

**NETHERLANDS  
ZOOLOGICAL  
SOCIETY**

**ZOOLOGICAL  
STATION  
DEN HELDER**

**ANNUAL REPORT 1960**

EER





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 Traffic 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 jurisdiction of the same Ministry.

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





ANNUAL REPORT  
OF THE NETHERLANDS INSTITUTE FOR  
SEA RESEARCH (FORMERLY THE ZOOLOGICAL  
STATION OF THE NETHERLANDS ZOOLOGICAL  
SOCIETY) FOR THE YEAR 1960

In 1960 the work of the Institute underwent to a certain degree the disturbing influence of the 15-years scheme for extension, which was now in its fourth year. The principal items of interest are discussed below.

Mr. DE BLOK continued his investigations dealing with the influence of lunar and tidal cycles on the reproduction of marine animals. In the first place oysters from the Eastern Scheldt were used, which, according to KORRINGA, show a periodicity of roughly a fortnight there. This year again no definite results were arrived at, although there were indications that changes in intensity of the various moon-phases may have some influence. Just as in the Eastern Scheldt the maximum release of larvae in the experiments with an artificial illumination-rhythm occurred roughly ten days after full and new moon. No indications were obtained about a possible influence of the *duration* of moonlight or the *shifting* of the period of moonlight in successive nights.

The oyster under experimental conditions has the advantage of satisfactory reproduction, but the disadvantage of a not very distinct periodicity, even with the pronounced and undisturbed periodicity of the experiments. Therefore, Mr. DE BLOK looked about for species with a clear-cut reproductive periodicity. One of them is *Platynereis dumerilii*. After it had been missing for years on end it turned up again in large numbers in the Eastern Scheldt in 1960. In order to obtain a stock Mr. DE BLOK tried to set up a culture and succeeded in obtaining two successive generations of this species. Further breeding failed, however. In the autumn of 1960 fresh animals were collected with a view to further experiments.

Mr. DE BLOK did not succeed as yet in obtaining a shipworm-species with a clear-cut periodicity in the Mediterranean. A renewed attempt to experiment with the Queen Scallop, *Pecten opercularis*, was successful in so far that the animals did better than before; reproduction, however, was negligible. *Angulus* (*Tellina*) *fabula* showed reproduction once. Attempts to make the common mussel, *Mytilus edulis*, reproduce were again hardly successful. A fact worth mentioning is that so far larvae were obtained instead of eggs, which for *Mytilus* is quite abnormal.

From hydroid-polyps found on *Pecten opercularis* four species of Medusae developed. Colonies of *Obelia*-species, kept in the hope that they might also yield medusae, died without having done so.

These last years the Institute owed much to the Laboratory for Anti-fouling Research of the Netherlands Organization for Applied Research, adjoining the Institute. They supplied us with the Chrysophycean *Phaeodactylum tricornutum*, which served as a food to Mr. DE BLOK's molluscs. Since we did not want to trouble the Anti-fouling Laboratory repeatedly, and since it seemed of value to get some experience with algae culture, a separate culture-room was built and provided with glass walls, transparent roof, neon-lamps, adjustable temperature, and air-conditioning. The culture of algae met with the usual set-backs, but a sufficient production was obtained.

In September B. SCHRIEKEN, one of Mr. DE BLOK's two laboratory assistants, started an inventory of plankton, hoping gradually to arrive at a plankton-calendar for Den Helder. As relatively little time was left over for this work it was for the time being practically confined to qualitative research on Diatoms and Medusae. Mr. DE BLOK's second laboratory-worker, J. J. MÖLS, besides doing his other work, looked after the algal cultures.

The work of Mr. DE BLOK and others on nitrogen- and phosphor-changes in aquarium water will be dealt with further on.

Mr. CREUTZBERG spent most of his time on working out his data on the orientation of migrating elvers. Some additional experiments were carried out. This contribution will appear as a doctor's thesis in the Netherlands Journal of Sea Research. An investigation was started on the physiological condition of the elver when entering fresh water. Mr. CREUTZBERG read a short paper on the results of his orientation-research at a Symposium on migration problems, which was held in Heligoland from 1st to 3rd May 1960.

Mr. DRAL, who in 1960 joined the Institute's work on the influence of radioactivity on marine organisms, in the beginning of the year worked out the results obtained in 1959 on the feeding mechanism of the mussel. We hope that the important results obtained by Mr. DRAL in the past years will be published in 1962.

Incidentally, Mr. DUDOK VAN HEEL devoted much time to an extension of his work on Cetaceans. He was especially interested in the problem of the consequences of orientation by means of echo-sounding when the animals get into shallow coastal water. On one hand he collected accurate data on strandings of Cetacea all over the world, on the other hand he obtained the cooperation of the Royal Dutch Navy in making echo-soundings in various directions in shallow coastal waters. Combining these data it seems likely that strandings of Cetaceans



occur in those places where, owing to the configuration of the coast, it is difficult for the animals to find an exit to deeper water by means of echo-sounding. Mr. VAN HEEL hopes to take his doctor's degree on this subject in 1962.

In view of his research Mr. VAN HEEL visited the whaling station at Steinshamn near Ålesund in Norway from 24th May to 16th June 1960, during which time he spent 3 weeks on board whale-catchers. During his visit to Norway he gave a short lecture on his work in the Zoophysiological Institute in Oslo, and at the invitation of J. Y. COUS-TEAU he also read a paper to the Congress on Aquariology, held in Monaco from 21 to 26 November. On both occasions the porpoise-film of the Netherlands Educational Film Foundation was shown.

Besides carrying out this work the investigations into the light-orientation of periwinkles were continued, especially by the analyst Miss G. BAARD under Mr. VAN HEEL's direction.

When placed in „diffuse” light from the side, either on the upper or on the under side of a horizontal glass-plate, *Littorina obtusata* moves mainly perpendicular to the direction of the light, a fact which, as far as we know, has never been recorded before, and which, ecologically speaking, is not self-evident. Moreover, with this illumination the animals on the upper side showed a slight tendency to move away from the light, while those on the underside tended to move towards it. When the animals are placed on a vertical plate, a strong negative geotaxis is of course dominant, but apart from that there was a certain amount of negative phototaxis with this illumination. The possibility is not to be excluded that the results of JANSSEN, recorded in Archives Néerlandaises de Zoologie, Vol 13, 4, p. 500-510, 1960, may have to be explained not by a combination of negative geotaxis and positive phototaxis, but in the first place by a combination of negative geotaxis and the tendency to move perpendicular to the direction of the light.

Another interesting point is that, when crawling upward in absolute darkness or with the light entering perpendicular to the front or the back of the vertical plate, *Littorina obtusata* shows a slight deviation of the negative geotaxis to the right, which may well be caused by its asymmetrical build. This asymmetry in the geotaxis is another new fact, as far as we know.

The above experiments were started among other reasons to find out the differences in reaction to light and gravity shown by different *Littorina*-species. So far, only *Littorina obtusata* and *Littorina littorea* have been compared. It was found that *L. littorea*, when put on a horizontal plate, contrary to *L. obtusata*, has a tendency to move in the direction it was facing when placed on the plate. Under these circumstances illumination from the side had less influence than it had with *obtusata*.

When put on a vertical plate *L. littorea*, with the same light intensity as before, shows a stronger negative phototaxis and a less strong negative geotaxis than *L. obtusata*.

Mr. WESTENBERG, who in his work is much encouraged by Prof. H. R. VAN DER VAART, Leiden, was occupied in 1960 with statistical methods necessary for the interpretation of countings in all sorts of biological research. Whenever two samples of planktonorganisms, pollen or sediment grains are compared, a certain species will as a rule be represented by different relative frequencies. Special attention has been given to the method of testing the significance of the difference between these relative frequencies, especially in the case of samples of unequal size.

Mr. VERWEY is gradually arriving at the stage of a managing director, who, owing to the organizing and administrative cares of a larger institute, hardly finds time for research of his own. Incidentally he was engaged in mutual food-relations in species inhabiting the Wadden Sea and in compiling a history of the Institute, but that was all he practically came to in 1960, scientifically speaking.

Mr. C. DAVIDS, Zoological Laboratory, Amsterdam University, continued his investigation started in 1959, on the influence of the concentration of a suspension on the pumping and so-called filtration of mussels. With the help of a method designed by DRINNAN and not yet published the excurrent water was separated from the incurrent water, after which the drips were counted by the opening of an electric circuit. By Mr. DAVIDS' experiments, in which the amount of water pumped per second could be measured over long periods, it became again evident that one should distinguish between the number of drips pumped per unit of time and the number of interruptions in pumping. The two together define the amount of water pumped over a longer period. Mr. DAVIDS' experiments clearly showed the connection between the concentration of a suspension and the pumping-rate, as already described for the oyster by LOOSANOFF and ENGLE. The number of drips per unit of time increases at first when a small amount of *Phaeodactylum* is added to the seawater. As soon as a suspension gets more concentrated, however, the number of interruptions may also increase. In this connection not only the concentration as such is important, but especially the previous situation. Just as was found by LOOSANOFF *et al.* for the oyster, clean sea water after concentrated suspensions may give rise to strongly accelerated pumping.

Mr. DAVIDS also worked with *Chlorella*, but afterwards it turned out that the concentrations used for this species had been too high. *Chlorella* is certainly not in demand with the mussel, and seawater from which *Chlorella* has been filtered causes pumping with a good many inter-



ruptions. If *Phaeodactylum* is added to this liquid the number of drips per unit of time increases, but the number of interruptions remains large. Mr. DAVIDS obtained some evidence that from a mixture of *Phaeodactylum* and *Chlorella* more *Phaeodactylum* than *Chlorella* were taken. A similar result led LOOSANOFF to suppose that a mollusc might be able to select from a mixture of plankton-species, but since the species are quite different in shape the result need not be brought about by active selection.

It must be added that Mr. DAVIDS, who originally hoped to study the influence of the concentration of a suspension on the so-called filtering, did not arrive at results which could make this connection clearer. It would also be worth while to investigate the connection between the amount of pumped water and the percentage of filtration. The field is still offering various perspectives.

From 1st May to 30th June, with an interruption in the beginning of May, Mr. STURE ABRAHAMSSON, Lund, Sweden, examined the ecological demands of some coastal Amphipods, particularly *Talitrus saltator*. He investigated the optimal degree of moisture of the sand in which the animals burrow, and the temperature and moisture-preferendum in the air. Besides for *Talitrus saltator* the latter two were also determined for *Orchestia gammarella*, *O. mediterranea* and *O. cavimana*. The specimens of *Talitrus saltator* which he used showed a preference for sand with about 2–13% (especially 2–4%) of water. Sand with over 14% of water was clearly avoided when burrowing. The temperature-preferendum in air for the *Talitrus saltator* used was apparently 15–18°, for *Orchestia mediterranea* it was about the same, for *O. gammarella* it was apparently slightly higher, for *O. cavimana* lower. When exposed to air *Orchestia* showed a definite preference for a high percentage of moisture, with *Talitrus* this percentage was apparently lower. The data are present in Den Helder as a photocopy of a typed report in Swedish.

In the beginning of November 1960 Mr. M. FONDS, Zoological Laboratory, Free University, Amsterdam, in concert with Dr. L. VLIJM, started a comparative research into the occurrence and behaviour of the gobies *Gobius minutus* and *G. microps*, of which the latter occurs especially in brackish water. Both species occur together in winter in the Wadden Sea, *G. minutus* dominating. Mr. FONDS obtained some indications that with *G. minutus*, which has 2 more vertebrae than *microps*, the average number of vertebrae decreases slightly along our coast from North to South. He succeeded in getting both species to spawn in heated aquaria and afterwards tried to rear the brood. In this, however, he did not succeed. The two species show slight differences in behaviour.

Incidentally Mr. FONDS also made the Butterfish, *Centronotus gunnellus*, spawn, and he tried to rear the larvae of this species as well as those of

the Father Lasher, *Cottus scorpius*. It is still too early to say much about the results, however, although they do not seem unfavourable.

In the beginning of the season Mr. H. L. DE BEAUFORT made some additional observations on *Sepia officinalis*, continuing his research of the previous years, but since he had to stop for lack of time he wrote a preliminary report on his results. The data were mentioned in detail in the previous Annual Report.

Mr. P. A. W. J. DE WILDE, Amsterdam, worked in Den Helder from 16th to 25th July, preparatory to his visit to the Caribbean Marine Biological Institute in Curaçao. His chief subject were questions of osmoregulation.

Miss E. J. NIJHOF, Central Bureau for Fungus cultures, Baarn, paid a few visits to the Zoological Station to put up some experimental boards in connection with the study of marine fungi in wood.

Furthermore, four amateur frog-men, under the guidance of Mr. VAN VLIMMEREN, tried for some days in July to obtain data on the bottom fauna in the gully along the Vangdam and near 't Horntje, South Texel. Because of bad weather and muddy water they did not get any results.

In connection with the removal of the Institute to Texel and our requirements for the seawater-installations to be built there, especially as concerns the necessary stock of sea-water, observations were started in 1960 to study the course of N- and P-increase in aquarium water with and without filtration, when a more or less constant number of animals are present. To this research chemists and biologists, inclusive analysts and laboratory-workers, all co-operated in close contact, but the care of the animals by the laboratory-worker B. SCHRIEKEN deserves special mention here.

After consulting the State Institute for the Supply of Drinking Water a closed circuit was improvised, containing two filters, one with shells and one with sand. The sand filter was a closed one, through which, besides water, air was squeezed. When the filters were not in use the intermediate products of organic breakdown, *viz.* ammonia and nitrites, increased at first to 10 and 15 times the normal amount, but then decreased again to twice the normal level. When the filters were turned on a further decrease to normal ensued. The phosphates were apparently absorbed either by the filter or by the bottom material, their level was about 8 times the maximum in the sea. The nitrates continued to increase and after 8 months reached a level of 25 times the maximum in the sea. All the same, mortality in the fish population was relatively low. It is worth mentioning that in the beginning of the experiment a prolific growth of algae apparently succeeded in keeping the nitrate content constant.



<i>Species</i>	<i>Sex; Size (cm)</i>	<i>Locality</i>
MIGRANTS SUPPOSED TO HAVE ENTERED THE NORTH SEA THROUGH DOVER STRAIT		
<i>Petromyzon marinus</i>	27.5-74	Off Callantsoog, off Texel, Molengat, Molen- gat to Petten
<i>Scylliorhinus stellaris</i>	115	53°10' N., 2°50' E.
<i>Raja montagui</i>	♂♂ and ♀♀ 30-88.5	Black Bank, Tea Kettle Hole, New Zealan Ground, Texel Hole, North of Terschelling, o Texel, near buoys P3-P4, ST4 and ET-ST
<i>Raja blanda</i> (= <i>brachyura</i> )	♂ 48	Near buoy ST4
<i>Raniceps raninus</i>	6.5-18	Haaks Grounds, Molengat, off Texel
<i>Hippocampus europaeus</i>	2 ♂♂	Texelstroom: near Burgzand-buoy and off L Cocksdorp
<i>Mullus surmuletus</i>	15.4-16.8	Texel Hole, off Texel, Waddensea near harbor of Den Helder
<i>Box boops</i>	26	52°23' N., 3°20' E.
<i>Spondyllosoma cantharus</i>	♂♂, ♀ 9.8-35	Black Bank, Tea Kettle Hole, North of Te schelling, off Callantsoog, off Texel
<i>Blennius pholis</i>		Dike Den Helder
<i>Blennius gattorugine</i>	abt. 8	Molengat and off Texel
<i>Trigla cuculus</i>	♂♂ and ♀♀ 22.5-33	Texel Hole region, North of Terschelling, o Callantsoog
<i>Spinachia spinachia</i>	13.8	Off De Koog (Texel), Texelstroom, Balg
<i>Solea lascaris</i>	24.9	Texel Hole
<i>Sepia officinalis</i>	♂♂ and ♀♀ 7.4-27	Black Bank, Tea Kettle Hole, Botney Gu North of Terschelling, Texel Hole region, nea buoys ST3 and P3, off Texel, Molengat, Haal Grounds, Texelstroom and Balg in the Wad densea, off Callantsoog, Petten, Bergen an Zandvoort
<i>Octopus vulgaris</i>		Tea Kettle Hole, Texel Hole, West of Borku Stones, near buoy ST3, Schulpengat
MIGRANTS SUPPOSED TO HAVE ENTERED THE NORTH SEA AROUND SCOTLAND		
<i>Myliobatis aquila</i>		53°30' N., 4°20' E., see previous Annual Repo
<i>Scomberesox saurus</i>	♂♂ and ♀♀ 33.5-38	Beach near Huisduinen, dike Den Helder, nea sluices Den Oever, near buoy ST3
<i>Brama raii</i>	54, 58	Near Zuiderhaaks buoy





Species	Sex; Size (cm)	Locality
NORTHERN SPECIES, RARE IN THE SOUTHERN PART OF THE NORTH SEA		
<i>Raia radiata</i>	2 ♂♂ 1 ♀ 30.5-45	Between buoys P1 and 2, P3 and 4
<i>Maurolicus mulleri</i>	6.2	Molengat
<i>Onos tricirratu</i>	♀ 33.5	Near buoy ST3; Marsdiep
<i>Onos cimbrius</i>	13 and 18	Near buoy ST4, around Haaks Grounds and off Texel
<i>Sebastes marinus</i>	20.3	Borkum Stones
<i>Cottus bubalis</i>	♂♂ and ♀♀ 4.5-14	From off Petten to De Koog (Texel), including region Haaks Grounds and western Waddense (De Balg and Den Helder harbour)
<i>Hippoglossoides platessoides</i>	♀♀ 22-25	Near buoys P1 and P3 to 4
<i>Hyas coarctatus</i>		Off Texel and near buoys ST2-3
<i>Eledone cirrosa</i>		Cleaverbank, Texel Hole, near buoys P3, ST2 ST3
SPECIES WITH DISTRIBUTION UNCERTAIN		
<i>Crenilabrus melops</i>		't Horntje, Texel

This year we tried to keep alive species of fish leaving the North Sea for the winter by keeping them at higher temperatures than those normal for the Aquarium in winter. This was done in a large basin (about 6 × 6 metres) with aeration and with circulation, but without changing of the water. As a result garfish, gurnards and horse-mackerel did well throughout the winter.

Special catches were bought up as usual from the fishing-fleet. This time-consuming work, just as the providing of the Universities *etc.* with material for study, falls to Mr. DUDOK VAN HEEL, assisted by Mr. BUHRE. For these species we refer again to the table in this report, in which some data received from the State Institute for Fishery Research, IJmuiden, are also included.

1960 was characterized by a good number of animals of which we may assume that they entered the North Sea by way of the Straits of Dover. An adult specimen of the nursehound or greater spotted dogfish, *Scylliorhinus stellaris*, was caught on 8th October West of Texel (53°10' N, 2°50' E); before 1940 this species was extremely rare in the North Sea. A specimen of the Sparid *Box boops* was caught on 20th

## Numbers per month

F	M	A	M	J	J	A	S	O	N	D
2	1	—	—	—	—	—	—	—	—	—
—	1	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	1	1
9	9	1	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	1
13	13	4	2	1	—	—	—	—	3	—
—	8	—	—	—	—	15	—	—	—	—
—	—	1	—	3	—	—	—	—	—	34
2	4	3	—	3	1	2	—	—	—	—
—	—	—	—	—	2	—	—	—	—	—

October at 52°23' N and 3°20' E. Two specimens of the sea horse, *Hippocampus europaeus*, were caught in August near Texel, 2 specimens of the southern sole, *Solea lascaris*, were caught, in April and June resp., off Den Helder. We received no less than 12 specimens of the Gadid *Raniceps raninus*, the lesser fork-beard. Of *Spondyllosoma cantharus* 5 specimens were received in February, 4 in March, 1 in May and 1 in July. The occurrence of this species off our coast is mentioned in detail in the previous Annual Report. Of the southern *Trigla cuculus* (cuckoo gurnard) 26 specimens were received in June alone, 1 specimen was received in January. *Sepia officinalis*, a migrant from the South, was also numerous. No less than 638 specimens were received in July. The occurrence in large numbers of juvenile animals in January and February (the remnant of the 1959-migrants) was already mentioned in the previous Annual Report. The mild winter was also evident from the catch of 1 resp. 3 adult *Sepia*'s on 25th January and 9th February, 1961, respectively.

As against this great number of animals entering by way of the Straits of Dover there were only few animals of which it may be as-



sumed that they came to our coasts by the way around Scotland. In January, February and November only 10 skippers, *Scomberesox saurus*, were received, in December 2 specimens of Ray's bream, *Brama raii*. Data on the occurrence of the skipper around the coasts of Great Britain are given by WHEELER and MISTAKIDIS in Nature, Vol. 188, p. 334-335, 1960. In the previous Annual Report the catch of one specimen of the eagle ray, *Myliobatis aquila*, on the 29th January 1960 west of Texel, was already mentioned.

Another possible consequence of the higher temperatures in the last years may be the – if only very slight – increase of the fifteen-spined stickleback, *Spinachia spinachia*, of which 2 specimens were caught in September and 3 in December. On the other hand, in the period January-June no less than 45 specimens were brought in of the long-spined sea scorpion, *Cottus bubalis*, a species which is probably more an indication for cold than for warmth.

Another specimen of *Maurolicus mulleri* was brought in, caught on 24th March in the Molengat off Texel. For this species we refer to the previous Annual Report.

A very special catch was that of a specimen of the Norway Haddock, *Sebastes marinus*, on 28th December in the Borkum Stones. This species is rare in the southern North Sea.

The fishing method with "kom" and fish traps as executed by our fisherman H. A. BEUMKES in Texel begins to show results<sup>1</sup>). Not only were large numbers of living animals of various species and in perfect condition obtainable whenever wanted, but valuable data were also obtained on beginning, culmination and end of occurrence of a number of species, as is shown in the tables below. When interpreting those data one has to keep in mind that fishing was not continuous and that in some weeks no fishing was done at all. Yet, the periodicity is obvious for the pilchard (*Clupea pilchardus*), the anchovy (*Engraulis encrasicolus*), the garfish (*Belone belone*), the bib (*Gadus luscus*), the horse-mackerel (*Caranx trachurus*) and the silversides (*Atherina presbyter*). Further, it is of value to know more about the time of occurrence of species as the sea-trout (*Salmo trutta*), the pollack (*Gadus pollachius*) and the bass (*Morone labrax*).

As concerns the hydrographical part of the work, in the beginning of 1960 Mr. POSTMA completed his research on the transport of various fractions of suspended matter in the Wadden Sea as mentioned in the previous Annual Report. The results of this investigation are to be

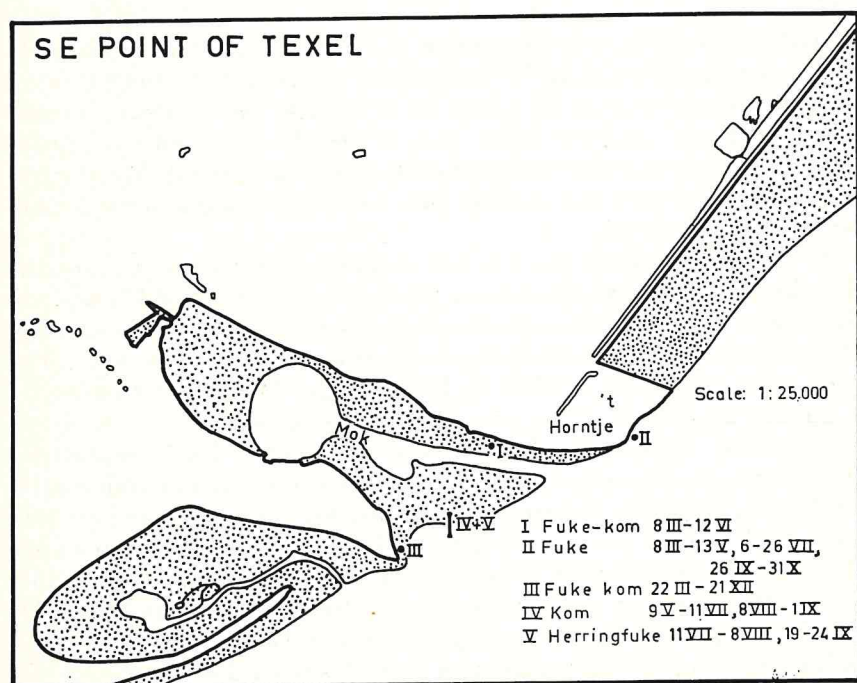
<sup>1</sup>) It should be added that fishing started on 8 III and ended on 21 XII, without constant use of the same equipment all the time. For details see the map, in which the dotted areas represent the flats falling dry at low tide, with the sea to the right and the land to the left. For "fyke" read "fyke". A description of a "kom" is given in the previous Annual Report.

## Results of the "Kom" catches (BEUMKES)

	M	A	M	J	J	A	S	O	N	D	First	Last
<i>Clupea pilchardus</i>	—	—	3	2	2	5	6	—	—	—	11 V	7 IX
<i>Engraulis</i>												
<i>encrasicolus</i>	—	—	16	41	3	—	—	—	—	—	14 V	6 VII
<i>Salmo trutta</i>	2	3	4	2	17	2	13	28	9	3	9 III	21 XII
<i>Belone belone</i>	—	1	897	507	114	331	57	10	—	—	19 IV	31 X
<i>Gadus luscus</i>	—	—	—	1	2	4	6	20	1	—	27 VI	15 XI
<i>pollachius</i>	36	10	3	5	16	2	26	73	25	9	8 III	21 XII
<i>Morone labrax</i>	—	1	—	1	3	1	—	5	24	16	4 IV	8 XII
<i>Caranx trachurus</i>	—	—	237	4600	326	1552	348	23	—	—	13 V	26 X
<i>Mugil ramada</i>	—	25	105	4	34	5	47	252	23	4	13 IV	6 XII
<i>Atherina presbyter</i>	—	211	132	1	15	60	476	42	—	—	9 IV	4 X

published in the Netherlands Journal of Sea Research (see Vol. 1, 1/2, p. 148-190, 1961).

As mentioned already in previous reports the various grainsize-fractions of the silt are separated by means of their settling velocity. The grainsize-sorting of material is for the greater part determined by this settling velocity, or, in other words, its transportability. This





process at the same time leads to a chemical sorting, through which, *e.g.*, lime and iron oxide are distributed over the Wadden Sea according to a special pattern. It therefore seemed useful, following up the above research, to study one component fully. Iron was chosen because its determination is easy. For sampling a number of anchor stations were chosen between the outlet of Texel and the island of Wieringen. It is still too early to publish the results.

Within the scope of this investigation on suspended matter Mr. POSTMA also worked out a large number of data on the relation between the concentration of suspended matter and the limits of visibility of a white disc lowered into the water. When plotted in a graph this relation is an approximately straight line, the slope of which varies for different areas. This relation was investigated for the North Sea, the Wadden Sea, the Ysselmeer, the main rivers and the Delta area. Data were obtained on a series of successive years. From the slope of the lines and a number of experiments in the laboratory conclusions could be drawn on the differences in grainsize-composition of material from the various areas. The influence of suspended organic material on the transparency of the water received special attention. This research will also be published in the Netherlands Journal of Sea Research (see Vol. 1, 3, p. 359-391, 1961).

The Hydraulics Laboratory in Delft sent a team to British Guyana to study possibilities of improvement of the harbour of Georgetown. As a member of this team Mr. POSTMA, from 9th August to 2nd October, studied the transport of silt along the coast near Georgetown, a study which is closely connected with that in Den Helder, and which may be of interest for our knowledge of silt transport in general. Mr. POSTMA laid down his results in a number of reports. The complete results will be published later on.

In the end of 1960 Mr. POSTMA started an investigation into the distribution of nitrogenous components in the western Wadden Sea and the adjoining North Sea with the intention of studying the conversion of the various nitrogenous compounds in the course of the year. The work was carried out by Miss C. J. BOSCH and Mr. CH. F. BEKE.

In the beginning of the year Mr. DUURSMA, who went over to the radioactivity work of the Institute on 1st January, 1960, finished his publication on the quantity and distribution of dissolved organic matter in the sea, on which research he obtained his doctor's degree on 27th May in the Free University in Amsterdam. The thesis is to appear in the Netherlands Journal of Sea Research (See Vol. 1, 1/2, p. 1-147, 1961). Mr. DUURSMA's research will be continued in 1961 by Mr. A. DE BRUIN, who, just as Mr. DUURSMA, will work in Den Helder for account of the Netherlands Organization for pure Research. From mid-October

to the end of November 1960 Mr. DE BRUIN carried out a preliminary research into the possible use of chromatographical determination methods for the classification of organic matter in seawater. Before Mr. DE BRUIN arrived Mr. J. W. ROMMETS had already paid some attention to this subject.

Furthermore, Mr. DUURSMA and Mr. ROMMETS investigated the possibility of exact measurement of dissolved organic matter under ultraviolet illumination. This research, too, will be published in 1961 in the Netherlands Journal of Sea Research (see Vol. 1, 3, p. 391-405, 1961).

A new facet of the Institute's research is that of the study of the influence of radioactivity on life in the sea, started in 1960. As already mentioned above Mr. DUURSMA and Mr. DRAL, as well as 3 analysts, went over to this work. Mr. DUURSMA and Mr. DRAL gave much time to the study of literature, to organizing work and to preliminary research. As concerns the biological aspect of this work, first of all the role of adsorption and physiological incorporation (inclusive the mechanism of its uptake) seems of importance, beside the problem which concentration of a certain radioactive isotope will damage the organism by radiation. On the chemical side it seems worth while to study the interchange of ions between water and its suspended organic and inorganic compounds in relation to temperature, size of suspended material, *etc.* — The fitting up of the work-rooms for this part of the research will be dealt with below.

Proceeding to the non-scientific part of the report we want to mention first of all that the preparations for a new building suffered a year's delay on account of difficulties concerning the future harbour of our ships near the Institute. These difficulties have been partly removed because of a plan to build a pier and jetty at "t Horntje", which, however, will not provide a safe berth under all weather conditions. It is intended to take up the building schemes again in 1961.

As mentioned already in the previous Annual Report the Institute is faced with a severe lack of space in the near future, as the 15-years scheme involves a continuous increase of staff, and the new building will not be ready for some time. In 1958, when this scheme started, the personnel consisted of 19 members, in 1962 there are to be 43. In this connection we mentioned in the previous report already that a students' lodging house was established in the town, that the former lodging house was converted into a workshop and that the former workshop was made a laboratory room. The changes further involved the conversion of part of a neighbouring building into work-rooms for the radioactivity group. The rooms comprise a chemical and a biological laboratory, a communal work-room, a room for the measuring ap-



paratus, a dark room and a cellar. The house in question is rented from the State. The alterations were executed by the Public Building Service for account of the Netherlands Institute.

As concerns the Institute itself we mentioned already the addition of a room for the culture of algae. Painting the outside of the building was finished early in the year.

The new lodging house opposite the Institute in the town forms a very fine acquisition. There is room for some 25 students. From 1962 on a stay in the house is free of charge for students from all Dutch Universities; foreigners pay 1 guilder a day. The students have to prepare their own meals. The house is run by Mrs. and Mr. TEN BOSCH, who deserve a word of thank for their care.

The Max Weber was in service for only 52 days. Over and over again the reversing-clutch is causing trouble, as critical resonance is caused by the revolving parts. Because this makes the ship gradually less reliable we have to consider changing the engine, but, since both the ship and the engine date from 1932, it may not be wise to install a new engine into an old ship. Therefore, the Society's Board decided to ask the Government to grant the sum for a new ship as part of the 1962-budget of the Institute.

To the instrumentary were added in 1960 a Zeiss stereo-microscope, an elongation-piece for microscopy, apparatus for microphotography and other photographic equipment, a semi-microbalance and an automatic balance, a Zeiss spectrophotometer with equipment for the measurement of fluorescence, a Philips potentiometric recorder, an incubator, a refrigerator, an electric water bath and a photorapid copying apparatus. The sum total of these acquisitions amounted to f 35.196,—, which was separately placed at our disposal. Moreover, the radioactivity group were equipped with a standard instrumentary, among which a Mettler semi-microbalance, an ultrathermostate, an electric laboratory centrifuge, a Sigmaphump, an electric annealing furnace, a Zeiss flame photometry equipment, an incubator, drying and paraffin stoves, a Reichert microtome, a stereo-microscope, *etc.*, to a total amount of about f 22.000,—.

Again, room had to be found for the periodicals in the library so that now the possibility is considered of closing 2 of the 3 library windows and building steel racks in front of them.

A great number of handbooks were acquired in 1960, especially on behalf of the radioactivity group, the sum total amounting to about f 3.000,—. We also spent a relatively high sum for binding purposes, *viz.* nearly f 1.400,—. The exchange of periodicals remained much the same. The series *Rivista di Biologia* (Perugia, Italy) was completed; from 1941 on we now have the continuous set.

Just as in 1959 there were many changes in the staff, partly in consequence of the starting of work on radioactivity, partly from other causes. Beginning 1st January 1960 Mr. CREUTZBERG was taken over from the Netherlands Organization for Pure Research. Furthermore Mr. DUURSMA, until that time also in the service of the above Organization, was taken over, to start radioactivity work. Also Mr. DRAL joined the radioactivity group from that date onward. On the same date Miss G. H. BAARD and B. SCHRIEKEN were appointed assistant-analysts and J. H. BLAZER store-keeper. Miss C. C. M. J. VINKEN entered service on 1st February as a typist. Miss G. BUIK on 1st May started radioactivity work, and on the same date D. D. DE VRIES, also assistant analyst, joined the latter group. On 15th July J. J. MÖLS was appointed assistant-analyst. A. W. SCHREURS, who left us on 1st March, was succeeded as an instrument-maker on 1st September by C. P. J. VAN LANGEN. Miss J. VAN DER VLIET was succeeded on 15th October by Miss G. M. DAUVE as a typist. On 1st November Miss S. J. DE KRAKER entered service as a librarian, on 14th November P. VISSER became a servant to the radioactivity group. 1st December M. FONDS was appointed assistant.

As mentioned above Mr. POSTMA took part in an investigation by the Hydraulics Laboratory, Delft, in British Guiana. In his trip he included a visit to the Caribbean Marine Biological Institute in Curaçao. From 21st to 28th March Mr. POSTMA attended a meeting of UNESCO in Paris and from 12th to 17th July a similar meeting in Copenhagen. The subject was international oceanographical research and the rôle of UNESCO in this research. Especially the possible building of an international research vessel was discussed. The result of the discussion was put down in a report to the Ministry of Education, Arts and Sciences.

Mr. DUDOK VAN HEEL's trip to Norway from 21st May to 24th June has already been mentioned.

Mr. DRAL visited England from 16th to 28th July. From 18th to 22nd July he attended a course in autoradiography at the Isotope School, Wantage, Berkshire. Having finished this course he visited the Health Physics Department of the Nuclear Centre at Windscale, the new chemical and radiochemical laboratory of Cambridge University and the Radiobiological Department of the Fishery Laboratory, Lowestoft. When in Cambridge, Mr. DRAL also visited Professor Sir JAMES GRAY, with whom he discussed the mechanism of ciliar movements in evertebrates. From 12th to 23rd December Mr. DRAL attended a course at the Institute for Nuclear Research in Amsterdam.

Mr. DUURSMA also visited England, from 20th to 28th July. Besides the institutes mentioned for Mr. DRAL he also visited the National Institute of Oceanography, Wormley, Berks., and the Office of Naval



Research as well as the Medical Electronics Exhibition in London.

Mr. DE BLOK and Mr. DUDOK VAN HEEL attended the Congrès international d'Aquariologie, held in Monaco from 21st to 26th November.

Mr. CREUTZBERG, as already said, attended a symposium on migration problems, held in Heligoland from 1st to 3rd May.

Under the heading staff two items demand separate mention.

Shortly after she came to Den Helder to take care of the library Miss DE KRAKER was hit in a gale by a zinc plate blown from a roof, which cut her Achilles tendon completely through. We hope that she will recover and will be able to take up her work again.

The second item, which is of interest in connection with the training of chemists in the Institute, is that the chemical laboratory is now officially approved for this training, and analysts may work at the Institute for obtaining the 2nd part of the certificate for chemical analyst.

Of the visitors to the Station in 1960 the following may be mentioned: Miss F. ADAMS, Oxford University, England; H. BARNES, Marine Biological Station, Millport (Isle of Cumbrae), Scotland; PER BERGAN, Oslo University, Norway; M. BERNHARD, Comitato Nazionale per le Ricèrche Nucleari, Fiascherino, Italy; R. LE BRASSEUR, Biological Station, Nanaimo, Canada; G. DISTECHE, Inst. Ed van Beneden, Liège, Belgium; RENÉ L. ENGEL, Oceanographic Research Division U.S. Naval Ordnance Station, China Lake, California; D. C. GEYSKES, Paramaribo, Surinam; HEINRICH KÜHL, Institut für Küsten- und Hochseefischerei, Cuxhaven, Germany; C. MORIARTY, Fisheries Branch, Dublin, Ireland; K. G. NYHOLM, Stockholm University, Sweden; K. ORISTES, Stazione Zoologica Napoli, Naples, Italy; ROBERT H. PARKER, Scripps Institution of Oceanography, La Jolla, California; DIXEE LEE RAY, University of Washington, Seattle, Washington; K. RZEHAŁ, Krakow, Poland; A. C. SIMPSON, Fisheries Laboratory, Burnham on Crouch, England.

Furthermore, it should be mentioned that Mrs. JULIE REDEKE, née HOEK, and Miss L. REDEKE, wife and daughter of the former director of the Institute (1904–29), visited us last summer.

Again, co-operation with other institutes left nothing to be desired. We were in touch on the question of international marine research and research vessels with the Royal Netherlands Meteorological Institute, especially the Oceanographic Department. The T.N.O. Anti Fouling Research Laboratory next to the Zoological Station published a survey on its work in T.N.O. News of March 1960 (nr. 169, pp. 109–116).

Participants in the summer course numbered 23, of which 18 came from Groningen, 2 from Amsterdam and 3 from Leyden. Again, the

complete scientific staff, including Mr. DRAL, took part in the course. There was, moreover, from 21st to 27th April, a physiological course for 27 students from and by the Physiological Laboratory in Amsterdam, a course of 8 biologists from Ghent, Belgium, conducted by 2 of their own assistants from 2nd to 15th May, and a course for a score of undergraduates from Utrecht, conducted by Dr. P. J. KIPP from 13th to 18th June. Furthermore, Mr. HORREUS DE HAAS visited the Institute for some days with 14 older pupils from the Workshop, Bilthoven.

The total number of man-days of research-workers and course-participants visiting the Institute was 890. This is a low number, the average for 1947-60 being 1109.

Receipts for material for study amounted to *f*13.367,03, exclusive packing (*f*1.191,71). Animals were bought for *f*8.964,20, and about *f*3.075,— was spent on packing-material, formalin, alcohol, *etc.* This leaves a balance of about *f*2.500,—.

The van covered 5184 km, of which 1010 were in order to transport material for study, the rest were for research, orders in town, *etc.*

The total expenditure for the Institute in 1960 amounted to about *f*221,500 for personnel and *f*159,300 for material. Another *f*2,000 have to be added for the lodginghouse. Rebuilding the working-rooms for radioactivity research took a sum of *f*15,400, which is included in the total for material. A sum of *f*250,000 was available for building in Texel, but this money was not yet used.

Den Helder, February 1961.

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.

