three of them with the squid-jig. Several land-birds were seen far out at sea. A pair of kingfishers (Ceryle alcyon) flew about near station 2,096. A pair of fish-hawks (Pandion haliaetus) acted as if they were at home near station 2,099, 250 miles from land. A golden-winged woodpecker (Colaptes auratus) and a song-sparrow (Melospiza melodia) came on board to rest, at station 2,100.

The principal invertebrates taken were as follows:—

Station 2,095. — The sounding-cup brought up ooze containing foraminifera from a depth of 1,342 fathoms. The beam-trawl was put over with wings attached. Among its invertebrates were twenty-five holothurians (Benthodites), many large Zoroasters, several cup-corals (Flabellum), a shrimp nine inches long with very large eggs, three specimens of a crab (? Galacantha). Some of the holothurians were placed in picric acid before putting them into weak alcohol. A portion of the eggs were taken from the large shrimp, and preserved in Müller's fluid for the study of the embryos, which were plainly visible within.

Station 2,096.— Again the sounding-cup brought up ooze with foraminifera, this time from a depth of 1,451 fathoms. Strange to say, a large stone, weighing upward of a hundred and seventy pounds, was brought up with sponges and worm-tubes attached. This would, I think, preclude the possibility of its being below the surface of the foraminiferous ooze, which came up in quantity sufficient to yield two quarts of clean foraminifera. The principal ingredients found in the stone were quartz, hornblende, and iron. Eighteen holothurians (Benthodites), many specimens of a small ophiuran, a few large shrimp, and some small shells, made up the bulk of the material.

Station 2,097. — Bottom, ooze, with foraminifera from a depth of 1,917 fathoms. One amphipod three inches and a half long, shrimp, Epizoanthus on hermit-crabs (species unknown), Urticina concors Verr. on Sympagurus pictus Smith, Ophioglypha convexa Lym. and Ophiomusium armigerum Lym. in small numbers, a starfish remarkable for its large madreporic plate and ambulacral feet, small ascidians coated with foraminifera.

Station 2,098.— Depth, 2,221 fathoms. Epizoanthus, Urticina concors Verr. on Sympagurus pictus Smith, Ophioglypha convexa Lym. and Ophiomusium armigerum Lym., also a few shells.

Station 2,099. — This haul was remarkable from the fact that the sounding was in a depth of 2,949 fathoms. This is perhaps the deepest water ever successfully invaded by a large trawl: certainly it is the deepest we have record of with any trawl. The trawl went down more than three miles at the end of upwards of four miles and a half of wire rope without capsizing, and that in the middle of the Gulf Stream, while the water was quite rough. That there might be no question as to the specimens brought up, the captain had the net thoroughly cleaned before it was put over the side. The amount of material brought up was not large. The only specimens from the bottom were a species of Boltenia, and many fragments of a bryozoan we had not seen before. A fine large schizopod, with several species of shrimp and small crustacea, were taken in good condition. These, with a cephalopod and the fish, made it one of the best hauls.

Station 2,100, with a depth of 1,628 fathoms, and station 2,101 with a depth of 1,686 fathoms, brought us only shrimp and fish.

Specific gravities of sea-water.

BY P. A. SURGEON, C. G. HERNDON, U.S.N.

DATE.	Station.	Depth.	Temperature air.	Temperature by attached thermometer.	Temperature of specimen at time specific gravity was taken.	Specific gravity.	Reduced to 60°.
12 M.							
Sept. 30 .	2,095	Surface.	71°	69°	71°	1.0251	1.026706
" 30 .	2,095	5	71	67	71	1.0251	1.026706
6 P.M.							
Sept. 30 .	2,096	Surface.	70	70	72	1.0251	1.026864
" .	2,096	5	70	67 .5	72	1.0251	1.026864
" .	2,096	10	70	68	72	1.0251	1.026864
" .	2,096	15	70	68	72	1.0252	1.026964
" .	2,096	20	70	67	71	1.0253	1.026906
" .	2,096	25	70	66	67	1.0257	1.026687
" .	2,096	40	70	57 .5	67	1.0264	1.027387
" .	2,096	60	70	55 .5	67	1.0266	1.027587
" .	2,096	100	70	55 .5	84	1.0236	1.027512
" .	2,096	200	70	47	85	1.0235	1.027600
7 P.M.							
Sept. 30 .	2,096	300	70	40 .5	85	1.0235	1.027600
" .	2,096	400	70	40	85	1.0235	1.027600
" .	2,096	500	70	40	85	1.0235	1.027600
" .	2,096	600	70	39 .5	86	1.0233	1.027616
" .	2,096	700	70	39 .5	85	1.0235	1.027600
" .	2,096	800	70	38 .5	85	1.0236	1.027700
" .	2,096	900	70	39	86	1.0235	1.027816
8 P.M.							
Sept. 30 .	2,096	1,000	70	38 .5	86	1.0235	1.027816
6 P.M.							
Oct. 1 .	2,097	Surface.	66	69	75	1.0253	1.027565
" .	2,097	5	66	68	75	1.0253	1.027565
2 P.M.							
Oct. 2 .	2,098	Surface.	79	74	76	1.0248	1.027232
" .	2,098	5	79	72	76	1.0248	1.027232
7 P.M.							
Oct. 3 .	2,101	Surface.	63	68	75	1.0246	1.026865
" .	2,101	5	63	69	73	1.0248	1.026724

THE ZOÖLOGICAL STATION OF HOLLAND.[1]

FOR some years past, zoölogical science has been pursuing a course abounding in brilliant discoveries. The examination, however minute, of animals preserved in collections, no longer satisfies the naturalist: he must study the living animal. Zoölogy has become experimental. On all sides, maritime stations are being established. Numerous works on anatomy and embryology have cleared up the philosophical theory of the transformation of animals by showing that the metamorphoses, which, less than half a century ago, were almost unknown, are very common among marine animals.

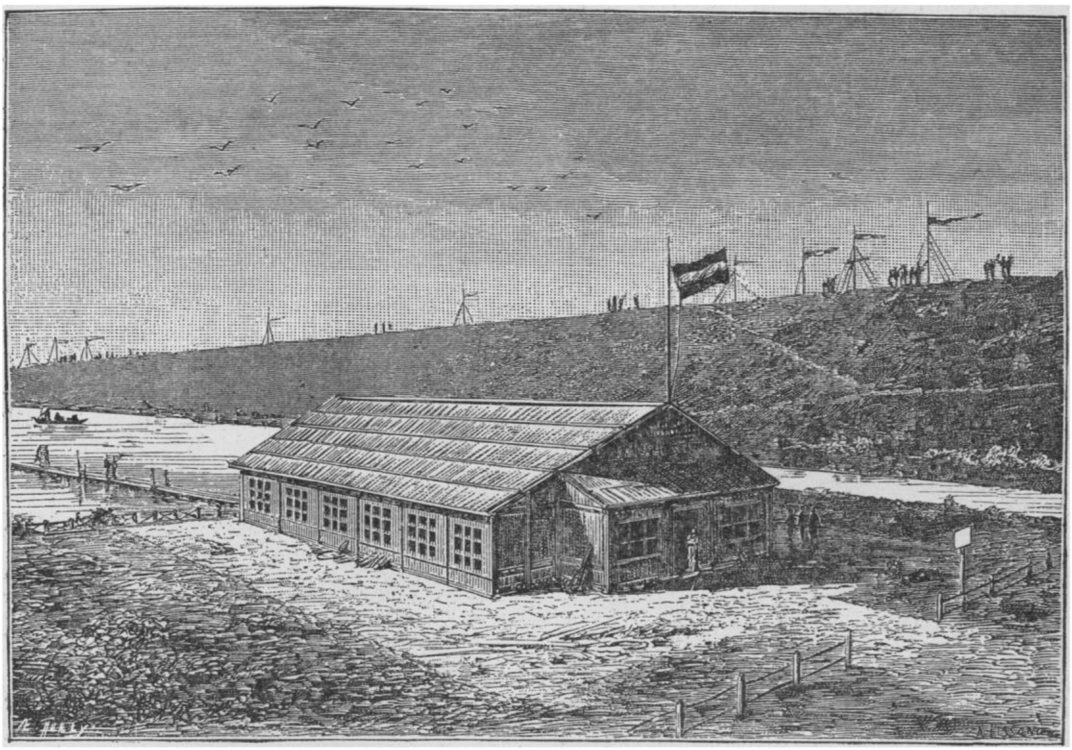
Holland, which has produced so many great anatomists and such patient naturalists, seemed to be tardy in following the example of neighboring nations, when, on the 4th of December, 1875, at the instiga-

[1] Translated from *La Nature* of Sept. 8.

tion of Professor Hoffman, its president, the Zoölogical society of the Netherlands voted to erect a zoölogical station on the shore of the North Sea. A committee, composed of Messrs. Hoffman, Hubrecht, and Hoek, decided on the erection of a station which could be easily transferred from one point to another on the Netherland coast. With its sandy shores and gradual slope, Holland has, it is true, a comparatively poor zoölogical fauna. The committee thought, therefore, and rightly, that a movable station would be more serviceable, as it would permit successive exploration of various parts of the shore.

The appeal made by the Netherland society to the generosity of the state, to scientific societies and private individuals, met with a response; and the sum of ten thousand francs was soon obtained. Work was immediately begun. The choice for the first season fell upon the city of Helder, situated at the northern extremity of the province of North Holland, at a point where an arm of the sea, called Helsdeur, separates the mainland and the island of Texel. The material, loaded in a wagon drawn by cattle, reached its destination, July 8, 1876. Three days after, the station was in readiness, and studies were begun.

As throughout the coasts of the Netherlands, the bottom of the sea is, at Helder, chiefly composed of shifting sand; and one can scarcely, under such circumstances, expect to meet with those fixed animal from which constitute the wealth of rocky bottoms. Few species can resist the sand which covers and smothers them. But while the downs extend west of the city of Helder, at the north there rises a spur of granite and basalt, in the irregularities of which numerous animals find shelter: it is the only point on the coasts of Holland where seaweeds are found. The minister of the marine having consented to place twice a week a steam-launch at the disposal of the commission, the little dredges invented by Wyville Thompson and the apparatus of Lacaze-Duthiers were employed, and a hundred and thirty species obtained.



THE DUTCH ZOÖLOGICAL STATION.

The second year the station was established at Flessingue; and the coast of Zealand proved not less rich in animal forms than the slope of Nieuvediep and the bank of Helder. In the years following, the station was at Bergen-op-Zoom.

During these latter seasons, the commission has not wholly devoted itself to the examination of animals which live on the coasts of Holland. Researches at the station have since aimed to furnish oyster-cultivators with information as complete as possible, on the anatomy, the embryology, the enemies, and diseases, in a word, on the biology, of the oyster. The eastern Scheldt has to-day become an important centre for oyster-culture; so much so, that the two stations, Kruiningen in Zealand, and Bergen-op-

Zoom in North Brabant, exported in 1881 a[illegible] million oysters, valued at some three million francs.

In order that the building may be easily taken to pieces and put in position, it is made entirely of wood; and the parts are arranged with such care that its removal from one place to another requires only three days besides the transit.

The station was at Bergen-op-Zoom when we visited it, and we were received by Professor Hubrecht with the cordiality and kindness characteristic of the *savants* of Holland. It is composed of a principal building about eight metres long and five broad. One façade has four windows; the other, three. The walls are three metres high; the ridge of the roof, four and a half. The framing of the roof is of wood, covered with a double layer of rush-matting. Opposite each window there is a stationary table: tables are also arranged in the centre of the room. In the laboratory are a closet for the instruments, another for the reagents and bottles, and also a small library, containing periodicals and the principal works on marine faunas. Each investigator can, in addition, send for books which he needs, either from the library of the zoölogical society, or from one of the universities of Holland. A desk, foot-rests, and some folding iron chairs complete the furnishings. The work-room, properly so called, is entered through a room in which are the aquaria, the collecting-apparatus, and the smaller dredges. The cumbersome instruments are placed in a room connected with one of the side-façades. Another room, opposite the entrance, leads into the private office of the director of the station. A fence of galvanized zinc wire runs around the building, and, while it wards off the thoughtless, encloses a space which may be used either for experiments in the open air, or for the dissection of animals of large size.

The construction of the house, as it stands to-day, has cost fifty-five hundred francs. An additional sum of six thousand francs was expended in the purchase of furnishings, aquaria, collecting-apparatus, reagents, thermometers, lenses, etc.

The management of the station is regulated in a very simple manner. The members of the zoölogical society nominate each year a committee, which publishes at the end of the year a report of the work, and gives an account of the funds expended.

Although the resources of the zoölogical commission are very limited, nevertheless the members have undertaken important work. During the season at Helder, Mr. Hubrecht was engaged upon fishes; Mr. Hoek studied the crustaceans; Mr. Horst, annelids; while Messrs. Van Harem, Noman, and Sluiter studied the other invertebrates. Mr. Hoek undertook, at Bergen-op-Zoom, his interesting researches on the embryology of the edible oyster. H. E. SAUVAGE.

LETTERS TO THE EDITOR.

The formation of tornadoes.

IN the discussion of Mr. Hoy's paper before the American association for the advancement of science, at the recent meeting at Minneapolis, I notice a number of statements which seem to me erroneous. Professor Rowland, for instance, asserts that "the rotation of the tornado is a necessary consequence of the earth's rotation." Now, if this be true, why are not tornadoes more frequent? Why is it necessary to have brisk, southerly winds, with high temperature and low barometric pressure? Why do they not happen on clear days as well as on cloudy ones? Again: if the earth's rotation determines the direction of the gyratory motion of tornadoes, why does it not govern the motion of the little whirlwinds occurring in dry weather? Every observer knows that these revolve, sometimes in one direction, and sometimes in the other, but perhaps, in a majority of cases, in the same direction as tornadoes.

It is well known that tornadoes in our latitude occur on days when there is a strong breeze from a southerly direction. Now, the air on such days, in spring and early summer, is heavily charged with moisture; to which fact is due the oppressiveness of the heat. As the heat of the day increases, local showers are formed, which move, not with the surface-wind, but in a higher current from a westerly direction. There is usually a divergence of about ninety degrees in the angle formed by a line indicating the direction of the track of the tornado, and another marking the direction of the preceding surface-wind.

Now, the mingling of these currents, or even the passage of one beneath the other, must, on account of their unequal temperatures, condense more or less of the moisture of the warmer current. This condensation is nearly always noticed. A cloud, often of intense blackness, accumulates just under the southern edge of the storm-cloud, and is usually prolonged horizontally to the northward along its base. If the cloud is near enough, so you can see beneath it, the parts farther in the rear will be seen to move rapidly in an easterly direction, just as the air-current moves which bears them. How can it be otherwise than that a gyratory motion shall result from such conditions? People frequently say, in describing a tornado, that "two dark clouds rushed together from opposite directions, and produced the tornado." This statement, if we are expected to construe it literally, seems somewhat absurd, since a cloud is always a passive element, moving only as the air moves in which it floats. That fragments of clouds and often quite large masses move toward each other is true; but tornadoes are not produced because of this, but on account of the *mutual resistance of two currents of air*. If two liquids or gases are brought together from different directions, a whirling motion is produced, as may be seen where two small streams of water flow together, or where a rock or fallen tree interrupts the direct movement of the water. This is but a necessary result of the combination of properties inherent in such a medium.

A volume of air, under pressure, escapes in the direction of least resistance: and, as there is a considerable pressure of the air where the two currents meet, an escape-current must form somewhere; and it forms, in accordance with the above law, in the direction of minimum resistance, obliquely upward to the east or north-east. As soon as this escape-current is developed, its position is at once located by a slender stem of vapor rapidly ascending obliquely; though, if the observer is at some distance, it seems to be suspended from the cloud above it, and even at times to descend toward the earth. Some of the downward movements of this 'funnel' are apparent only, the constantly ascending vapors sometimes condensing near to the ground, and at other times high in air. The funnel-cloud is often absorbed into the