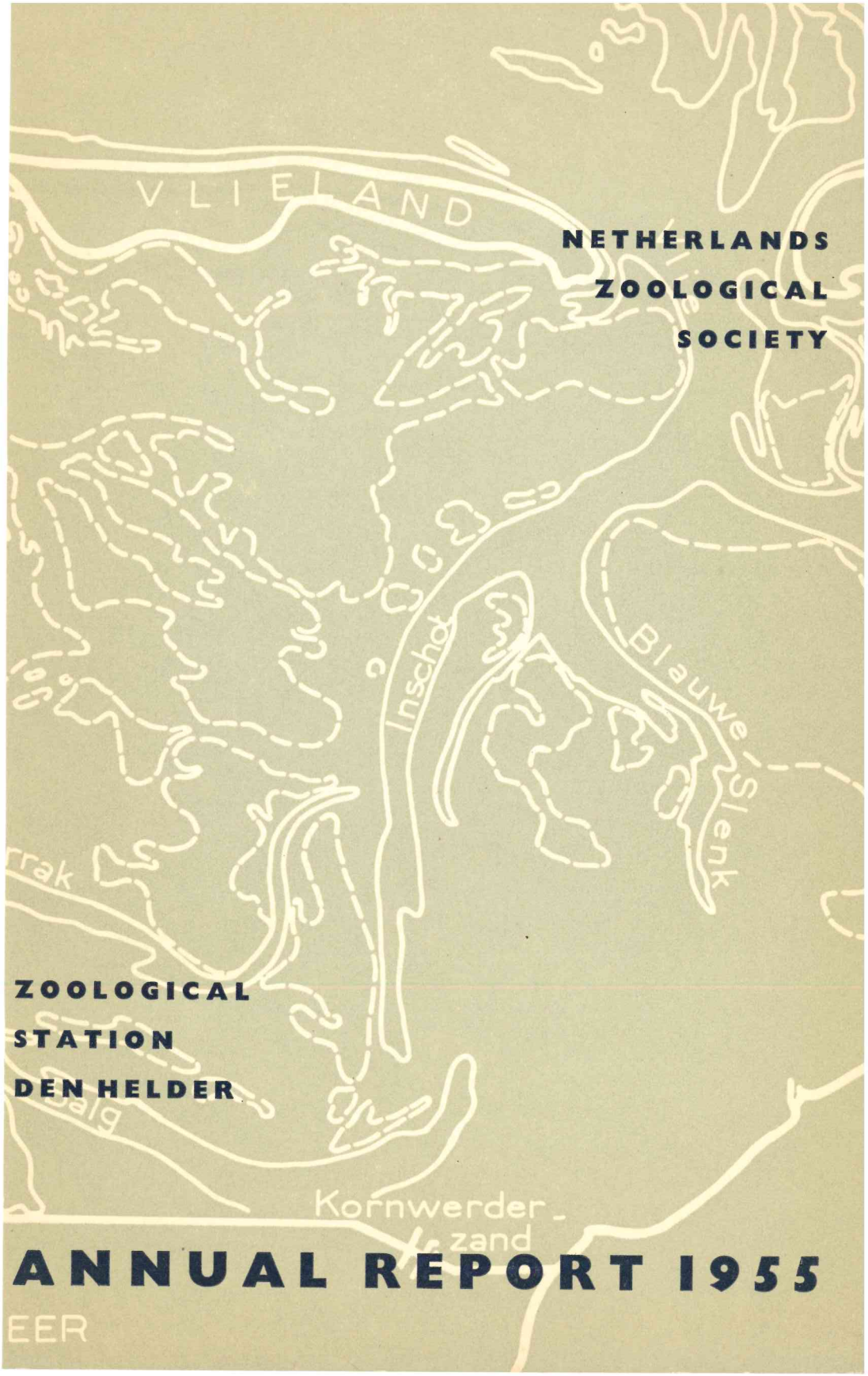

NETHERLANDS
ZOOLOGICAL
SOCIETY

ZOOLOGICAL
STATION
DEN HELDER

ANNUAL REPORT 1955


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.

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.

Extrait des Archives Néerlandaises de Zoologie,
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ANNUAL REPORT OF THE ZOOLOGICAL STATION OF THE NETHERLANDS ZOOLOGICAL SOCIETY FOR THE YEAR 1955

The research programme carried out at Den Helder in 1955 again featured the mussel (*Mytilus edulis*) as one of the main objects of investigation. The work on this species is gradually gaining depth. Apart from this, other important work was done, not in the last place by the two research biologists working for the Government Organization for Pure Research.

As to the mussel, a contribution to field work was made by Mr. S. PARMA, Amsterdam, detached by the Government Institute of Fisheries Research for a four months' stay at Den Helder. His task was to find out to what extent the quantity of young mussels in the Wadden Sea could be enhanced by certain measures. The method employed in mussel-farming in this country is that young mussels, so-called seed (mainly mussels in their first year of life), are caught on the natural musselbanks and scattered in certain localities where they have ample room to develop. In due course they are gathered for commercial distribution. Because this is a remunerative trade, musselseed is in great demand and it would be advantageous to find a method by which to increase the available quantities. Theoretically, this might be done in two ways: 1) by increasing the material for primary settlement, so that more spat would have a chance of settling on metamorphosis; 2) by providing a good substratum in the shape of a suitable solid bottom for young mussels that have passed through the period of primary settlement.

For this purpose the Government Institute of Fisheries Research had nets fastened to solid wooden stakes in a few places in the Wadden Sea. In these nets branches of broom (*Sarothamnus*) and of various kinds of trees and strawrope were deposited. The nets were mainly hung in a vertical position at various depths, a small number were placed horizontally. Mr. PARMA was to inspect the spatfall on this artificial substratum, determine the different degrees of density on the various

types of material, and study the growth of the spat in order to form an idea of the length of time during which the mussels remain on this material, or make other observations that might appear to be of interest in connection with the problem involved.

In our previous Annual Report it was already indicated how laborious this investigation is because such a large part of the work involves spat from 250 μ upward, which are invisible to the naked eye. As also the work on mussels up to about 2000 μ continually calls for *measuring*, so much time is taken up by this purely mechanical part that in point of fact an investigation of this kind should not be carried out by a single person. Nevertheless, Mr. PARMA obtained a number of valuable results, also from a purely scientific point of view:

1. The spatfall in the Wadden Sea started rather late in the season, viz., in the second half of June. No spatfall was observed in the autumn, as is sometimes the case in other years.

2. For the settling of the musselspat a certain amount of fouling is of great importance as a secondary substratum. A firbranch will become densely overgrown especially with *Tubularia*, hence it will attract many small mussels; on straw there will be many *Balanus* and consequently small mussels will be attracted. Species which play an important part in this respect are the Hydroids *Laomedea* sp. and *Tubularia larynx*, the barnacles (*Balanus crenatus*), and the red alga *Ceramium rubrum*. Later mussels, settling among the earlier arrivals, have no need of the original secondary substratum, so that the latter gradually becomes less important. *Lanice conchilega*, the sandmason, was favourable to settlement if the species was not present in large numbers; if it was abundant, as was the case on the horizontal net, it had an adverse effect on the eventual numbers of mussels.

3. The production of spat was greatest on the nets farthest from the bottom. Further, the horizontal net, as compared with the vertical ones, produced hardly any spat.

4. Branches and strawrope, driven into the bottom on a tidal flat covered with shallow water, yielded a reasonable production in the slightly deeper parts. Also a herringnet stretched along the bottom was covered moderately well. The growth of the mussels was less here than on the nets in somewhat deeper water along the creeks. The full data on the growth of the mussels are not yet available, however.

Also laboratory work on the mussel was continued.

Mr. HERREBOUT, Utrecht, studied the combined influence of temperature and salinity on the mussel. Before the war much work was done at Den Helder on the combined influence of these factors on the shrimp, *Crangon crangon*, and the shore crab, *Carcinus maenas*. Longevity was then taken as the starting point and it was found that optimal conditions are

obtained if salinity decreases with an increase of temperature and vice versa. Investigations elsewhere have shown that the same holds for other Crustacea which move from the shore to deeper water in winter. Migration in these animals so to speak takes the combined influence of salinity and temperature as a starting point. Naturally, the question arises whether in a non-migratory species a change of temperature is *not* attended with a shift in optimal salinity. Mr. HERREBOUT chose the mussel to work with, and the quantity of water pumped by the animal was taken as a measure to determine the combined influence of temperature and salinity. The quantity of water pumped was found indirectly through determining the decrease in concentration of a suspension of uniform particles of such a size that the mussel could not pass them out. From the work of Dr. TAMMES and Mr. DRAL we know that *Lycopodium* spores can serve as such. Mr. HERREBOUT's investigation presented all kinds of difficulties. The main one was that it is so hard to keep the rate of settlement of the particles constant in the individual experiments. Mr. HERREBOUT obtained indications (but no more) that the salinity at which the rate of pumping attains maximum values is higher at a higher than at a lower temperature, which would indeed indicate a shift of optimal salinity attending a change in temperature, but this shift would be the reverse of what we find in Crustacea. It should be added that the results are not yet to be considered definitely established.

Other work on the mussel was done by Mr. DRAL in consultation with Mr. VERWEY. This investigation centred round the question how the mussel succeeds in retaining or passing out at will the suspended particles of a suitable size which form its food. TAMMES and DRAL (Annual Report for 1952 and their paper in Archives Néerl. de Zoologie, 1955) found that material of a particle size of about 40 μ is retained almost completely, while particles below 5 μ are the more difficult to retain as they become smaller. Particles of sizes between these extremes can apparently be retained and passed out at will. Dr. TAMMES explained these facts by assuming that larger particles stand a better chance of being caught by the stiff laterofrontal cilia than smaller ones, and his view was that the particles adhere to the cilia, as had also been observed by WALLENGREN in the early part of this century. Further, Dr. TAMMES thought that the mussels could make the cilia sticky at will and thus retain or pass out particulate material. The large size of the particles passed out, however, made it appear probable that variation in stickiness alone was not sufficient and that the *position* of the laterofrontal cilia has something to do with the passing out of particles. Mr. DRAL's researches aimed at obtaining data on this point. Through his efforts the movement of the cilia has now been subjected to detailed enquiry, and it is practically certain that their position can indeed be

changed and that it is of vital importance for the retention or passing out of suspended particles.

In connection with the research on mussels we should also mention a visit paid us by Fräulein Brunhild STURCKOW, a former pupil of Prof. ANKEL, Giessen. For some years she has been engaged upon an investigation of the way the mussel attaches itself to its substratum by means of its byssus, and this research has led her to the question of growth and wear of byssus, and of the causes of the differences in thickness of the byssus in individual mussels and their effect on attachment. The object of her visit was to test her findings on animals from different habitats, and at the same time to see something of the work done on mussels at Den Helder.

An entirely different kind of investigation on mussels was made by Miss KOOPMAN, Utrecht, in continuation of preliminary research started in 1953. It was made at the suggestion of Dr. KORRINGA. When a mussel closes its shell, heart pulsation virtually ceases. Miss KOOPMAN tried to find out what precisely causes this reaction. She worked with mussels of about 600–1000 μ, in which the heart can be seen pulsating through the transparant shell. It was found that a decrease in oxygen of the water does not bring about a diminution of pulsation until the oxygen concentration in the surrounding water has become as low as about 20 %. In these circumstances the shell may remain open. The animal's reaction to carbon dioxide is quite different from that on oxygen. Even when the CO_2-concentration in the seawater increases slightly, the rate of pulsation decreases a little and it will fall further according as the carbon dioxide concentration increases, also if the water remains saturated with oxygen. These results do not constitute definite *proof* that carbon dioxide actually provides the stimulus that stops pulsation in mussels which have their shells closed (we know nothing about the carbon dioxide tension in the blood), but they do indeed make this quite probable. In a recent study, which did not, however, involve *changing* quantities of carbon dioxide, SCHLIEPER arrived at the same conclusion.

Miss GEHRELS, Amsterdam, had hoped to find out particulars of the life history of the small cuttlefish, *Sepiola atlantica*. Unfortunately, she did not succeed in keeping her specimens in good condition. After some weeks she therefore transferred her attention to another subject: the factors which induce the appearance of a particular colour pattern in the common cuttle, *Sepia officinalis*. The colour patterns of *Sepia*, which have been described by HOLMES, are obviously a response to changes in the animal's environment. Miss GEHRELS gave her special attention to one particular pattern characterized by a white spot approximately in the centre of its back. This spot appears when the animal lies quietly

on the bottom, especially if light-coloured objects like shells and pebbles cover the bottom. Miss GEHRELS found that it tends to appear even more often as a response to shells painted yellow rather than white, but hardly, if at all, as a reaction to dark-coloured ones. A striking point was that not only did the animals produce the white spot in response to light-coloured objects, but they also showed a preference for taking up positions near these objects. It rather looked as if in this way they sought to promote their own camouflage. Further experiments seemed to indicate, however, that they were also partial to positions near dark-coloured shells, where consequently they would not produce their white spot. To sum up the results it would appear that *Sepia* shows a preference for a highly structurated bottom, and in addition produces its white spot if on this bottom there is a white (or yellow) coloured object. This investigation to some extent followed up the work done by KÜHN, though KÜHN used the colour adaptation of *Sepia* to the bottom as a means to study the animal's sensitivity to colours. Miss GEHRELS also tried to determine the influence of the size and number of white objects, but her researches did not yet produce an answer to this and other questions. The work takes up an enormous amount of time as the various specimens differ in the degree to which they tend to exhibit particular colour patterns. It would certainly be worth while, however, to continue this item in the near future.

Mr. JANSSEN, Utrecht, studied the influence of temperature on geotaxis in the flat periwinkle, *Littorina obtusata*. We know from the work of BARKMAN and EBBINGE WUBBEN, the results of which were published in one of the recent issues of Archives Néerlandaises de Zoologie, that these animals are kept within the tidal zone by a strong negative geotaxis, which causes them to seek higher levels in the water, and a negative phototaxis and their dependence on Fucaceae, which keep them below the surface. One may expect, however, that this strong negative geotaxis is eliminated in winter, so that the animals are enabled to seek lower levels. The investigation was made to establish this point. In the course of it evidence was obtained that the negative sign of the geotaxis is not changed until the temperature falls to little above zero. As soon as the temperature approaches zero and particularly at 0° and below, the animal's geotaxis becomes positive. In a manner of speaking, the animals are detained as long as possible within the tidal zone, which offers good conditions as regards food, and they do not leave it until frost sets in. We hope this study will be published in the Archives.

Mr. HAECK, Utrecht, endeavoured to bring his investigation mentioned in our previous Annual Report, on the minimum change in salinity that is still percepted by the common shrimp, to a satisfactory conclu-

sion. Owing to various setbacks he was hardly successful in his attempts, and the results obtained last year underwent no significant change: the animals probably perceive changes down to 0.20 % Cl and possibly smaller. SPIEGEL conjectured that changes in the salinity of seawater are registered by means of taste perception, that is to say as a real difference in salt content.

Mr. DE BLOK, who works at Den Helder on a grant from the Netherlands Organization for Pure Research, to study the influence of lunar and tidal periodicities on the reproduction of marine animals, devoted the first six months of 1955 to examining the possibility of inducing various species of marine animals to propagate in small aquaria, as will be used in his definite experiments. He was successful as regards the worms *Polydora* sp., *Scoloplos armiger*, *Harmothoe* sp. and *Nereis diversicolor*, the molluscs *Chiton cinereus*, *Macoma balthica* and *Hydrobia ulvae*, and the sea urchin *Psammechinus miliaris*. The latter six months of the year were spent by him on further preparation of the experimental apparatus to be used. In our previous Annual Report it was stated already that the Organization for Pure Research had placed *f* 21 300.— at Mr. DE BLOK's disposal for this purpose. By means of the apparatus, which has been designed in collaboration with MR. DUK, instrumentmaker at the Zoological Laboratory, Leiden, some eight factors which vary with the lunar and tidal periodicities, will be investigated both separately and in conjuction with one another. The requisite rhythms will be evolved by mechanical devices geared to an electric clock which operates a number of rotating shafts with convenient revolution periods. These rhythms will be partly superimposed on each other. The original plan was to convert them into electric signals to be transmitted to the experimental aquaria, where they were to induce the desired rhythmical changes in pressure, light and other factors. Especially for the experiments involving varying hydrostatic pressures this electric transmission presented great difficulties. Therefore a pneumatic regulating system was adopted. For this purpose it was necessary to build a concrete pressure chamber, while also a fairly heavy compressor and expensive regulating equipment became necessary. Toward this end the Organization for Pure Research has granted an additional sum of *f* 6300.—.

In January Mr. CREUTZBERG, likewise appointed by the Netherlands Organization for Pure Research, started his investigations on the way eels find their bearings at sea, by building a shallow concrete basin with minute eel traps along the walls. By means of these it would be possible to determine whether in the dark the animals set loose in the middle would show a preference for a particular direction. In the spring and early summer months many preliminary experiments were

made with elvers caught at sea or taken from the large numbers accumulated before the sluices at Den Oever. They have not yet produced any positive results. From the outset Mr. CREUTZBERG has reserved the possibility that after its metamorphosis around the 1000 m line along the coast of the European Continent the elvers might be carried *passively* (that is by the currents), instead of actively, to within the sphere of influence of riverwater, after which the animals are supposed to be directed by hydrographic factors during their further migration. For this reason it appeared of importance to determine accurately the time of arrival and frequencies of elvers in the open North Sea off our coast. To this end, with the kind cooperation of the Netherlands Pilotage Service, widemeshed planktonnets were worked from two Dutch lightvessels, Noordhinder and Texel, the nets being handled by the crews. For a period of six months they will be hung out daily during an entire ebb and flood tide, to filter something like 10.000 m^3 of water per tidal period. In this way Mr. CREUTZBERG also hopes to find out whether elvers behave differently during ebb and flood and thus may possibly further their own transport. His plans provide for the resumption of experimental research as soon as the field work has produced sufficient indications to decide what should be the trend of the experiments. We may add here that during the autumn months Mr. CREUTZBERG also worked with silver eels which make for the open sea at that time of year. These experiments were likewise of a preliminary character and have produced no positive results so far.

Mr. WESTENBERG is engaged in theoretical considerations regarding the balance of animal populations. His review of the development of the theory of fisheries previously given in French and Dutch has now appeared in a German version (Zeitschrift für Fischerei, N.S., **4**, p. 297–314, 1955).

The data obtained this year by Mr. KRISTENSEN by buying up specimens of migratory and other species are again tabulated in this report. A remarkable point was that the southern species that as a rule arrive early were late in 1955, no doubt owing to the cold spring. Animals like pipefishes (Syngnathids), Anchovy (*Engraulis*) and the squid (*Loligo vulgaris*) did not arrive until May. Most southern species that come to these parts in spring exhibited a pronounced scarcity. This was the case with the pilchard (*Clupea pilchardus*), the John Dory (*Zeus faber*), the gurnards *Trigla cuculus* and *Trigla lineata*, the black bream (*Spondyliosoma cantharus*), the silversides (*Atherina presbyter*), and also with *Loligo vulgaris*. *Sepia officinalis* and the Syngnathids appeared in normal numbers. The southern species that are caught especially in autumn in 1955 were late, no doubt in connection with the warm autumn weather of that year. Examples were *Scyllium canicula*, *Mustelus vulgaris*,

Species	*Sex; Size (cm)*	*Locality* (*ST means buoy on the Silverpit-Texel route*)
MIGRANTS SUPPOSED TO HAVE ENTERED THE NORTH SEA VIA DOVER STRAIT		
Cetorhinus maximus	± 250	Inschot (W. Waddensea)
Scylliorhinus stellaris	♀ 51; ♀ ± 45	Tea Kettle Hole; Callantsoog, 13 m
Raia brachyura	33–108	Texel Hole-Tea Kettle Hole
Raia montagui	32–69	Texel Hole-St 2- N. of Terschelling
Hippocampus europeus	♀; ♂	Texelstroom (W. Waddensea)
Spondyliosoma cantharus	29.5; 27; 21.5	near ST 4
Trigla cuculus	23–31	Texel Hole–ST 1
Solea lascaris	♀ 26.5; ♀ 24	Texel Hole; ST 3
MIGRANTS SUPPOSED TO HAVE ENTERED THE NORTH SEA VIA THE NORTHERN ENTRANCE		
Cetorhinus maximus	♂ 351	ST 4
Scombresox saurus	34–37	stranded between Egmond and Texel
Phycis phycis	37; 53	58°20′ N, 2°15′ E, 104 m; 58°20′ N, 3° E, 108 m
Brama raii	51–63	58° N 3′ E; Zeeland (2 spec.); 54°25′ N,2°25′E; 58°20′ N, 2°15′ E; Zandvoort; Zeeland; Huisduinen
NORTHERN FISHES, RARE IN THE S. NORTH SEA		
Raia radiata	♀♀ 40, 45, 46, 48	Pit 3–4 buoy 44 m (3 spec.); ST 4
Onos cimbrius	25; 19; 22; 22	West Hole; off Callantsoog; N. of Terschelling, 26 m (2 spec.)
Anarhichas lupus	30–36	Texel Hole–ST 2
Hippoglossus hippoglossus	27	ST 4
FISHES, WHOSE DIRECTION OF MIGRATION IS UNCERTAIN		
Petromyzon marinus	60–66	Zuiderhaaks; River Maas (30 spec.)
Merluccius merluccius	24.5	Texel Hole area
Raniceps raninus	18; 13; 25	Zuiderhaaks; Camperduin; Zuiderhaaks
Acipenser sturio	185	NW of L V Terschellingerbank, 36 m
Capros aper	15.2	near PE 4 buoy (= 54°02′ N, 6°51′ E), 31 m
Pagellus centrodontus	25.8	54°18′ N, 5°21′ E
Labrus berggylta	5	Texelstroom (W. Waddensea)
Crenilabrus melops	18.5; 16.5; 20	Zuiderhaaks; Egmond; Huisduinen
Scorpaena dactyloptera	17.5; ?; 15; 19; ± 10	Westhole; Texel Hole; Black Bank; Texel Hole; Wadden Sea
Zeugopterus punctatus		ST 4
EVERTEBRATES, "RARE" IN THE AREA OFF DEN HELDER		
Nephrops norvegicus		Texel Hole area–ST 4
Todarodes sagittatus	♀ ± 40	stranded near Petten
Todaropsis eblanae	♀ 9.6; 10.3	ST 2
Loligo vulgaris		mostly from coastal waters (no data collected in July–Oct.)
Loligo forbesi		mostly from Texel Hole area (no data collected in July–Oct.)
Sepia officinalis		mostly from coastal waters and Wadden Sea
Octopus vulgaris	♀ 7; ♂ 14; 5 ♀♀ 13–15	Texel Hole area – ST 3
Eledone cirrhosa		Texel Hole area – ST 4
Pontobdella Vosmaeri	♀	SW of Texel Hole

Numbers per month											
J	F	M	A	M	J	J	A	S	O	N	D
—	—	—	—	—	—	1	—	—	—	—	—
—	—	1	—	—	1	—	—	—	—	—	—
1	3	—	2	1	—	1	—	—	—	1	—
19	7	6	2	2	1	3	2	—	4	1	4
—	—	—	—	—	—	—	1	1	—	—	—
1	—	—	—	—	—	1	—	—	—	—	1
2	—	—	—	—	3	2	—	—	—	—	—
1	—	—	—	—	1	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	1	—
—	—	—	—	—	—	—	—	—	—	—	> 100
—	—	—	—	—	—	—	—	—	—	1	1
—	—	—	—	—	—	—	—	—	1	4	3
—	—	3	—	—	1	—	—	—	—	—	—
1	—	1	—	—	—	2	—	—	—	—	—
—	—	—	6	1	1	—	—	—	—	—	—
—	—	—	1	—	—	—	—	—	—	—	—
—	—	—	—	1	30	—	—	—	—	—	—
—	—	—	—	—	1	—	—	—	—	—	—
—	—	—	2	1	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	1	—
—	—	—	—	—	—	—	1	—	—	—	—
—	—	—	—	—	—	1	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	1	—
—	—	1	—	—	—	—	1	1	—	—	—
1	—	1	1	—	—	—	—	—	—	2	—
1	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	2	—	2	—	—	2
—	—	—	1	—	—	—	—	—	—	—	—
—	2	—	—	—	—	—	—	—	—	—	—
—	—	—	—	5	32	?	?	?	?	—	—
—	—	—	—	—	41	?	?	?	?	100	7
2	—	—	—	17	216	29	5	—	—	—	—
—	—	—	—	—	—	—	1	—	—	—	6
5	1	—	—	—	—	—	—	—	—	1	—
—	—	—	—	—	—	—	1	—	—	—	—

Raia montagui, *R. brachyura* and *Octopus vulgaris*. Of these species only *Octopus vulgaris* was numerous, the others were definitely scarce. Of the Atlantic species which enter the North Sea particularly from the North, fairly normal numbers were observed of the bream (*Brama raii*), the skipper (*Scombresox saurus*) and the squid *Loligo forbesi*. A specimen above 2.5 m long of the basking shark (*Cetorhinus maximus*) was observed by Mr. KRISTENSEN in the Inschot (Waddensea) in July, and another, 3.5 m in length, was caught northwest of Vlieland in the North Sea in November. The latter was without gillrakers, a fact of interest in connection with the supposed periodical loss of these, see PARKER and BOESEMAN, Proc. Zool. Soc. London, 1954. Among the species of fish with a northern distribution, *Anarhichas lupus*, the catfish, was somewhat more numerous than was the case in the last few years (though still less common than before the war), whereas haddock, which before the war had practically disappeared from the Dutch coast, were again caught this year in small numbers off Den Helder (in April).

It is worth mentioning that in December more than 100 *Scombresox saurus*, the Oceanic skipper, got stranded on the beach between Egmond and Den Helder.

A second point of interest is that in August and September a specimen of the grey seal, *Halichoerus grypus*, was observed a few times near Den Helder, off Texel and on tidal sands outside the Marsdiep. In the latter area it was filmed by Mr. H. Th. DE BOOY, Honorary Secretary of the Netherlands Humane Society, who kindly placed the reel at our disposal. The animal shared its resting-place with ordinary seals, but was striking through its length, which was about 3 metres. The only certain record of this species on our coast hitherto consisted in a lower jaw found by VAN GIFFEN in a Groninger mound from about the 10th century.

Finally, it should be mentioned that oviposition of a specimen of the leech *Pontobdella vosmaeri* occurred in the aquarium.

The hydrographic work under the direction of Mr. POSTMA made good progress, as will appear from the following.

In the first 3 months of 1955 Mr. SOERIAATMADJA continued his investigations mentioned in the previous Annual Report, which concerned the influence of the North Holland Canal on the water of the Wadden Sea near Den Helder. Mr. SOERIAATMADJA found that only in a very narrow belt of but a few hundred metres width along the seawall of Den Helder does the water from the Canal have a fertilizing influence on the water of the Wadden Sea; indeed, this influence is only clearly perceptible around slack low tide. The intensive mixing caused by the strong currents apparently takes up the fresh water transported to sea so quickly that after a single ebb and flood tide its presence can

hardly be demonstrated, neither as regards its effect in decreasing salinity nor in its fertilizing influence.

In January Mr. AL KHOLY of the Marine Biological Laboratory at Ghardaqua on the Red Sea wound up the research items undertaken by him in 1954. He left for Kiel and Copenhagen in February.

In cooperation with Mr. M. ROESSINGH of the Government Institute of Fisheries Research a study was made in February and March of the distribution in the North Sea of water transported from the Wadden Sea through the Marsdiep. To this end both the "Anthonie van Leeuwenhoek" of the Institution of Fisheries Research and the "Max Weber" made two trips, the former ship dealing with the North Sea area, the latter with the Western Wadden Sea. Water samples were taken near the bottom and the surface at 40 stations in all. Of these samples, apart from salinity, a large number of chemical factors were determined which might be expected to show differences between the Wadden Sea and the North Sea. From the analyses it appeared that the presence of the Wadden Sea water could be demonstrated rather far to the South along the coast, probably as far as Petten. All this water is then transported to the North by the residual current in the North Sea. It thereby does not hug the coast of Texel at all closely, but is quickly transported a long way from the island. The investigation will be continued in the early part of 1956.

For six weeks in the summer Mr. P. EVERHARDUS, a student of chemistry of the Vrye Universiteit, Amsterdam, and a pupil of Prof. P. GROEN, studied tide-rips. For this piece of research he used a self-registering salinity-meter temporarily placed at our disposal by the Royal Netherlands Meteorological Office. Tide-rips mark the dividing line between two water-masses, which may exhibit large differences in salinity, temperature and other properties. From a spatial point of view, they are dividing-planes rather than dividing-lines and Mr. EVERHARDUS's main point of investigation was to determine the exact location of these dividing-planes between the bottom and the surface. He further tried to find out how fast the surface water flows to the tide-rip under certain conditions, and whether this occurs on one or on both sides. Finally, he tried to form an idea of the stability of the dividing planes at an increasing rate of flow of the tidal current. The results cannot yet be set forth here.

As in former years assistance was given to Rijkswaterstaat, section Hoorn, by carrying out a number of determinations of the percentage of suspended material in the New Harbour. Also in other respects the composition of the water of this harbour was studied, as will appear further on.

As in 1954, a number of phosphorus determations were made of

water samples collected in the Easter Scheldt. In 1956 this form of assistance to Dr. P. KORRINGA's productivity studies will not have to be continued, as he now has his own Laboratory for Oysterculture at Wemeldinge. Miss H. FAVERY DE JONGE, analyst of this laboratory, spent a week at Den Helder to become acquainted with the chief determinations of seawater that are of importance for the above mentioned productivity studies.

Also other institutions sent workers to Den Helder to get acquainted with the methods of chemical-hydrographic investigation. They were: Mr. TIMMERS of the Government Institute for the Purification of Wastewater, Section Dollart, Baflo, Miss Le Cosquino de Bussy of the National Defence Organization T.N.O., Mr. DE VRIES of the Government Institute of Fisheries Research, IJmuiden, and Mrs. VAN OORDE- DE LINT and Mr. PEELEN of the Research Team for Biological Investigation of the Big Rivers, Amsterdam. For the last mentioned study, water samples were taken by this Research Team at regular intervals in the course of a year. They were analysed at Den Helder by Mrs. VAN OORDE and Mr. PEELEN after they had become acquainted with the methods. Finally, we should mention that in April some research workers of the Bataafse Petroleum Maatschappij called in our assistance for the collection of recent plankton and sediments in the Wadden Sea. For this purpose the laboratory and the Max Weber were used for a few days.

In addition to the work mentioned above and the assistance given to other institutes Mr. BEKE continued his analyses of suspended material.

Mr. POSTMA himself spent considerable time on preparing for publication the data collected at Hamburg and Naples in 1954. He further gave his attention to the bottom samples collected over a number of years during the biological inventory of the Wadden Sea. These sedimentological data, which are also of interest in themselves, were likewise prepared for the press. In the last few months Mr. POSTMA has also undertaken to work out the data on oxygen, alkalinity, pH and phosphate of the Snellius Expedition. Also part of the temperature and salinity values were taken into account to obtain an approximate picture of the currents between bottom and surface. It is hoped he will be able to terminate this work in the first six months of 1956.

The following persons spent short terms at Den Helder: Mr. H. J. DE JONG, Leiden, to study jaw movements in live fish; Mr. W. J. R. LANZING, Utrecht, to read up references in our library; Mr. A. ROOSENSCHOON, Utrecht, to make observations on cockles digging themselves into the sand; Mr. J. H. STOCK, Amsterdam, for studying parasites of Lamellibranchs; and Mr. W. S. VOLKERS, Leiden, to obtain specimens of the developmental stages of *Psammechinus miliaris*. Also this

year some assistance was given to the Netherlands Educational Films.

The number of students who attended the summercourses was 23, of whom 18 came from Leiden, 2 from Utrecht, 2 from Groningen, while also Mr. SOERIAATMADJA, the Indonesian analyst, attended the course. The courses were given jointly by all the members of the staff. They were held from 13th to 25th June and from 27th June to 9th July.

From 13th to 23rd April Mr. PUNT, with the assistance of Mr. VAN NIEUWENHOVEN and Mr. PARMA, gave a physiological course for biologists from Amsterdam, which was attended by 13 persons. Moreover, the first and second years students from the Vrije Universiteit, Amsterdam, accompanied by Mr. ANTHEUNISSE and Mr. JOOSSE, visited the Zoological Station from 23rd to 28th May and from 31st May to 4th June, while a group of 20 second year students from Utrecht, conducted by Mr. KIPP, paid us a visit from 6th to 8th and from 9th to 11th June.

The total number of man-days for individual workers and summercourse participants amounted to about 1380. The average for the years 1947–1955 is approximately 1110.

Among the visitors from abroad who paid us brief visits were: Prof. W. E. ANKEL, Giessen (Germany), Prof. TAKEO IMAI, Sendai (Japan), Prof. and Mrs UMBERTO D'ANCONA, Padova (Italy), Dr. and Mrs. PETER DOHRN, Naples (Italy), Prof. D. DAVENPORT, Santa Barbara (California), Prof. F. HAXO, Scripps Institution of Oceanography, LA JOLLA (California), Dr. A. ALEEM, Cairo (Egypt), T. K. RUEBUSH, Office of Naval Research, U.S. Navy, London (England).

The maintenance of the building in 1955 required no large-scale expenditure. The caretaker's living-room was redecorated; an internal telephone-system was installed. As Mr. DE BLOK will take over for his own use the new cellar under the net store an open shed was built to store the wicker bottles, tins, crates, etc., which are used in forwarding study specimens and other material.

It should be put on record that the collection of animals from the Southern North Sea, which had been stored away in the National Museum for Natural History at Leiden during the war, was brought back to Den Helder towards the close of 1955. The director of the Museum deserves the expression of our sincere gratitude for his inexhaustible patience.

The Station's equipment was supplemented by the purchase of a stereomicroscope of *f* 1850.— and a Philips stroboscope of *f* 550.—. We also want to place on record that the refrigator was at long last equipped with running cooled water. This improvement contributed to the successful accomplishment of Mr. JANSSEN's *Littorina*-experiments.

The "Max Weber" was equipped with the electric lighting to which we had been looking forward for years. The current is generated by a dynamo mounted on the mainshaft. The skipper, Mr. VAN BREDA, thoroughly overhauled the ship. It spent a smaller number of days at sea than in the past years, which is to be attributed to the kind of research undertaken this year. The maintenances of the two rowing-boats required no special measures.

On 15th May Mr. DIJKSTRA entered the service of the Zoological Station in the newly created function of managing assistant. The purpose of this appointment is to relieve especially the Director of many administrative and organizing duties. On 1st December Mr. VAN BREDA, skipper and caretaker, was released from his function at his own request. On 1st April Miss G. WATTIEN joined the staff as student-analyst, taking the place of Mr. G. VAN DER WAL.

In April Mr. VERWEY attended an International Conference on Marine Biological Stations in Rome. On that occasion he also spent some days at the Zoological Station at Naples. Early in the autumn he attended the Meetings of the British Association for the Advancement of Science at Bristol. He took that opportunity to visit the catching-grounds of elvers on the river Severn, the Laboratories for Shellfish Research at Conway (Wales) and Burnham-on-Crouch (Essex), and the new Marine Biological Laboratory on Anglesey off Bangor (Wales), a small, very modern Institute with admirable facilities and great possibilities.

The condition of the library remains quite satisfactory since it has become possible to give more time to it than in former years. The Organization Het Natuur- en Geneeskundig Congres donated a sum for the purchase of Russell's fine work "The Medusae of the British Isles". Also to other donors of books and separates we wish to express our sincere gratitude. A small number of books were bought, also a few series of periodicals, among which the Lincolnshire Naturalist, which was hitherto not available in this country. The binding of books and periodicals made steady progress. The need for more library space is gradually becoming pressing.

The supply of study materials to Universities, etc. brought in *f* 4990.03, against which must be set costs amounting to *f* 4512.17. This amount includes expenditure for wicker bottles and other packing materials, preserving solutions, etc., totalling *f* 1257.27.

The Government subsidy amounted to *f* 93 500., of which *f* 77 534.75 was paid to salaries. The other expenses are given in the Statement which follows.

The Government moreover refunded last year's deficit of *f* 2260.35, while at the end of the year the Government allocated a sum of

STATEMENT OF INCOME AND EXPENSES

Income		*Expenses*	
Government grant	*f* 93 500.—	Salaries	*f* 72 113.96
Grant from Roy. Netherl. Bot. Society	,, 100.—	Auditing	,, 600.—
Contribution to salaries from Reservefund	,, 500.—	Contribution to National Insurance	,, 5 420.79
Study Materials	,, 4 990.03	Rates, taxes, and insurance	,, 1 762.20
Sickness Benefit	,, 46.29	Lighting, heating, telephone	,, 5 635.07
Contribution to Library from the Society	,, 300.—	Buildings and furniture	,, 2 455.15
Deficit	,, 4 175.96	Ships and nets	,, 2 569.70
		Instruments, glass utensils, chemicals	,, 3 761.08
		Fitting shop	,, 623.32
		Study Materials	,, 4 512.17
		Postage, freight packing, writing and drawing materials	,, 1 967.78
		Library	,, 1 365.90
		Travelling expenses	,, 634.22
		General	,, 190.94
Total	*f* 103 612.28	Total	*f* 103 612.28

f 21 000.— for urgently needed improvements, which will be mentioned in the Report for 1956.

If one considers that the Government Department settles pension payments direct with the National Pension Fund, and that through the Netherlands Organization for Pure Research they contribute another *f* 15 000.— for the salaries of two research workers in addition to considerable grants for their equipment, the actual overall expenditure for the Zoological Station should be put at something like *f* 125 000.—. It is to be expected that in the years to come this amount will increase considerably, a state of affairs which is commonly met with in all kinds of research institutes. This period of civilization might appropriately be called the Era of Scientific Research.

A few remarks should finally be added about the new harbour. In the reports for 1952 and 1953 something was said about its consequences for the Zoological Station, particularly as regards the supply of seawater of a good quality. Now that the new harbour is largely finished, it seems fitting that we should briefly revert to this question. The old outer harbour (Buitenhaven) has now been dammed off both on the landside and in its outer end. From the old harbour opposite the locks of the Naval Dockyard ships can now reach the sea through

the wide new harbour. The seawater therefore enters the old harbour through the new one. Through the latter the fresh water of the North Holland Canal is discharged. A counter current of salt water is developed along the bottom, so that in front of the Zoological Station, where our seawater pipeline cuts across the dike, salt water of a good quality is present at all times. In winter it is pumped up and used for the aquaria. In the summer months the enormous amounts of sediment on the bottom cause a lack of oxygen in the lower water layers. A waterboat then brings in supplies from the Marsdiep. The cost of this transport, which most years takes place from May to October, is borne by the Royal Navy. As a result of excessive sedimentation the depth of the harbour has greatly decreased. For this reason an extra vertical length of piping has been welded to the inlet, so that its mouth now lies 7 metres below the surface instead of 9.

Den Helder, February 1956
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 Nederlandsche 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—11,	1948—1955	30.—
Suppl. to vol. 3,	1938	10.—
„ „ „ 7,	1946	2.—
„ I „ „ 10,	1953	8.50
„ II „ „ 10,	1953	8.50

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.