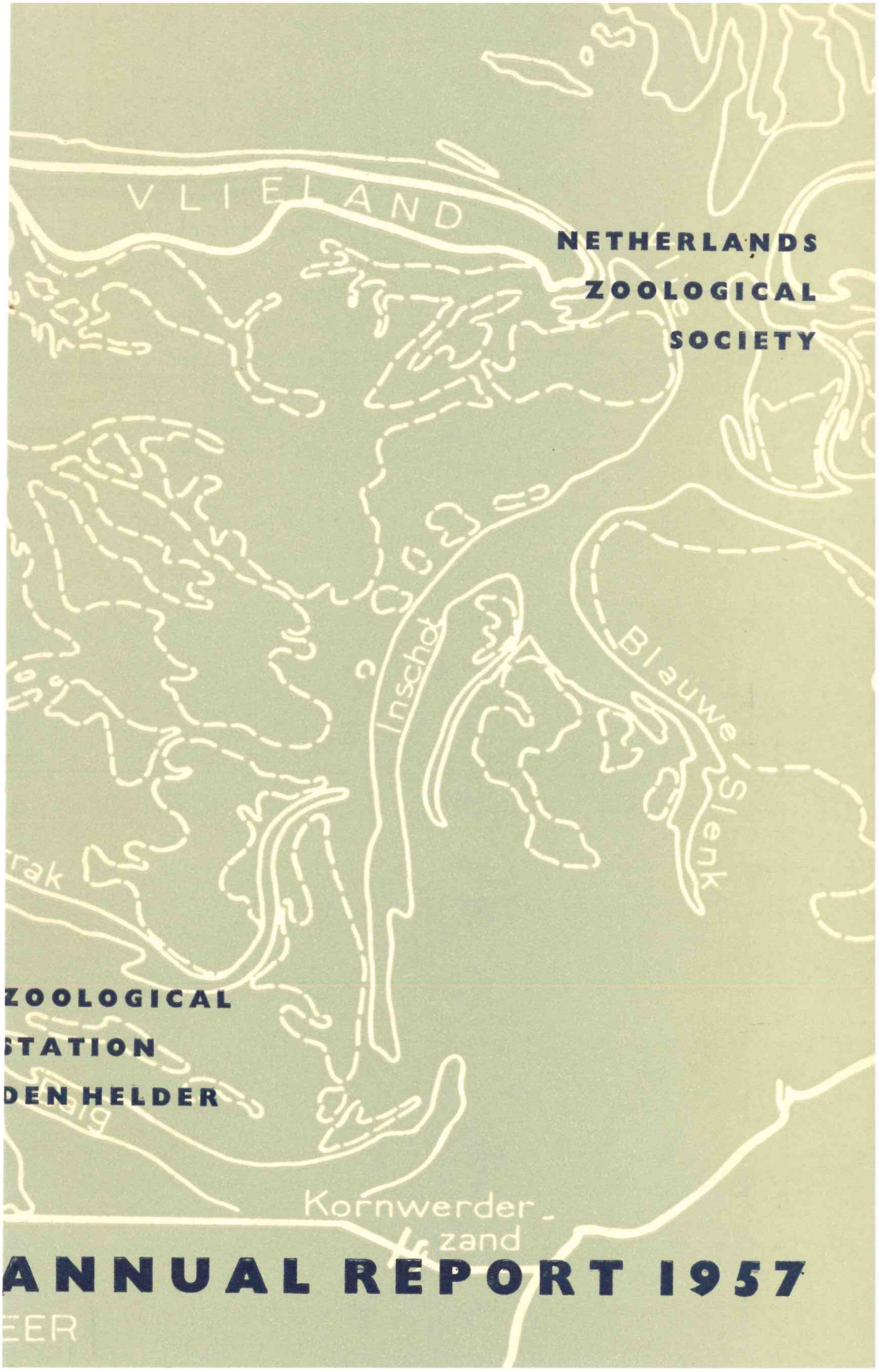

NETHERLANDS
ZOOLOGICAL
SOCIETY

ZOOLOGICAL
STATION
DEN HELDER

ANNUAL REPORT 1957


HOE ZIT DAT

Marine research in the Netherlands is carried out by the following Institutions:

Zoological Station of the Netherlands Zoological Society at Den Helder. Marine biological and hydrographical research. University extension work. Expenses paid by the State: Ministry of Education, Arts and Sciences.

Department for estuarine research (Delta-onderzoek) of the Hydrobiological Institution. Its task is to study the biological changes in the estuarine waters of the province of Zeeland, as well as their causes. These changes will be due to the closing of these waters in the near future. The Hydrobiological Institution itself (which is a fresh water station) is at Nieuwersluis (province of Utrecht), the Department for estuarine research is at Yerseke (province of Zeeland). The Institution (including its Department) is run by the Royal Netherlands Academy of Sciences at Amsterdam. The expenses are paid by the State: Ministry of Education, Arts and Sciences.

Government Institution for fisheries research at IJmuiden. Sea, coastal and inland fisheries. Fish preservation. Oyster research at Bergen-op-Zoom and, temporarily, at Wemeldinge for studies in connection with the closure of the estuaries in the province of Zeeland. Ministry of Agriculture and Fisheries.

Oceanographical Department of the Royal Netherlands Meteorological Institute at De Bilt (Utrecht). Physical oceanography and maritime meteorology. Ministry of Defense.

Hydrographical Department of the Navy. Office at the Hague. Bathymetrical surveys. Study of tides. Chart construction. Ministry of Defense, Dept. of the Navy.

Research Department of the Rijkswaterstaat. Headoffice at the Hague, research departments scattered. Current, tides, sedimentation, erosion, reclaiming of land. Ministry of Traffics and Waterways. The service of the Zuiderzee works, with office at the Hague, under whose direction reclamation of land in the Zuiderzee is organized, is under the junction of the same Ministry.

Geological Institute of the State University at Groningen. Marine geology.

Extrait des Archives Néerlandaises de Zoologie, Tome XIII, 4e livraison p. 540-555

ANNUAL REPORT OF THE ZOOLOGICAL STATION OF THE NETHERLANDS ZOOLOGICAL SOCIETY FOR THE YEAR 1957

Owing to advanced schemes for extension of the Zoological Station, of which more will be said later on, the year 1957 somewhat lacked a quiet atmosphere, but nevertheless promising results have emerged again from our investigations.

The investigation by Mr. J. F. W. NUBOER, Utrecht, mentioned in our previous annual report, was continued in 1957 with renewed efforts. The idea was to measure the spatfall of mussels *(Mytilus edulis)* during one or more tidal periods at different depths of water, at the same time taking into account the current velocity, temperature, salinity and amount of light at those depths, and the quantities of mussel larvae and young mussels of various sizes present in this water. Measuring the spatfall was made possible by the development of a satisfactory method in the previous years. It had been shown (see DE BLOK and GEELEN in Arch. Néerl. de Zool., 13, 1. Suppl., 1958) that threads of embroidery silk and other material are in great demand with settling mussels. Such threads, of a known length, were attached to wooden frames, which were suspended in the sea. Mr. NUBOER had made some improvements in the 1956-method, and, with the kind cooperation of the Physical Laboratory at Utrecht, he had constructed a simple photometer, while the Oceanographic Department of the Royal Netherlands Meteorological Institute took care of the current velocity measurements. We were still in doubt whether the numbers of mussels, settling in 1 ½–2 hours on 20 meters of thread would be large enough to provide reliable data about the actual settling of spat, especially as we intended to investigate separately the behaviour of young mussels, just out of metamorphosis, and that of slightly older young, which may settle for the second or third time after having left their original substratum. We therefore began, in April 1957, by estimating the number of mussellarvae found in a certain amount of sea water, and started the more extensive observations only after we were sure that sufficient numbers of mature larvae were present in the

plankton. The quantitative study of the plankton samples and the determination of the number and the size of the mussels on the threads hung out at sea was a terrific job, which at the beginning was carried out by Mr. NUBOER, but later on was taken over by Mr. DRAL, assisted by Miss STEINFORT SCHAAP. However, the results were well worth the trouble, and they even surpassed our wildest hopes. There were 2 hour periods in which as many as 300 mussels and over settled on one single thread. A substantial addition to our knowledge was the discovery that practically no spat settled at still water. The settling took place mainly when the current was strongest. Hitherto we had always assumed that, just as with the oyster, no settling would be possible with a strong current. Furthermore, many data were obtained about transportation and settling of younger and older stages at various current velocities. In this way we got valuable additional data to other observations, collected by Mr. LUCAS in 1950, which so far had partly been a mystery to us. Though we regret that it will be a long time before the data of Mr. NUBOER and the earlier ones of Messrs. LUCAS, ROOTH, VAN DONGEN and VAN HAAFTEN will have been worked out completely, we are now in a position to do so and the efforts of all those years have not been in vain.

Moreover, as a side-issue, valuable data were obtained about the reproduction of *Mytilus*, which led to the plankton investigation by Mr. DRAL being continued throughout the year. When we started in early April 1957 the first larvae were already there, while at the end of the year we still found young larvae. In fact the reproductive period has extended over the whole of the year after March, the largest number of young larvae being present in the period June–July. The development from new born larvae to the stage of metamorphosis took about 4–5 weeks in spring.

Mr. DRAL spent also much time to all kind of laboratory work, so that not much time was left for other subjects, the more so as he attended a histological training course of 2 months at the Zoological Laboratory of Amsterdam University. Still, he devoted some time to the study of the movements of the septa in the exhalation siphon of *Mytilus*, movements which are of importance in the regulation of the amount of water pumped. He also tried to investigate the influence of temperature on the lateral cilia of *Mytilus*, but he did not arrive at conclusive results.

Miss BOSCH and Miss STEINFORT SCHAAP spent much time in measuring jellyfish, caught in large numbers in Mr. CREUTZBERG's widemeshed plankton nets at the lightvessels Noordhinder and Haaks in 1956 and '57. By using these nets continually throughout the months of spring, when the catch is collected at the end of every low

and high tide, valuable data were obtained on the presence of the younger stages of *Cyanea capillata* and *Aurelia aurita*. Small young of *Cyanea*, born a month before at the utmost, were found to be present from the beginning of January to at least the middle of May; small young of *Aurelia* were caught from mid-February also to mid-May. This means that the production of ephyrae by the polyps of these species must have taken place from about mid-December to at least mid-April, a very long period indeed. However, *Cyanea* showed a definite peak of very young jellyfish from January 24th to March 28th. With *Aurelia* it is not well possible to say anything definite about the maximum time of production of jellyfish, as the sea around the light-vessels, far off the coast, is not its proper habitat. The young *Cyaneae* disappear from the surface water at a size of about 5 cm, when we assume their age to be 2 months at the utmost. Their disappearance certainly results from the fact that they are too heavy then to be carried upwards by turbulence, while at the same time they show no vertical movement of their own as yet. Such movements do not start before fine days in April.

A subject, which had several times been recommended to students, the study of which, however, presented so many difficulties that it had never been accepted so far, was chosen by Mr. VAN ERP, Utrecht. It dealt with the possible influence of temperature on the strobilation of the polyps of jellyfish. Though the various species of jellyfish show rather large differences, we may say that, generally speaking, sexual reproduction takes place in summer, while the polyp generation strobilates (that is to say produces young jellyfish by asexual reproduction) in winter. The cycle as a whole is determined chiefly by the time of strobilation, because the young jellyfish grows up, becomes sexually mature and produces eggs (out of which, after a short larval stage, polyps develop) without any resting period. The polyp stage, however, does show a resting period, which, in a way, is terminated by its strobilation. One would therefore like to know which factor governs the period of strobilation. It seems likely that, as strobilation is apparently connected with a definite time of the year, either temperature or light is responsible for its beginning. There are some indications in literature that temperature indeed plays a part.

By keeping sexually mature jellyfish for some time in tanks with a weak water current, the bottoms being covered with shells etc., an abundance of polyps of *Chrysaora hysoscella* were obtained, and also smaller numbers of polyps of *Aurelia aurita* and *Cyanea capillata*. At the end of the year they were submitted to the influence of various temperatures. The investigation has not progressed far enough to say much about the results, but the influence of temperature on stoloniza-

tion and possibly also on strobilation seems to be considerable. It looks as if we had taken up a subject here, which will keep us busy for a number of years. The refrigerator, donated at the time by the Netherlands Organization for Pure Research, proved to be most valuable for this investigation. We applied for it especially with a view to this subject.

The investigation of the movement of shrimps in the Wadden sea, from shallow water to the gulleys, was continued in 1957 by Mr. J. J. BEUKEMA, Groningen, who worked at Den Helder for 6 months. It was a continuation of the research by Mr. GLAS and Mr. HEYLIGERS, carried out in 1953 and 1954. The starting point were the questions: 1. How does the shrimp, visiting the sand flats at high tide, perceive that the water is going out again, so that it has to leave the banks?, and 2. What external factors does it use for orientation when leaving the flats? Mr. GLAS established that a change in water pressure is not involved and that, obviously, the animals follow the diminishing head of water by perception of the water's surface. Mr. HEYLIGERS gave those data a more solid foundation. Both did not quite arrive at the second question, the orientation problem, but it looked as if the animals not just left automatically with the current. After unsuccessful trials in the laboratory Mr. BEUKEMA transferred the investigation to the field, where he discovered that the animals, when leaving the flats for the gulleys, cross the current which is going over the bank more or less parallel to the gulley. Of course this direction is opposite on the two sides of the gulley. Though the point is not quite settled as yet, Mr. BEUKEMA thinks it possible that orientation is connected with the sun. If this is true, then there is certainly no question of a fixed direction in relation to the sun, like the one demonstrated by PAPI and PARDI with *Talitrus*, but the direction would depend on the direction in which the animals first ascended the bank. Sun orientation would then be similar to the kind of orientation used by ants in spring.

In February, 1957, Miss A. J. WARBURG, Groningen, wound up the investigation mentioned in our previous report. It dealt with the question whether the preference of nudibranchiate slugs for certain Coelenterate species is innate or acquired. It was thought to be possible to make the animals accept a certain Coelenterate species, which formerly they refused, by offering this species as sole food to the youngest stages. We hoped that in this way it might be possible to establish a stock which would prefer a species different from the normal prey.

From Miss WARBURG's investigation it appeared that several hypotheses, which had been used as a starting point, did not hold good. To begin with, it is not true that as a rule *Aeolidia* refuses the sea anemone *Diadumene* as a food species; on the contrary, every individual accepts

Diadumene, but in a relation to *Metridium* of abt. 1:7. So, all one could hope for was that by breeding experiments and offering *Diadumene* to the young animals the relation *Metridium*: *Diadumene* might be changed in the offspring. Secondly, *Aeolidia* turned out to have a rather long span of life as a larva, perhaps 8–12 days instead of just a few. This made the rearing of the young animals much more difficult than we had expected. Thirdly, it looked as if the young animals were rather defenceless against the sea anemones; the anemones tended to eat their supposed predators. Through all these difficulties the investigation yielded no positive results, but it had so many interesting aspects that it is to be hoped that it will be taken up again sooner or later.

The apparatus which will be used by Mr. DE BLOK to study the influence of lunar and tidal movement on the reproductive periodicity of marine animals was completed at last in 1957. On account of the important summary on lunar periodicity in marine animals, given by Mr. KORRINGA in Ecological Monographs 1947, Mr. KORRINGA and Mr. VERWEY together applied for a grant to the Organization for Pure Research, in order to find out what factors ultimately induce periodicity. In his first year Mr. DE BLOK made himself thoroughly acquainted with the literature on the subject, and he gave a theoretical review about the way in which lunar and tidal movements apparently make themselves felt. In the second year he designed the apparatus. His idea to include in the investigation the whole complex of possible factors did not withhold the Netherlands Organization for Pure Research to bear its cost. In the third year the schemes were worked out and substantially altered, because it was decided to convert the mechanically produced rhythmic phenomena not by electric, but by pneumatic means into rhythmic environmental influences. The fourth year was wholly spent in building the complex apparatus, which was completed in the fifth. The total installation has cost about *f* 28 000.— on the part of the Organization for Pure Research and several thousands on our own part, while Mr. DE BLOK got at his disposal one of our seawater tanks and a dark cellar. In designing and building the apparatus Mr. DE BLOK has received valuable help from Mr. DUK, instrument-maker at the Zoological Laboratory at Leyden. We shall soon see whether our expectations about this apparatus will come true. Now that Mr. DE BLOK has been taken over by us from the Organization for Pure Research, we want to express our thanks to this Organization for the confidence and patience with which it has attended our work on this item.

The investigation by Mr. CREUTZBERG, also paid for by the Netherlands Organization for Pure Research, yielded some new results in 1957. In 1956 he found that the elvers, entering the Wadden Sea from the

North Sea in spring, use a mechanism by which they let themselves be transported passively during the flood and seek the bottom during the ebb. Obviously, the animals are able to distinguish between ebb and flood. In the surface water the catches during flood averaged over 3 times those during ebb, but the catches made when navigating with and against the current were always practically equal, which proves that transport is passive. These results were born out by additional evidence, from which it appeared that the migration takes place both at night and day, though in day time at a certain depth. Moreover, it appeared that the elvers concentrated in the inner part of the Wadden Sea not far from the sluices in the closing dyke of the Zuiderzee, obviously because they were hesitant to enter fresh water. In this area flood- and ebb-catches proved to be of the same order, which points to the animals oscillating there with the tide. Later in the season, from the last week of March onward, they entered the sluices. This happened one month after strong migration in the outer part of the Wadden Sea had started, nothwithstanding the fact that, with their ebb–flood-mechanism, they could have reached the closing dyke in a couple of days. Some years ago DEELDER had proved already that, long before they enter, the elvers are present in the sea outside the sluices.

Mr. CREUTZBERG noted once that the migration changed into the opposite direction, possibly under the influence of a cold northern wind. The catch during the ebb was 25 times higher than that during the flood; it was clear that the animals fled from the inner area of the Wadden Sea on that occasion. Mr. CREUTZBERG assumes that the direction of transport, both with flood and ebb, is determined by both temperature and salinity.

Mr. CREUTZBERG also tried to find data in favour of an urge of the elvers to migrate to a fixed point of the compass. To this end the animals were brought into a round tank, the rims of which sloped gradually upwards, thus allowing a clear view of the sky. The experiments did not yield any evidence in favour of the supposition that the animals would have a preferred direction of escape. Everything seems to indicate that it is exclusively the ebb–flood-mechanism, which determines the direction of migration. A short summary of the data obtained so far is to appear in "Nature" (see Vol. **181**, p. 857–858, 1958).

Finally, Mr. CREUTZBERG investigated whether there were any indications that the old eels—of which it is proved that they follow a fixed course over a long distance when leaving the Baltic—may be guided by the direction from which certain vibrations reach the animal. It would lead us too far to enter into this question here, but the outcome of the experiments does not exclude this possibility.

Mr. DUDOK VAN HEEL spent the first few months of 1957 in getting acquainted with the job he had taken over from Mr. KRISTENSEN: buying animals from the fishing fleet and providing the Universities with material for study. After that he gave some time to his own line of investigation, viz. the perception of sound by seal and porpoise, a subject he was already interested in at the time he entered our service. He made use of a young seal, which had been brought up for 1½ years by Mr. DE HAAN, warden of the Texel Museum. The animal was trained to come and fetch fish at a source of sound. With a simple apparatus it could be established that the upper limit of hearing is over 16000 Hz and that the susceptibility decreases rather quickly under 100 Hz. It was not well possible to establish the perception of direction, owing to reflection of the sound in the stone basin. A beginning was made of training the animal to react to differences in pitch. We owe many thanks to Mr. G. J. DE HAAN, who, by his great interest and unremitting helpfulness, greatly stimulated the investigation.

At the same time Mr. VAN HEEL, together with Mr. DE HAAN, tried to find a means to get hold of live porpoises for the same investigation. Before the war this species was numerous in the Wadden Sea, but ever since it was found to have become rather uncommon. It is not likely that this decrease is connected with the loss of the Zuyderzee, because the dyke was closed in 1932 and porpoises were still numerous in 1940. However, roundabout 1940 the Zuyderzee herring disappeared and this may have had something to do with the disappearance of the porpoise. When it was clear that no *Phocaena* were available in our country Mr. VAN HEEL tried Denmark, where porpoises leaving the Baltic in winter are caught in the Little Belt. Part of a pond near the windmill of De Bol, Texel, a pond which is connected with the sea by a small lock, was fenced in. Anticipating our annual report of 1958 we may already state that at this moment a couple of *Phocaena* is swimming in this pond.

As in other years the acquisition of animals from the fishing fleet furnished a great many data, of interest either from a faunistical or an ecological point of view or in connection with migration studies.

Owing to the abnormally mild spring *Sepia officinalis*, the common cuttle-fish, was unusually early. The first animals came in at Den Helder 6th and 9th April. From 26th April they occurred in increasing numbers. The animals, moreover, were very numerous, also in the Easter Scheldt. If handled with care, the time of arrival and the number of *Sepia* is a good indication of the temperature in the sea in a certain year. In the late spring of 1956 the species was extremely late and hardly got as far as Den Helder, in the mild spring of 1957 the opposite did happen.

As to the occurrence in autumn of Atlantic migrants around Scotland it seems worth while to mention that not a single catch of *Mola mola* was reported. Mr. KRISTENSEN heard of 3 catches of ray's bream in late autumn. *Scomberesox saurus*, the skipper, stranded at the end of December in large numbers from Egmond to Vlieland. For the stranding of this species in Zeeland waters we refer to the contribution by WALRECHT in "De Levende Natuur", vol. **61**, pp. 32–34, 1958.

Mr. KRISTENSEN drew our attention to the fact that in the end of 1957 and in the beginning of January 1958 an enormous amount of young herrings *(Clupea harengus)*, about 12 cm long, together with a small number of sprats *(Clupea sprattus)*, were washed ashore alive near Egmond, where the animals were gathered by the basketful. Eye witnesses report that they did not get the impression that the herrings fled for predators. The observation may be of importance in connection with the regular strandings of species as bream, moonfish, skipper and others.

Mr. KRISTENSEN also drew our attention to the fact that a number of congers *(Conger conger)* were washed ashore after the cold spell in December. Most of them were still alive. The species cannot stand the cold very well; apparently it curls up then, probably to be washed ashore by the currents.

Other data are summarized in the list of special catches. Worth mentioning are 2 *Ctenolabrus rupestris* from near Den Helder in April, 2 *Scorpaena dactyloptera* caught off Texel and Terschelling in March, and 2 specimens of *Scylliorhinus stellaris*, the southern dog-fish, off Texel in September. Furthermore, Mr. DEELDER informed us that a specimen of *Balistes capriscus* (♂? 41 cm), captured at 53°2′N and 3°20′E, was brought in at IJmuiden on 29th October. It is now in the collection of the State Museum of Natural History at Leyden.

Mr. WESTENBERG continued to work out his population theory. He intends to arrive at an insight in known phenomena without the use of mathematical formulations. His paper on "The mechanism of fluctuations in populations and the ups and downs of an unrestricted fishery" (Vakblad voor Biologen", vol. **36**, pp. 41–53, 1956) on the suggestion of Prof. Umb. D'ANCONA (Padua) was published in an Italian version (Archivio di Oceanografia e Limnologia (Venezia), vol. **11**, pp. 47–61, 1957). His contribution to the summer course of 1957 is to appear in "Vakblad voor Biologen", vol. **38**, pp. 21–27, 1958. He hopes to extend his theories to more complicated population systems.

Before we pass on the the hydrographical work we may add that Mr. VERWEY, besides to other people's investigations, devoted his time to the compilation of a non-official report on the influence of radioactive waste water on life in the sea.

In 1957, as in previous years, hydrographical research, under the

Species	*Sex; Size (cm)*	*Locality (ST means buoy on the Silverpit-Texel route)*
MIGRANTS SUPPOSED TO HAVE ENTERED THE NORTH SEA VIA DOVER STRAIT		
Raia brachyura	♂ 45; 90; ♀ 41	Texel Hole
Raia montagui	♂ and ♀ 40–71	Tea Kettle Hole, Texel Hole, Terschelling Bank
Spondyliosoma cantharus	26; 22; 36; 41	N of ST 4, Westhinder
Trigla cuculus	♂ 23; ♀ 19.7	Texel Hole, off Callantsoog
Balistes capriscus	♂ ? 41	53°2′ N, 3°20′ E
Sepia officinalis		
Octopus vulgaris	nearly all of them alive	near L.S. Texel, Texel Hole
MIGRANTS SUPPOSED TO HAVE ENTERED THE NORTH SEA VIA THE NORTHERN ENTRANCE		
Scomberesox saurus		Stranded at Den Helder, Vlieland, Texel, Egmond
Brama raii	53; 56; 56	Stranded at Scheveningen, Wijk aan Zee, Egmond
NORTHERN SPECIES, RARE IN THE S. NORTH SEA		
Raia radiata	♀ 60	Texel Hole
Anarhichas lupus	38; 31	Pit 4 buoy, ST 4, Texel Hole
Scorpaena dactyloptera	16.5; 21	ST 4, Texel Hole
Hippoglossus hippoglossus	young	Callantsoog 13 m
Eledone cirrhosa	alive	N of Terschelling Bank
SPECIES, WHOSE DIRECTION OF MIGRATION IS UNCERTAIN		
Acipenser sturio	♀ 295	Texelstroom
Scylliorhinus stellaris	± 100, alive	Texel Hole
Scylliorhinus caniculus		Texel Hole, Terschelling Bank
Ctenolabrus rupestris	15.3; 15	near Den Helder
Loligo vulgaris		
Loligo forbesi		
Nephrops norvegicus		Terschelling Bank, Texel Hole, ST 3

Numbers per month											
J	F	M	A	M	J	J	A	S	O	N	D
1	1	—	—	—	2	—	—	1	—	—	—
17	—	1	2	3	4	1	1	3	2	7	—
—	1	—	—	—	—	—	—	—	—	3	—
—	—	—	—	1	1	1	—	1	—	—	—
—	—	—	—	—	—	—	—	—	1	—	—
—	—	—	26	very large numbers		8	3	2	—	1	1
2	—	1	—	1	1	—	—	2	—	2	4
—	—	—	—	—	—	—	—	—	—	—	34
1	—	—	—	—	—	—	—	—	—	1	2
—	—	—	—	—	—	1	—	—	—	—	—
—	1	2	1	1	1	—	—	—	—	—	—
—	—	2	—	—	—	—	—	—	—	—	—
—	—	—	1	—	—	—	—	—	—	—	—
—	—	1	—	—	—	—	—	—	—	—	—
—	—	—	1	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	2	—	—	—
large numbers from 15 J on		3	2	2	2	—	—	2	2	7	32
—	—	—	2	—	—	—	—	—	—	—	—
—	—	—	1	17	5	30	—	5	—	—	—
—	1	2	—	2	1	very large numbers		25	—	—	2
2	—	1	—	—	1	4	—	2	45	3	—

direction of Mr. POSTMA, was mainly concentrated in the Wadden Sea, but additional data were collected about the IJsselmeer and the Zeeland and South Holland estuaries. When we add the observations obtained in a previous year in the Eems and Dollart area, we can say that we now possess a number of data concerning the more important Netherlands coastal waters. The point at issue is the chemical composition of the water and of the material in suspension. Special attention has been given to the question whether chlorophyll may be used as a standard for the amount of phyto-plankton present in the water. Mr. POSTMA has gradually become convinced that by far the largest part of the chlorophyll is present as dead matter. Comparable results in other areas point to the same conclusion. Even in the ocean an important part of the green plankton pigments is not confined to living matter.

Research in Zeeland was meant to give us some idea about an area which is shortly to be investigated more extensively by the Delta-Research Department of the newly erected Hydrobiological Institute. In so far as we may draw conclusions from one series of observations we may say that, just as with the Wadden Sea, suspended material from the North Sea enters the Zeeland estuaries. The organical part thereof probably furnishes an important contribution to the balance of organic matter in these estuaries. The influence of fluviatile matter is restricted to the area north of the Zijpe. The Wester Scheldt is enriched to a great extent by organic matter and minerals from the Scheldt (Antwerp), so that this area occupies a separate place in the complex of the Zeeland and South Holland estuaries.

The data collected in the IJsselmeer are concerned with the distribution of biologically important minerals in this area. Special mention should be made of the fact that the horizontal distribution of the various components, besides by the discharge of the IJssel and of the city of Amsterdam, was at the time of the investigations apparently determined by material from the dyke which is built to connect the island of Marken with the mainland. This influence seemed to be present all over the IJsselmeer, also as concerns e.g. the amount of chlorophyll and phosphor[1].

Mr. POSTMA again devoted much of his time to working out the chemical data of the Snellius expedition. The results of this investigation are shortly to appear in print. They lead to a clearer notion of the way in which various water masses enter the Indonesian area from the Pacific and of the changes in chemical composition of the water during the transport through the Indonesian Archipelago.

Mr. DUURSMA continued his investigation about the amount and

[1] See, however, Annual Report for the year 1958.

possible composition of dissolved organic matter. As mentioned in the previous report he has worked out analytical methods allowing the accurate determination of carbon and nitrogen in small amounts of dissolved organic matter. In this way he hopes to get some indication on the origin and decomposition of these materials.

In the past year Mr. DUURSMA investigated a number of samples from the Wadden Sea, the Eems and the IJsselmeer, with the intention to find out what changes may occur when salt and fresh water mix. Large amounts of organic matter in solution are carried into the Waddensea with the river water. So far, the results give no indication of a speedy alteration of this material, once in the sea. In view of its high concentrations in the sea, even at great depths, such an alteration was not to be expected either.

It is Mr. DUURSMA's intention to extend his investigations to the Atlantic Ocean, so that it will be possible to compare water from the coast and from the high sea. A preliminary investigation was made possible, since Mr. DUURSMA got the opportunity to join a trip of the German research vessel "Gauss" to the Norwegian Sea between Jan Mayen and the Norwegian coast. On this occasion water samples were taken to a depth of 3000 m. They confirmed the notion that in this deep water rather high concentrations of dissolved organic matter may be found. However, there were measurable differences along the vertical. Continuation of the research in open sea may therefore lead to important conclusions and this justifies Mr. DUURSMA's scheme for the investigation of a great number of samples which will be collected by German research vessels on the occasion of the International Geophysical Year, between the Azores and Greenland. In this connection special mention should be made of the cooperation rendered by the German Hydrographic Institute at Hamburg.

As to the work nearer home we mention a number of water samples from the harbour of Den Helder, which were tested for salinity on behalf of Rijkswaterstaat (Ministry of Roads, Canals and Dykes). We also cooperated with the same service on the movements of water marked with fluorescene. The observations were carried out to find the best place for discharge of the sewage from the town of Den Helder.

We should finally mention that Mr. POSTMA published two hydrographical papers: Size frequency distributions of sands in the Dutch Wadden Sea, in Arch. Néerl. de Zoologie, vol. **12**, pp. 319–349, and, together with Mr. P. KORRINGA: Investigations on the fertility of the Gulf of Naples, in Pubbl. Staz. Zool. Napoli, vol. **29**, pp. 229–284.

In the beginning of 1957 discussions were held with the Organization for Applied Research, which led to the Station offering accomodation to this Organization for research concerning means of combating fouling

of ships. Mr. DE WOLF, to whom this investigation was entrusted, had at first found accomodation with the State Institute of Fishery Research at IJmuiden; however, this institute was cramped for space. Mr. DE WOLF started working at Den Helder on March 15th. He intended to choose a species of barnacle as the chief animal for his experiments, hoping that he would be able to raise larvae throughout the year. So he set up a culture of barnacles on the one hand and on the other hand a culture of phytoplankton to serve as food to the larvae. Since nowadays it is very important for any marine biological station to possess phytoplankton cultures, the experiences of Mr. DE WOLF are also of great value to the Zoological Station.

Among the other institutions with which the Zoological Station had connections especially the State Institute for Fishery Research at IJmuiden, inclusive its oyster laboratory at Wemeldinge, should be mentioned. The scientific staff of IJmuiden and Den Helder strengthen the ties by mutual lectures; investigations on the lightvessels are organized by the two institutes together, while for a time in 1957 Den Helder granted facilities to IJmuiden so that lobsters could be isolated for studying a disease of this species in Zeeland.

Relations with the Oceanographic Department of the Royal Netherlands Meteorological Institute at De Bilt are also good. This Department helped us repeatedly by lending an Ott current meter, even together with the man who worked it, and by lending the very valuable self-registering salinity and temperature meter built by the Institute. We are further on good terms with several services of the Rijkswaterstaat, an institute of much value to any marine institution. Further, we are much obliged to the Royal Netherlands Navy and the Pilotage at Den Helder for help on various occasions. A special word of appreciation is due to the crew of the lightvessel Texel for the care with which they worked the large plankton nets. Finally, we should express our most cordial thanks to the personnel working the sluices at Den Oever for their cooperation in the elver-investigations.

Just as in previous years the summer courses were given by the entire scientific staff, including the members appointed by the Organization for Pure Research. The number of students participating in these courses was 47, of which 14 came from Groningen, 3 from Utrecht, 2 from Amsterdam and 27 from Leyden. One of the courses was attended by a Belgian biologist, Mr. Ph. POLK from Blankenberge. In addition, Amsterdam gave a private physiological course, conducted by Mr. PUNT, with the assistance of Mr. KRISTENSEN and Mr. PARMA, while the Free University at Amsterdam gave a short course for 22 of her own 1st and 2nd year biologists, and Utrecht University did the same for 37 people.

The total number of man days spent in 1957 at the Zoological Station by individual investigators and course participants amounted to 1140; the average for the years 1947–1957 is 1122.

The Dutch visitors to the Station included a group of biophysicists of the Physical Laboratory of Groningen University, under the guidance of Prof. H. DE VRIES, the participants of an excursion to Den Helder and Texel of the Royal Netherlands Botanical Society, and the members of the section for Ecology and Phaenology of the Royal Society for Agricultural Science.

Foreign visitors to the Zoological Station in 1957 were Mr. and Mrs. BRODIE, Victoria University, New Zealand; Mr. and Mrs. DAWSON, New Zealand Oceanographic Institute, Wellington, N.Z.; Mr. and Mrs. ORR and Miss Sheina M. MARSHALL, Marine Biological Station, Millport, Scotland; Mrs. M. KALK-THOMAS, University of the Witwatersrand, Johannesburg, South Africa; Messrs. K. MASAYASU and H. TOSHIO, Tokyo, Japan; Mr. V. LEPETIC, Dubrovnik, Yugoslavia, who worked for a long time at IJmuiden.

Under the heading Building we should say a few words about the plans for extension of the Station, to which much time was devoted in 1957. In the spring of 1957 the council of the Society submitted to the Government a scheme for considerable extension of the scientific and technical staff of the Zoological Station which, starting 1958, would have to be realized in about 15 years. It would involve the building of additional quarters or a new institute. This plan was accepted in essentials by the Ministry of Education, Arts and Sciences with the consequence that a lot of conferences and other work had to be done by some Government departments, the Society's council and the Zoological Station itself. The main question was whether, in case a new building was found to be necessary, the Zoological Station should stay at Den Helder or not. The answer has been that Den Helder offers many favourable conditions, but that the site suitable for a new Zoological Station will be found with great difficulty or not at all. The schemes may be worked out further in 1958. In view of this uncertainty no alterations to the building and to the students' lodge were undertaken in 1957.

The library continued to expand, especially as concerns the periodicals. Although the allowance was raised to *f* 1100.— we regret to say that the budget was again exceeded, this time by *f* 600.—. We gratefully remember the contribution of the Netherlands Physical and Medical Congress, which allowed us to procure Vinogradov's The elementary chemical composition of marine animals. The State Institute for Fishery Research placed at our disposal a considerable number of duplicates, which made it possible to fill up some gaps in

our library. We are also much obliged to the Fisheries Research Board of Canada for sending us a collection of old issues of several of their periodicals. Our exchange relations with the Sovjet Union begin to take shape again after a long interruption. Last year (1956) the contact with Tartu was re-established and in the present year the Lenin-library in Moscow took the initiative for exchange.

In the previous annual report we mentioned already that in the winter of 1956–57 the Max Weber got a new engine-block. Consequently the vessel was out of service until 15th March and during that time we used a ship hired at Harlingen: the Ha 42, which, together with its skipper Dirk Bos, has helped us out. The number of working days of this ship was 28, that of the Max Weber amounted to 87, so that 113 days were made in all. At the end of '57 and the beginning of '58 the wheel-house of the Max Weber was well enlarged. There is now room for some instruments and more room for unrolling charts, writing and other work and for the men. The shape of the ship has in fact improved and the navigability in rough seas has not noticeably changed. The alteration was made possible by a separate grant of *f* 3100.— by the Department of Education, Arts and Sciences, which also furnished the costs of reparation and of the hire of the Ha 42.

The provision with sea-water of the Zoological Station, which since the autumn of 1951 was looked after by a private person, in November 1957 was taken over by the Royal Netherlands Navy. About every other day a ship delivers a quantity of some 50 m^3 of sea-water, and since the skipper tries to get water of a high salinity the provision leaves nothing to be desired.

There were not many changes in the personnel, only the analyst Mrs PEETERS-PLANKEN resigned on February 1st. Appointed were 2 other analysts: Miss C. M. BOSCH and Miss. S. STEINFORT SCHAAP, on 1st Jan. and 1st Febr. respectively. On March 15th Mr. PRINS celebrated 25 years of service with the Zoological Station. Starting 1 July Mr. POSTMA was appointed substitute director.

As mentioned above Mr. DUURSMA took part in a 3 weeks trip with the German research vessel "Gauss", stationed in Hamburg. On this occasion Mr. DUURSMA also attended the meeting of the International Council for the Study of the Sea at Bergen, Norway.

In the company of Mr. KORRINGA, IJmuiden, and Mr. WINDEMULLER, physician at the Netherlands Reactor Centre, Petten, Mr. VERWEY visited some English institutes carrying out investigations on the influence of radioactive material on marine life. The visit was connected with the above mentioned report on this subject to the President of the National Health Board.

Mr. VERWEY used up part of his holidays by visiting German marine

biological and fishery laboratories: the "Biologische Anstalt" at Hamburg and at List on the island of Sylt, the "Institut für Meereskunde" at Kiel, the "Deutsche Hydrografische Institut" at Hamburg, the "Bundesforschungsanstalt für Fischerei" at Hamburg with its branch office at Cuxhaven, the "Institut für Meeresforschung" at Bremerhafen. Thus he was in a better position to compare the German institutes with the French and English ones he visited in previous years. He also visited the Hydrobiological Station at Plön, Kramer's Institute of the "Max Planck Gesellschaft" at Wilhelmshaven, and the fine aquarium of the Institute "Senckenberg am Meer" at Wilhemshafen.

Mr. CREUTZBERG also visited some institutes abroad during his holidays, viz. the Fishery biological Institute at Drottningholm, Sweden, the Station Kristineberg on the Swedish West Coast, and the Max Planck Institute as well as the institute Senckenberg am Meer at Wilhelmshaven.

The receipts from study materials in 1957 amounted to *f* 9645.42, while *f* 4467.38 was spent on the acquisition of animals and *f* 1768.26 on preserving liquids, wicker bottles and other materials for expedition, so that the expenditure amounted to *f* 6235.64. This makes a balance of *f* 3409.78, a somewhat higher amount than before as a consequence of our attempts to make this part of the work somewhat more self-supporting. In fact, the work practically represents a full-time job for one of our men, and it is therefore rather costly. We intend in the near future to enter into special demands from university laboratories for histological or other more specialized purposes.

The total costs of exploitation, excluded the grants of the Netherlands Organization for Pure Research, amounted to *f* 130000.—. When we add to this the costs for the apparatus of Mr. DE BLOK amounting to *f* 28000.—, the total expenditure for 1957 amounted to *f* 160000.—. We are much obliged to the Government for the considerable support now given to marine biological research, and it may not seem altogether realistic that at the same time we plead for the Station's extension. However, when taking a broad view of the matter, we must be aware of the fact that also this field of research should stand on a high, that is to say on an internationally recognized level. This is only possible if the ever increasing specialization in this branch of science also finds expression in our country, a state of affairs involving considerable sacrifices anyhow. It is reassuring that the Government does its best to promote this development.

Den Helder, February 1958 J. VERWEY

The Netherlands Zoological Society has issued the following publications, which are obtainable from the Director of the Zoological Station, Den Helder, at the prices given below:

Tijdschrift van de Nederlandse Dierkundige Vereniging

Series I, vols 1—7, 1874—1885, out of print	
„ II, „ 1—20, 1887—1927, partly out of print . .	8,50*
„ III, „ 1—3, 1928—1933, partly out of print . .	5.—
Supplement to vol. 1 (Ser. I), 1883—'84:	
Report on oyster research	6.—
Supplement to vol. 2 (Ser. I), 1888:	
Report on certain fisheries	6.—
Index to Tijdschrift, 1874—1909	1.20

Archives Néerlandaises de Zoologie, issued in cooperation with the Holland Society of Sciences at Haarlem:

Vols. 1—7, 1934—1947	22.—
„ 8, 1947—1951	25.—
„ 9—13, 1948—1958	30.—
Suppl. to vol. 3, 1938	10.—
„ „ „ 7, 1946	2.—
„ I„ „ 10, 1953	8.50
„ II„ „ 10, 1953	8.50
„ I„ „ 13, 1958	40.—

Flora and Fauna of the Zuiderzee. In Dutch. 4°. 460 pages, 1922. Out of print.

Supplement to Flora and fauna of the Zuiderzee. In Dutch. 4°. 258 pages, 1936 . . . . . 7.—

Changes in the flora and fauna of the Zuiderzee since its closure in 1932. In Dutch, with English summary. 4°. 359 pages, 40 figures, 11 plates and many maps and tables, 1954 . . 15.—

De Biologie van de Zuiderzee tijdens haar drooglegging, parts 1-6, 1928-1944 . . . . . Per set 10.—
Per part 2.—

Mededelingen Commissie faunistisch onderzoek Zuiderzeepolders, parts 1-2, 1949 . . . . . Per set 1.50

Catalogue of the Society's library. 1907. 1924. Out of print.

*) Prices in Dutch guilders per volume, reduced prices for members. Postage extra.