opened first the long posterior extension of the body cavity on the right, dark, and upper side. When the skin was laid open, without further dissection, four parallel

lengths of intestine were seen extending right to the posterior termination of the cavity. Beneath these, but partially exposed at the ventral edge of the cavity, was the right ovary, which was four and a half inches long, three quarters of an inch broad. It was yellow in colour, and almost mature, the ova being visible to the unaided eye as separate granules. The ovary did not reach posteriorly to the end of the cavity by about an inch. Anteriorly it did not extend into the undivided anterior portion of the body cavity, the oviduct, which was about three quarters of an inch long, passing forwards and ventrally to the genital opening.

The cavity of the left side was then opened. In it there was no portion of the intestines; it contained the left ovary, which was five inches long and half an inch broad, longer and narrower than the right. At the anterior end of the cavity was seen the left kidney, a large portion of which lies in this posterior extension of the body cavity. In the undivided portion of the body cavity on the left side is seen nothing but the left surface of the liver. The two posterior extensions of the body cavity are, of course, completely divided by a thick median partition containing the interspinous bones belonging to the anal fin.

In a male which was fifteen and a half inches long, including the tail, on opening the posterior extension of the body cavity on the right side, the same four lengths of intestine was seen, and no genital organ was visible while these were undisturbed. The testis was found beneath these intestines, at the anterior end of the cavity. It was a flat plate with an entire outline lying on the partition which separates the right posterior cavity from the left. It did not extend in front of this partition into the undivided body cavity, its vas deferens passing forwards and ventrally to the genital opening. The testis was one inch long and half an inch broad. On the left side the posterior body cavity was short, only about half the length of the corresponding cavity on the right. It contained no organs except the left kidney which extends back into it. The left testis was smaller than the right, being three quarters of an inch in length; it lay with its longer axis transverse to the axis of the cavity,

*i. e.* in a position at right angles to that of the right testis ; and it was in front of the anterior edge of the partition between the two posterior cavities, so that its duct passed ventrally to the genital opening.

I believe that the male can always be distinguished by the narrower shape of its posterior region. The presence of the roe in the female causes the ventral edge to have a more convex outline in the female, but the dorsal edge also is much less slanting and more convex in the female than in the male. The tail in the male is also, in the specimens I have examined, larger than in the female.

The sole spawns in winter and spring, as stated in the books, and it is evident, from the condition of the specimens I have described, that they were near the spawning period.

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