more delicate. (*d*) A fourth series have their large eggs enveloped in dense horny capsules, which either are fixed by their twisted filaments to marine bodies or find sufficient protection on the extensive sandy flats where they are deposited. (*e*) Finally, a few produce living young, this condition ranging from the well-marked ovo-viviparous *Zoarces* to the even more complex state in the sharks.

It would seem, as far as present observations go, that in those fishes which shed their eggs on the bottom, or in brood-pouches, the ova are matured simultaneously in the ovaries, so that the act of deposition is performed rapidly. This is exemplified in the *Cotti*, in *Agonus* (*Aspidophorus*), *Cyclopterus*, *Liparis*, the herring, and others. In the case of fishes with pelagic ova, on the other hand, the ovaries mature and shed their contents at intervals, so that the process of spawning occupies a period of greater or less duration.

There is little difficulty in the case of the pelagic ova of our shores, such as those of the cod, haddock, whiting, bib, ling, rockling, gurnard, and others in artificially impregnating and hatching them, even from fishes that have been dead for some hours. The mortality, however, from excessive cold and heat is very considerable in a marine laboratory, since the limited quantities of sea-water contained in vessels a foot or even a yard or two across are much more subject to such influences than the vast body of water in the sea. It has to be borne in mind also that the sea-water usually employed in such researches is shore-water, and liable to considerable contamination from the estuaries of rivers and streams—besides other impurities. The difference, indeed, between such water and that of the open sea was illustrated in 1884 (NATURE, vol. xxxi. p. 536), when the pelagic ova of the cod could be more successfully hatched in the large glass vessels ("drop" bottles) in which they were conveyed from the fishing-ground without change, than in the ordinary water dipped from the shore and frequently renewed. In like manner eggs of plaice fertilised on the same ground this year (for which I have to thank Capt. Burn, of St. Andrews) were conveyed quite safely, even after a week's vicissitudes in a stoneware jar amongst sea-water—lightly tied over with "cheese" cloth. During the late winter ova of various kinds suffered severely, however, and the effects of such changes of temperature on the embryos were even more pronounced.

The first series of eggs of the haddock were fertilised on the 15th, and the second on the 16th of February, but the rigorous weather proved ultimately fatal to both. The earlier stages proceeded satisfactorily, but the water in the vessels by and by was frozen on the surface—softish flakes of ice forming a thick coating—on which many of the ova were elevated. No sooner was this ice broken than all or almost all the ova were observed to present the whitish patch and sink to the bottom. Some of those which had floated in mid-water or under the trickle from the supply-pipe escaped destruction, but in a few days they also succumbed after a night of unusual severity, and after the embryos had been outlined. On the other hand, a few ova carelessly thrown at the same period into a small vessel of sea-water in the window of a library escaped injury and developed quickly, though the water remained unchanged.

In the sea the danger from such extreme cold would be minimised, since these pelagic eggs in winter and spring do not float quite at the surface, but always some distance beneath it.

Under the same circumstances in the laboratory the intense frost proved fatal to many adult viviparous blennies and Montagu's suckers, though only the surface of the sea-water in the large glass vessels was coated with the softish flakes of ice. The fluid in the ovaries of the pregnant examples of the former was frozen into a solid mass, as was also the liquid in the urinary bladder, yet the animals were surrounded in all cases by sea-water.

In the Report to H.M. Trawling Commissioners in 1884 reference was made to the statement by Alex. Agassiz (*Proceed. Americ. Acad. of Arts and Sci.* xvii. p. 289, 1882) that the ova of several species of *Cottus* float. In his recent beautiful memoir along with Whitman (*Mem. Mus. Comp. Zool.* xiv. part i. 1885), he again returns to the subject—giving figures and descriptions of the ova of the so-called *Cottus grœnlandicus*, Cuv. and Val., which he found in a pelagic condition abundantly during the summer months, especially in July. The authors, indeed, appear to have met with the ova only on the surface of the sea, and do not seem to have identified them with those in the ovary of the species indicated, which in our country is supposed to be only a variety of *Cottus scorpius*, L. Unless, therefore, the *Cottus grœnlandicus*, C. and V., of Prof. Agassiz, is a form very different, there is room for doubt in regard to this interpretation of its oviposition.

The spawning of the *Cotti* in this country wholly diverges. Instead of the issue of the eggs in detachments, as in most fishes with pelagic eggs, the ovaries of the *Cotti* become distended at the breeding-season with ripe eggs of a uniform size, which are generally deposited in a mass at once—along with a transparent mucous secretion. When ejected into the water the eggs adhere together, but at first they can hardly be lifted on account of the soft and yielding nature of the connecting medium, though they do not readily separate. In a few hours the hardening of the connecting medium and the egg-capsules stiffen the outer layers of eggs, but the central region is still soft. The process of hardening is thus somewhat slow, and apparently depends on free contact with sea-water. These eggs are comparatively large and thick-walled, as well as slow in development, the embryo being ushered into the world in a much more highly organised condition than in the embryos from pelagic eggs. There is, indeed, little resemblance between Agassiz's form and the young *Cottus*, which is considerably larger, is variegated with much pigment, has rudimentary lamellæ (papillæ) on the branchial arches, complex circulatory organs, and a small yolk-sac possessing a single large oil-globule; and it shoots upward into the surrounding water like the young *Liparis* and *Cyclopterus*.

While the newly-hatched *Cottus* therefore greatly surpasses Agassiz's type in complexity, there are certain marine forms, *e.g. Anarrhichas*, which as greatly surpass *Cottus*. This will be evident when it is mentioned that the strongest embryos of the wolf-fish are much more highly developed on their escape from the egg than the salmon is for a week or two subsequently. Artificial stocking of the sea with the valuable food-fishes, such as the cod and haddock, would have been comparatively easy if their ova and embryos had been as readily handled and reared. However, since a noteworthy increase in tenacity has been observed in certain forms as soon as the yolk-sac has been absorbed, there is room in this respect for further investigation.

THE HONG KONG METEOROLOGICAL OBSERVATORY[1]

THIS first-class meteorological observatory was erected in 1883, and the regular work of observing began on January 1, 1884. Weather Reports appear monthly, and we have now before us the observations and work of Mr. Doberck and his staff for the first two years. For the first two months the work was restricted to eye-observations, but meanwhile no time was lost in erecting the barograph, thermograph, anemograph, pluviograph, and sunshine recorder, which are similar to those in use at Kew; and from April 1, 1884, the Monthly

[1] "Observations and Researches made at the Hong Kong Observatory in the Years 1884 and 1885." By W. Doberck, Government Astronomer.

Reports include a continuous hourly record of the more important elements of the climate of Hong Kong. The buildings are erected on the peninsula of Kaulung, facing the harbour, on the top of Mount Elgin, a small eminence rising from the plain to a height of about 110 feet above mean sea-level. It may also be noted that the ground has been carefully turfed where the instruments are placed. In addition to the usual tabulations and their averages, the Monthly Report gives a carefully observed log of non-instrumental phenomena, such as dew, fog, unusual visibility, halos, and thunderstorms.

The results show that the amplitude of the daily range of the barometer is greatest from November to February, when the rainfall is least and the air driest, the mean difference during these four months between the morning maximum and afternoon minimum amounting to 0·102 inch. On the other hand, the mean of the four months from June to September, when the monthly rainfall nearly equals 12 inches, only amounts to 0·069 inch. The diurnal range of temperature is small, being for the year only 5°·5, the maximum, 7°·2, occurring in December, and the minimum, 4°·0, in February. The daily minimum occurs at all seasons shortly before sunrise, and the maximum from 1 to 2 p.m. during the dry season, but an hour later during the wet season. The hourly means for the tension of the aqueous vapour are very interesting, as showing very clearly for those months when the sunshine is daily practically constant and the air relatively dry a minimum period during the hottest hours of the day; whereas when the sunshine is much interrupted, the rainfall frequent, and the air moist, the daily maximum tension occurs at these hours.

For the twelve months beginning March 1884, the greatest amount of sunshine was from noon to 2 p.m., and the least from 4 to 5 p.m., the former being per hour nearly double the latter. During the 22 months the greatest monthly number of hours of sunshine for any hour of the day was 26·3 hours from 9 to 10 a.m. of October 1884 out of a possible 31 hours. From midnight to noon the mean monthly rainfall has been 4·98 inches, but from noon to midnight the amount has only been 2·73 inches. The four consecutive hours of largest rainfall are from 5 to 9 a.m., amounting to 1·91 inch, and the four consecutive hours of least rainfall from 8 p.m. to midnight amounting only to 0·76 inch, or considerably less than half the former time of the day. The diurnal period of the rainfall of Hong Kong is remarkable as showing the maximum fall during the period of rising temperature, and the minimum when temperature is rapidly falling, the amounts for the six hours ending noon being 2·66 inches, and for the six hours ending midnight 1·24 inch. Future observations will doubtless modify in some degree the curve of daily rainfall, but from the general accordance of the fall of the individual months with what is indicated above, it is not likely that the change of the curve will be very material.

The daily curves for the winds, both as regards velocity and direction, are very decided. The daily curve for wind velocity has, for Hong Kong, owing to its peculiar position with reference to the island and the continent, peculiar features of its own. Thus for the year the maximum velocity extends from 10 a.m. to 2 p.m., the means for these four hours being the same, while the minimum velocity extends from 6 to 10 p.m., the hour of least movement being from 7 to 8 p.m. From midnight the wind rises to the daily maximum at 10 a.m. The month of greatest force of wind is March, and of least August, the air-movement in the former month being nearly double the latter. As regards direction the wind is about E.N.E. in the winter and E.S.E. in the summer season. For the whole year, the mean direction is E. 3° S., and the diurnal variation from E. 5° N. at midnight to E. 15° S. at noon, the mean variation being thus through 20°. During 1884 the total distance travelled by the wind was 103,237 miles, and of these 63,349 miles, or more than half the whole, was east wind. The least frequent wind is N.W., which showed only 2053 miles.

At a distance of about two miles from the Observatory an important station has been established on Victoria Peak, at which observations are made at 10 a.m. and at 4 and 10 p.m., and the results are published *in extenso* in the Monthly Report. The height of this station is 1823 feet above sea-level. These two almost contiguous stations, the higher being on a peak and the lower also on an eminence sloping directly down to the sea, form an admirable pair of stations for furnishing, in the best procurable form, the observational data necessary for some of the more important physical inquiries of meteorology. So far as we are aware, no pair of stations can be placed side by side with Hong Kong Observatory and Victoria Peak as affording the data for the physical inquiries referred to, except Ben Nevis Observatory and the station at Fort William.

Of these inquiries the important practical question of the rate of decrease of temperature with height may be cited as an example. The remarkable suitability of these two groups of stations for advancing this inquiry lies in the circumstance that in each case the upper station is situated on a true peak, thus reducing to a minimum the influence of the land in changing the temperature of the winds before arriving at the Observatory; and that the lower station is on a rising ground near the sea and sloping down to it, thus minimising the disturbing effects of radiation. At Hong Kong the rate of decrease of temperature with height is 1° for 261 feet in winter; 347 feet in spring; 262 feet in summer; 254 feet in autumn; and 281 feet for the year. At Ben Nevis the rates are for the seasons 279, 251, 268, and 290 feet, and for the year 270 feet—the results being thus closely accordant. On the other hand, such a pair of stations as Obirgipfel in Austria, on a peak 6706 feet high, and the neighbouring station at Klagenfurt, 1437 feet high, cannot furnish the data necessary to this inquiry owing to the circumstance that the lower station is situated in a deep valley. The result is that in January the difference of the mean temperatures of the two stations is less than 1°, although the one is 5269 feet higher than the other; whereas in May the difference of their mean temperatures is 22°·0.

It is earnestly hoped that the publication *in extenso* of the hourly observations at Hong Kong will not be limited to ten years, as seems to be hinted at in the Report, but that the meteorological observations and their publication will be made a permanent part of the work of the Observatory. The unique position of Hong Kong with respect to the great continent of Asia and its meteorology will no doubt secure this object.

CHOLERA IN ITS RELATION TO WATER-SUPPLY

THE epidemic of Asiatic cholera, which has been raging in Spain during the last two years, and which appears even yet to be lurking in some portions of that peninsula, has furnished some interesting data as regards its connection with water-supply, to which it would be wise in us to direct our attention, not only from the interesting nature of the facts as such, but also because it is not improbable that ere the disease quits Europe it may visit our own shores.

Broadly speaking, it would appear that in Spain this formidable disease never became truly epidemic or dangerous in any city in which there was a pure and good supply of water, and proper means were taken to guard against the sources being polluted by any of the specific choleraic poison.

In support of this idea I would desire to call attention to the cities of Toledo, Seville, Malaga, and Madrid, in contradistinction to such places as Aranjuez, Saragossa, Granada, and Valencia. I will commence with Madrid.