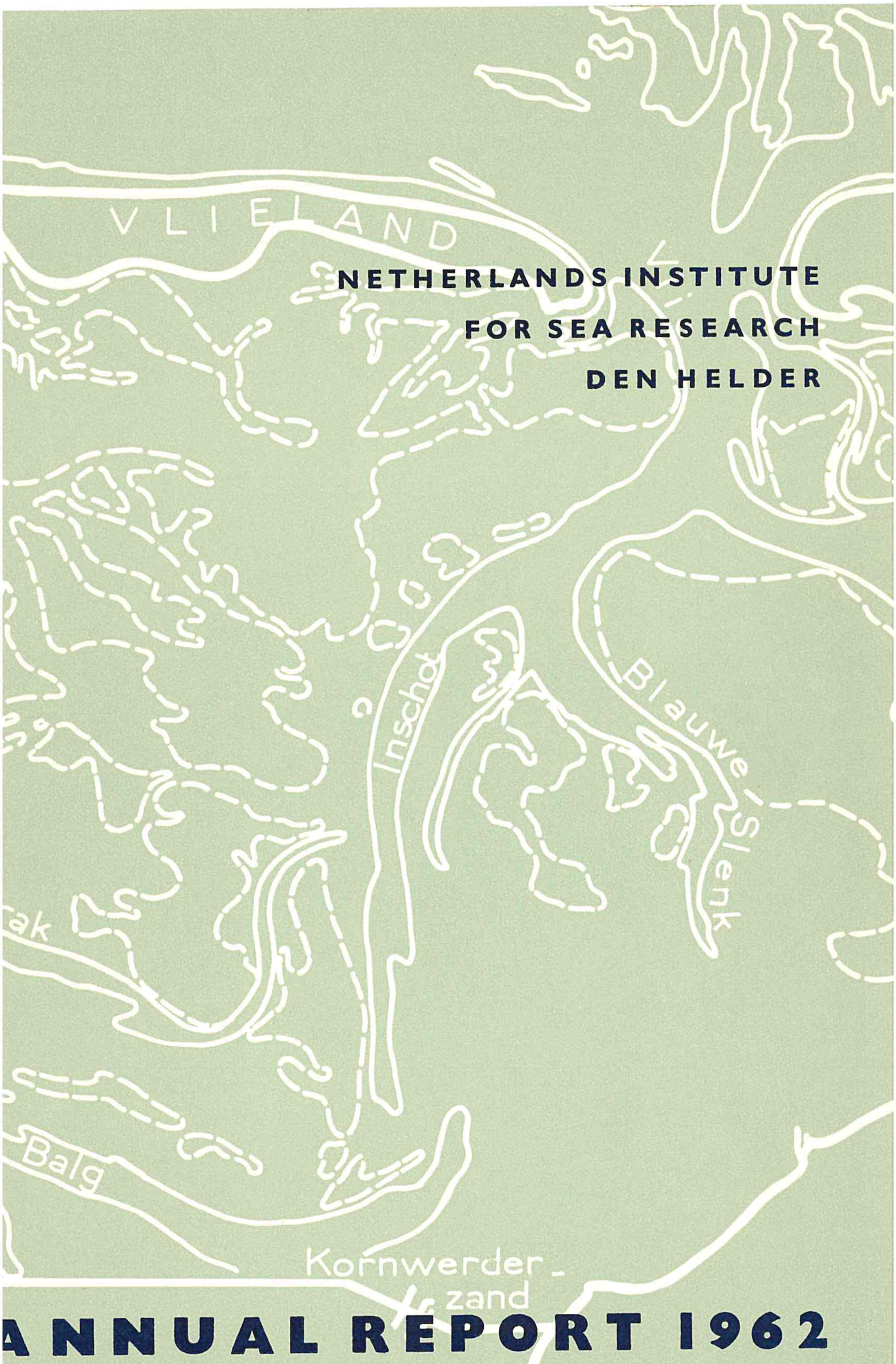
NETHERLANDS INSTITUTE FOR SEA RESEARCH

DEN HELDER



ANNUAL REPORT 1962

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

Netherlands Institute for Sea Research at Den Helder. Marina 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 Roads and Waterways.

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 Roads 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.

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ANNUAL REPORT OF THE NETHERLANDS INSTITUTE FOR SEA RESEARCH FOR THE YEAR 1962

I. SCIENTIFIC PART

The previous annual report opened with an extensive review of Mr. DE BLOK's research on lunar and tidal influences on the reproduction of marine animals. In this review the preliminary results since 1953 were summarized, from which it appeared that the main test animal, the oyster, had not yielded any decisive answer to the question in which way moon or tide may influence reproduction. In 1962 working out of the data was carried on, while at the same time the experiments themselves were continued for another year. Three species were studied, *viz.* *Ostrea edulis*, *Teredo pedicillata* (a Mediterranean shipworm) and *Nereis dumerilii*, a polychaete worm. In spite of previous set-backs the oyster was chosen again, but now in numbers of 150 instead of 10 per test-tank. Though large numbers of larvae were obtained they failed again to show a connection between periodicity in one or more environmental factors and their numbers. With the other two species the work is still at a stage of keeping the animals fit and capable of reproduction under experimental conditions. Working out of the data is still in progress.

Mr. CREUTZBERG continued his research on very young eels, the so-called elvers, partly by himself, partly by students taking over part of the program.

The main item of this research was the connection between successive stages of migration and internal organization of the animals. For a better understanding of what is to follow it must be kept in mind that the metamorphosis of *Leptocephalus* to elver takes place over depths of about 1000 m along the European continental shelf round about September, two and a half years after the *Leptocephalus* larvae were born in the Sargasso Sea. From there they start on their voyage from the ocean by way of the English Channel and around Scotland into the North Sea. In coastal waters the animals employ a mechanism which makes them seek the surface during flood and the bottom during ebb, to the effect that they are transported in the direction of the flood and at the same time inshore. They discriminate between flood and ebb by observation of an odour which is essential to them. It would be of much interest to know when this tidal mechanism of the elver develops for the first time and which are its successive alterations, if any. In 1961 it appeared from experiments by Mr. WEZEMAN, Groningen, that the attraction of inland water for animals in their first autumn after immigration decreases, if the animals have been prevented from entering inland water in the preceding spring and summer. It might be imagined that in their first winter in the open sea the animals do not as yet possess any tidal mechanism, that this mechanism develops in spring and that it disappears again in autumn, even if the animals are prevented from entering fresh water.

It was, therefore, important to expose winter elvers from the open sea to the influence of ebb and flood in coastal waters. Mr. CREUTZBERG and Mr. WEIJERS tried to obtain these animals in the Channel, with the help of the Station Biologique at Roscoff. Unfortunately, they did not succeed in finding any.

Also connected with the above problem was the work of Mr. WEIJERS, Groningen, who in 1962 examined the change in migratory behaviour over a whole season in elvers and young eels in which pigmentation had already started. Elvers were caught at various times off the sluices near Den Oever. The "roundabout" designed by Mr. CREUTZBERG, in which ebb and flood alternate at random, was used for this work. The only difference between ebb and flood in these experiments was that the percentage of inland water increased and decreased regularly, the direction of the current remaining the same. It appeared from the experiments that in April the elvers swam against the current during the ebb and that they swam with the current or let themselves be transported passively during the flood. As the season advanced more elvers swam against the ebb, but the swimming with the flood decreased. In this change of behaviour internal factors played a role, which in their turn must have been influenced by external factors, since animals kept at a low temperature from April till June showed a behaviour in June which was similar to that of normal animals in April. Our expectations that, in accordance with the results obtained by Mr. WEZEMAN, the animals would react more passively to the current in autumn did not come true.

What is most striking in the results obtained is that the increase in positive rheotaxis with respect to the ebb in summer is not attended by an increase in swimming with the flood, which would bring the animals quicker to inland waters, but that moving in the direction of the flood current decreases. Obviously, the behaviour in June is in keeping with orientation against the current, in which ebb or flood, that is to say increase or decrease in odour, do not play a role anymore.

The research started in 1961 by Mr. WEZEMAN, on the nature of the odour in inland waters which influences migration behaviour in the elvers, was continued on a smaller scale by Mr. BISSELINK. Aeration of the water does not greatly alter attraction; the effect of boiling as compared to filtration over carbon appears to be small. It seems as if, contrary to Mr. CREUTZBERG's initial expectations, the odour is not or only slightly volatile.

The histological work on thyroid gland activity in elvers, started in 1961, was continued in 1962 with the help of Miss G. DIJKSTRA. In 1959 it was found that the thyroid gland of elvers caught just off the sluices near Den Oever differed greatly from that of elvers caught at the same time in the Wadden Sea or the North Sea. In an attempt to reproduce this effect artificially elvers were kept at about 1°, 5°, 12° and 15° C. resp., both in sea water and fresh water. Since the iodine content of the water might be of influence elvers were kept also at the same temperatures in fresh water to which iodine had been added in a concentration similar to that of sea water. The following facts appeared from this investigation:

1. In the elvers kept at about 1° mortality was high, especially in fresh water, both with and without iodine.
2. In sea water no change in activity of the thyroid gland was observed at any of the temperatures involved.
2. In fresh water with and without iodine at temperatures of 12° and 15° no change of the gland was found, but at 5° a distinct change in thickness of the epithelium was observed, which was greatest in fresh water without iodine.

For the time being the conclusion seems justified that the penetration of the elver into fresh water at low temperatures leads to physiological difficulties, which seems obvious, since in the sea the animals also avoid the combination of low temperatures and low salinities. The increase in epithelium height of the thyroid gland previous to penetration into fresh water, which in tap water without extra iodine leads to hypertrophy, might also be connected with these difficulties.

Besides the elver the smelt, *Osmerus eperlanus*, was studied. On the one hand data on migration of this species were collected during the monthly fishing cruises in the Wadden Sea, on the other hand seasonal fluctuations in activity of the thyroid gland were investigated. It is still too early to draw any conclusions.

A certain amount of research was carried out on silver eels, the maturing animals on their way to the sea. On an earlier occasion Mr. CREUTZBERG assumed that these eels during migration might be directed by certain vibrations present in the water. To test this hypothesis some eels were put into a tub with four exit-tubes. Three of these tubes came to a dead end, the fourth, a longer one, led to the sea, from which it was separated by a membrane. Especially in rough weather the majority of the animals preferred the exit connected with the sea. In 1962 an attempt was made to obtain more data. In September and October, however, we had a practically unbroken spell of calm weather, and Mr. CREUTZBERG thinks this may be the reason why the animals were distributed equally over the four exits.

Mr. WEIJERS too worked with adult eels for some time. Inspired by the just mentioned research of Mr. CREUTZBERG he registered continuously in the months of October and November the activity of 11 animals in an aquarium in a closed cellar. We cannot enter here into the method of plotting the activity data, which gave the following results:

1. Activity was greatest in October and decreased in November. This was in keeping with the decrease in activity of the eels in the field.

2. The average daily fluctuations in activity could be correlated with those of the institute's staff and (or) those of a pile-driving machine present in front of the building. Moreover, activity was greater on working days than on Sundays. The activity of the animals was not influenced by light and dark periods in the cellar. Everything points to a strong sensitivity of the adult eels to vibrations.

3. In October the activity, both indoors and in the field, was least at full moon, although it was believed that no light entered the cellar from outside. This might point to the persistence of an autonomous rhythm maintained by the animals in the cellar. It must be added that, because of other experiments, a faint light was kept burning in the cellar with an alternating light and dark period of 12 hours and 21 minutes. In addition to the normal alternation of light and dark this lamp also gave a periodicity of 34 days. All the same there still was a correlation between activity of the eels and the actual phase of the moon.

4. A gale on the 27th October was preceded on the 26th by a strong increase of activity. The peak coincided with a wholesale emigration of mature eels in the field. DEELDER has demonstrated that very probably this migration is connected with the occurrence of microseisms of low amplitudes (1–20 micron) and a period of about 3 seconds. Apparently, the microseisms are caused by pressure minima over a sea of 100–200 m depth, the amplitude being determined by the intensity of the depression, the period by the depth of the sea. Those microseisms may also have played a role in the cellar.

From July to December Mr. VENEMA, Groningen, studied migratory movements in the swimming crab *Portunus holsatus*. His starting point were the observations of KRISTENSEN and VERWEY, who in the autumns of 1945 and '46 observed a great number of crabs swimming at the surface of the sea during the ebb, while a similar transport back during the flood seemed absent. They assumed that the swimming crab possesses a mechanism which enables it to use ebb and flood as a means of transport.

Mr. VENEMA's research involved collecting field observations, compilations and sorting of earlier data, and experimenting.

The field observations did not yield any important results, although they confirmed earlier data. In the experiments swimming crabs were kept in running sea water and exposed to changes in salinity and temperature with the aid of a modified CREUTZBERG "roundabout". The results were as follows:

1. *Decrease* of salinity from 17 to 12.5 ‰ Cl', at a high and constant temperature (about 16.5° C.) did not cause any upward movement of the crabs. A strong decrease in salinity even caused more animals to burrow.

2. *Decrease* of salinity at a *low* and constant temperature (about 9° C.) caused a general swimming of the crabs, so that they were transported with the current.

3. *Increase* of salinity at the same temperature made the crabs go to the bottom and burrow.

4. *A combined decrease* of salinity and temperature (17 → 14.25 ‰ Cl', 13 → 11.5° C. resp.) caused an increase in swimming. If the salinity was lowered too much the crabs sought the bottom.

5. *An increase* in salinity and temperature caused clinging to the bottom and resisting transport.

6. *A decrease* in temperature from 15 to 11.5° C. in water of a high and constant salinity (± 17 ‰ Cl'.) caused some swimming and walking with the current, but the effect of the decrease in temperature was only slight.

Although these results are only preliminary and the experiments will have to be repeated on a larger scale it seems evident that to make swimming crabs leave the shore a decrease both in temperature and salinity is essential. It is especially important that in this case it is a genuine decrease in salinity and not, as with the elver, an increase in some special odour present in the water. Changes in salinity obtained at about 7.5° C. with tap water had the same effect, whether the tap water had been filtered over charcoal or not.

Since the effect of the swimming movements of the crab is small as compared to the velocity of the current the main function of swimming seems to be to get the animals off the bottom, so that they can be carried off by the current. There is hardly any question of swimming in the direction of the current, still Mr. VENEMA observed some crabs which, instead of swimming upwards, walked with the current, which makes it possible that in principle the action is directed.

The results of this work confirm again the important role played by tidal currents in the migration of marine animals. The alternating currents yield direct information to the animals on conditions of the environment either inshore or offshore over considerable distances. The current is a means of orientation as well as transport. Moreover, the results support the lines of thought as developed previously by BROEKHUYSEN, CAUDRI, BROEKEMA and VERWEY, that for a number of Crustaceans migratory movements are determined by the relation between salinity and temperature.

In connection with these experiments it should be added that Mr. WEIJERS during a single day conducted an experiment in the roundabout with a hundred shrimps, showing that a combined decrease in salinity and temperature resulted in an increased swimming with the current and that an increase in temperature and salinity caused an increase in burrowing. There were also indications that the flood current (which in autumn means a combined increase in salinity and temperature) resulted in a slight increase of animals walking countercurrent, just as VENEMA found swimming crabs walking with the current during the ebb. The observations of WEIJERS further confirm the observations of STERK, who some years ago obtained indications that in *Crangon* studied in the outer part of the Waddensea transport by the ebb preponderates in autumn, whereas transport by the flood preponderates in spring. They are in accordance with recently obtained results of VENEMA, who, by using the macroplankton data from the surface water around lightvessel Texel collected by Miss VAN DER BAAN, also found *Crangon* predominating in the ebb water in autumn, in the flood water in spring. The latter observations at the same time prove that transport with the aid of the tides does not only take place in nearby coastal waters, but also at some distance offshore in an area where ebb and flood currents do not run in one direction, but where the tide turns round and the velocity-direction-arrows over the tidal period form an ellipse. CREUTZBERG already found indications for tidal transport of the elver at some distance offshore, and it might be worth while to find out how far offshore such a migration with the aid of a tidal mechanism goes on.

It must be remarked that the question is left open whether a change in salinity or in odour of the water is the deciding factor with the shrimp when it discriminates between ebb and flood. In Mr. WEIJERS experiments the changes in salinity were not obtained by tap water but by water from the IJselmeer, and an experiment with water filtered over charcoal has not yet been carried out.

Another aspect of shrimp migration was investigated by Mr. HARTSUYKER, of the Free University, Amsterdam. These last years the question had often been investigated—by GLAS, HEYLIGERS, BEUKEMA—what might be the stimulus that makes the shrimp leave the emergent tidal flats when the tide is going out and what factors the animals use for their orientation on leaving the shallow parts. HARTSUYKER was the fourth student who endeavoured to take up this problem.

To begin with, Mr. HARTSUYKER preferred to start with a detailed study of migration up and down the flats on the spot. This turned out to keep him busy for such a long time that there was no time left for the questions raised. The observations on up and down migration, however, are so interesting in themselves that they form a valuable gain. Mr. HARTSUYKER at first tried to use special self-made fish-traps, but collecting their catches took up so much time that a simpler method was preferred: that of catching shrimp at a few fixed places over a distance of 10 m parallel to the water's edge by pushing along a hand net. This procedure was repeated every time the water had risen or fallen 5 cm. Mr. HARTSUYKER collected data over 15 periods of flood and 5 of ebb. Since he began at a depth of 5 cm and ended at a depth of about 65 cm he obtained about 13 observations for each period. The youngest shrimps passed through the meshes of the net; part of the animals, especially the larger ones, may have evaded it. A drawback of the method was that not the migrating animals themselves were caught, but that the influence of these animals on the composition of the population was studied. That, even so, the results are so evident is caused by the fact that the young shrimps are the first to move up the flats, followed by ever bigger animals. The smaller animals follow the rising water almost directly, so that shrimps up to 30 mm length are already present in large numbers at a depth of the water of 5–10 cm. When the water has risen to 10–20 cm shrimps of 40 mm appear, while shrimps of 50 mm arrive at water levels of 30–40 cm. Since the bigger animals are only a minority as compared to the smaller ones (15–35 mm) the bulk of the animals follow the rising water rather closely. When the tide is going out the animals of 50 mm have already passed when the level has fallen to 35 cm. Shrimps of 40 mm have passed when the level has fallen to 15 cm, when at the same time the bulk of the animals of 20–25 mm is passing by.

These data confirm and extend the observations by BEUKEMA, who also observed the preference of shrimps of varying sizes for varying depths, but in the case of HARTSUYKER's observations we are concerned mainly with the time of arrival and departure of the shrimps, resulting from their preference for certain water depths. The data hold for a shallow part of the Wadden Sea near Texel. Deeper sandbanks will certainly show the same principle, but with a movement of bigger animals. Since the observations were carried out at daytime and shrimps are especially active at night movements up and down the tidal flats must involve massmigrations.

Mr. FONDS in 1962 started research on the influence of temperature and salinity on the number of vertebrae of *Gobius minutus*, the common goby. He found that, statistically, this number varies for gobies from different localities along the Netherlands coast, and even slightly for different localities in the Wadden Sea. Since it is known for other species of fish that the number of vertebrae is fixed in the egg Mr. FONDS started with recently deposited eggs, which were subjected to various combinations of temperature and salinity. The experiment involved three different salinities and four different temperatures. For each series of temperatures of a single salinity value spawn was collected from the same parents, in order to obtain material as homogeneous as possible. Since the number of vertebrae cannot well be established before the animals are at least 20 mm long the larvae had to be reared to fishes of this size. It had been found in 1961 that this is possible if they are fed with plankton collected afresh every day. The very young larvae were fed with fine plankton, later on coarser plankton was given. The first spawning took place in the beginning of April at a water temperature of 9.7–10.8° C. After spawning the eggs were put into various combinations of salinity and temperature, in which the larvae grew up too. Many larvae were lost, but all the same large differences were found to exist in the percentage of larvae with 32 vertebrae (the number of vertebrae varies between 31 and 34, the majority having 32 or 33, and normally only 3–6 % of the gobies have 31 or 34 vertebrae). It looks as if especially the temperature might be of importance, salinity having less influence. The work is to be continued in 1963.

Besides, Mr. FONDS continued his observations on the sea-trout, *Salmo trutta*, partly on animals caught by our fisherman, partly on his captive fishes. Field data showed that, at least in the Wadden Sea near Texel, three classes of this species are to be found, of which the youngest class arrived in 1962 at the end of May, was especially numerous in November and disappeared in December. The older animals were present from March to December, their numbers seem to decrease after September–October, coinciding with the occurrence of mature animals. It is not known where this summer population in the Wadden Sea comes from; earlier, however, a few specimens marked in the river Tweed, Northumberland, England, were caught. — As said before, Mr. FONDS also kept sea-trouts in captivity. They were fed with live shrimps, smelts, sand-eels and herrings and grew up quickly. He hoped the animals would become mature and that they could be made to spawn in winter by lowering the salinity of the water and providing a bottom of pebbles. This aim was reached and Mr. FONDS obtained about 100 young sea-trouts.

Since in 1963 Mr. FONDS will try to rear pelagic marine copepods some time was given in September and October to rearing a culture of pelagic diatoms from marine plankton. Although at first this attempt was successful with 4 species the cultures died off in December.

The investigations of Mr. FONDS on fish larvae and young fish from the macroplankton collected at Texel lightship and on fishes in the Waddensea will be dealt with below.

Mr. WESTENBERG continued the computation of tables on monograms for an easy application of the Fisher-Yates-test when comparing two relative frequences. Unfortunately, the monotonous work of writing and calculating could not yet be finished in 1962. The graphical interpolation of deviations pertaining to a certain tail error was subject to a technical complication, which now seems to have found a satisfactory solution.

Relatively much time was spent by Mr. WESTENBERG on a bibliographical study on transgression phenomena on the Netherlands coast. It is generally assumed that these increases in water level are connected with storm surges caused by gales in our shallow offshore waters, and it has often been assumed that a certain periodicity could be established. Although these transgressions are apparently limited to definite periods it seems that it is not at all certain that it concerns indeed a periodical phenomenon. A contribution of Mr. WESTENBERG on the subject is to appear in the „Jaarboek 1963 van het Genootschap West-Friesland".

Mr. DRAL continued his research on the mechanism of food-retention of the mussel. When working out earlier data on the movements of the laterofrontal cilia he found that, although the initial interpretation of their action will certainly prove to be right, too little is known of the details to understand the full extent of food retention with the aid of these cilia. Therefore the study of young transparent mussels was taken up again. By perfecting the stroboscopic illumination observations could be carried out with larger magnifications than before. The difficulty remains, however, that movement of the cilia is observed in an inconvenient direction, and therefore we hope that in 1963 it will be possible to work with an experimental design based on the principle of the solid image microscope as developed by R. G. GREGORY, Cambridge. With this instrument a three-dimensional image is obtained by a rapid up-and-down movement of objective and screen.

The improved stroboscopic illumination made it possible to measure the frequency of the beat of the laterofrontal cilia with shorter intervals. In this way the influence of external factors on this frequency could be studied. This research involved also the study of the lateral cilia, which take care of water transport. Besides, Mr. DRAL still hopes to arrive at an understanding of the regulation mechanism of the beat of the cilia.

In the investigations of Mr. DRAL on food selection of the mussel Miss G. BAARD took an active part. An experiment was designed in which the mussel was kept in a suspension the concentration of which is not altered by either ejection of peudofaeces or sedimentation. Since the difficulties of determining the grainsize in this suspension could not be solved as yet no results were obtained. In the meantime the experiment was used to study the influence of temperature on the pumping rate of the mussel, a subject still worth closer study. By using radioisotopes adsorbed to the suspended matter it will perhaps be possible to conduct the experiments with very low concentrations of suspended matter, which is more representative for the actual situation in the sea.

In the previous annual report the work of Mr. J. J. LAMMENS, of the Free University, Amsterdam, was mentioned, who in 1962 spent much time in Den Helder on his research on *Macoma balthica*. This work was undertaken in order to study periodicity in neurosecretion in this species and its possible influence on reproduction. When no direct connection between both phenomena was found to exist Mr. LAMMENS proceeded to study the connection between growth of the shell, reproduction and the annual cycle of temperature. Since this work is carried out by another institute we do not intend to anticipate Mr. LAMMENS' publication.

Mr. MEYS, Utrecht, visited Den Helder in the second half of the year to study the influence of temperature on reproduction in the nudibranchiate slug *Aeolidia papillosa*. Since not enough specimens of this species could be found Mr. MEYS carried on with *Lamellidoris bilamellata*. Both slugs are distinctly boreal in their distribution and both start reproduction in the coldest part of the year. The question arises whether they are restricted to a certain minimum temperature for maturation or spawning and, if so, which temperature is important to them. Unfortunately the work started too late to give results on the question of temperature influence on maturation.

The animals were kept at temperatures of 0°, 2°, 5°, 10° and 16° C. Food uptake, number of copulations and number of spawnings per animal, development of spawn and duration of this development were observed. It appeared that food uptake was greatest at 0° and decreased with higher temperatures. The number of copulations, on the other hand, was greatest at 16° and decreased with lower temperatures; so did the number of spawnings. It must be kept in mind that the gonads had already matured when the experiments started. As was to be expected development of spawn was quickest at the highest temperature and slowest at the lowest temperature, but at 16° many (perhaps as much as 80%), at 10° quite a few (perhaps 20%) deformed animals developed. Only at 5°, 2.5°, and 0° the development was normal.

It is evident that low temperatures are necessary for reproduction. The case is similar to that of the plaice, which also reproduces at mid-winter, while development of the spawn according to SHELBOURNE is less favourable at slightly higher temperatures (7–8° C.). We are not familiar enough with literature on this subject to say more about other species. It is still not known how temperature influences maturation of the gonads; apparently, the annual temperature cycle is of great importance since high temperatures do not prevent copulation and spawning. It might be worth while to extend this kind of research to other species.

Apparently, the larval stage of *Lamellidoris bilamellata* lasts rather long, at least a week. The larvae feed on flagellates. In a few cases Mr. MEYS succeeded in getting the animals through metamorphosis. Rearing the larvae in petri-dishes was not successful; it met with better success in tubes with gauzes at both ends, through which water passed.

Just as in 1961 a fair amount of time was spent on outdoor work. This included the macroplankton work of Miss VAN DER BAAN, the work of Mr. CREUTZBERG and Mr. FONDS in the Waddensea and the utilization of data collected by Mr. BEUMKES and the fishing fleet.

The work of Miss VAN DER BAAN, which is concerned with macroplankton collected at the Texel lightship, was started in January 1961, so that now data are available for 2 years. Thanks to the cooperation of the crew of the lightship a net is put out at the beginning of every flood and every ebb to be hauled at the end of every tide. The net, of 2 mm mesh, is about 10 m long, with an opening of 1 m^2. It filters some 10000–15000 m^3 each tide and is used practically continually. Four samples per 24 hours are collected, weather permitting. Since October 1962 fishing is restricted to 12 samples a week, on 3 consecutive days if possible. At first only medusae and elvers were considered, but very soon Miss VAN DER BAAN extended the research to other species. We want to acknowledge our debt especially to Mr. HOLTHUIS, Mr. VADER and Mr. VERVOORT, National Museum of Natural History, Leiden, for their help in identification of some species.

The results are of interest from the point of view of 1. periodicity in occurrence and fluctuations in this periodicity from one year to another, 2. the presence of species indicating the origin of different water masses, 3. movements of migratory species, 4. limits of distribution of certain species.

1. As to periodicity in occurrence it is of interest that young colourless *Cyanea* occurred for the first time on 25 November, both in 1961 and

1962, at temperatures of 9.7 and 9.2° C. resp. Young *Aurelia aurita* in these two years were first observed on 4 and 9 March resp., at widely divergent temperatures. As the investigations proceed such "first" data will become ever more predictable. Especially with jelly-fish they are of importance for understanding the annual cycle.

At the same time 1961 and 1962, with a great lag in temperature in late spring and summer 1962, yielded good examples of the influence of temperature on periodicity. For instance, *Aurelia aurita* had its maximum in 1961 from the beginning of April to mid-May, with 10 July as the latest date of occurrence; in 1962 the maximum fell from the beginning of May to mid-July, incidentally the species occurred up to 13 September (which is quite unusual), while 1 specimen was even caught as late as 30 November. Strobilization in 1962 must therefore have gone on till late summer. — In 1961 the maximum of *Chrysaora hysoscella* fell in July–August, with a strong decrease in October and some late animals till 9 November. In 1962 the main body was there in September and October, with late animals till 28 November. — In 1961 the Leptomedusa *Aequorea vitrina* occurred regularly in small numbers between 27 June and 5 August; in 1962, except for some individuals in other months of the year, the species was found from 4 September to 24 October. — The Ctenophore *Beroe cucumis* occurred in 1961 from 9 May to 18 July, in 1962 from 11 July to 12 August.

2. During a short period in early spring Miss VAN DER BAAN found four species which may be considered as indicators for Atlantic water, *viz.*, the Trachymedusa *Aglantha digitale*, the arrow-worm *Sagitta elegans*, the Euphausiid *Nyctiphanes couchii* and the Amphipod *Parathemisto gracilipes*. Of these *Aglantha* and *Parathemisto* were found in the period of 28 February to 10 March, during which time *Sagitta elegans* and *Nyctiphanes couchii* were also very numerous, but the latter two occurred over a much longer period. It would be worth while to establish the limits of salinity and temperature for these species. Of course, there are other indicators for the origin of water masses. For the Dutch westcoast the jelly-fish *Rhizostoma pulmo* is an indicator for nearby water of southern origin and the same holds for a number of larvae to be mentioned under 4.

3. From a point of view of migration the results of Miss VAN DER BAAN are of importance because they yield data on the movements of elver, swimming crab, shrimp and other species using a tidal mechanism for transport. Perhaps some Mysids, including *Mesopodopsis slabberi*, belong to the same group.

4. As to the limits of distribution the macroplankton data may be able to give information on their shifting. Every year the crab *Thia polita* is transported to the north in large numbers as a larva, but the

crabs themselves are seldom able to stand the cold in winter, and they may die in large numbers. The Stomatopod *Squilla desmarestii* is hardly known to occur at our latitude but the larvae and the postlarval stage were caught in quite a few numbers near the lightship Texel between 16 August and 29 September 1961, and another specimen was caught on 1 December 1962. — So far, *Lysiosquilla eusebia* has not been known to occur north of South-Brittany, but in 1962 Miss VAN DER BAAN found a considerable number of larvae between 31 August and 20 November. This means that the adult animals must have a more northernly distribution than South-Brittany.

From the point of view of periodicity and limits of distribution the fish larvae from the macroplankton are also of importance. They are studied by Mr. FONDS. A summary of regularly occurring species was given in the previous report. In 1962 much smaller numbers were found than in 1961 and there was a retardation of about one month in the maximum of occurrence of *Clupea sprattus*, *Arnoglossus laterna*, *Trachinus vipera* and *Onos mustelus*.

It is obvious that continuation of this research and a study of the data in connection with temperature and salinity is worth while.

The study of the annual cycle of occurrence of bottom fishes in the Waddensea, started by Mr. CREUTZBERG and Mr. FONDS in 1961, was continued in 1962. In principle fishing with a small beam-trawl was carried out every 4–6 weeks at 13 different localities in the Waddensea from Den Helder to Holwerd (province of Friesland) and at 2 localities in the outer part of the IJselmeer. The last trip was made on 7 November 1962. In connection with Mr. FONDS research special attention was given to the two species of goby. *Gobius minutus* in autumn is abundant in flat, sandy places, especially at depths of 2.5–7.5 m. It has practically disappeared from the Waddensea in January and February. In the course of March and April repopulation of the area takes place. In June and July the population disappears practically completely, probably because most animals die after spawning. In the meantime the new generation is born in April–May, and in August is found in the hauls. Apparently, most animals do not live for longer than one year. From the study of otoliths it appeared that very large specimens (7–9 cm) are two and a half years old at the utmost. — In 1961 these investigations yielded one specimen of *Gobius pictus*, caught near Terschelling, and in 1962 one specimen of *Onos septentrionalis*, caught near Den Helder. These species are treated in a separate paper by Mr. FONDS. *Gobius pictus* in the southern part of the North Sea has only been recorded from Heligoland. *Onos septentrionalis* was supposed to be a species from the extreme North: the Norwegian coast north of Bergen, and Greenland.

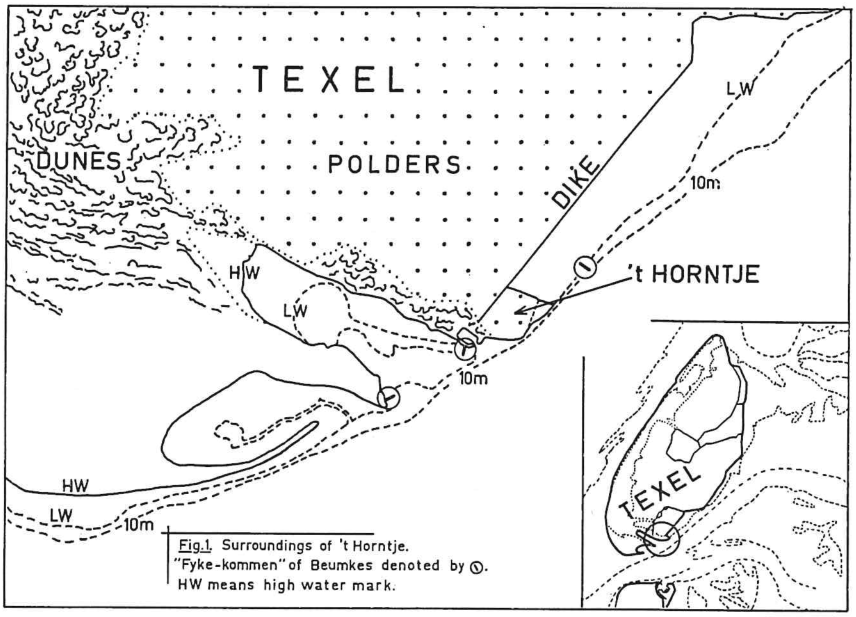


Fig. 1. Surroundings of 't Horntje. "Fyke-kommen" of Beumkes denoted by ⊘. HW means high water mark.

The work of our fisherman BEUMKES has been discussed extensively in the previous annual report. It furnishes many data on periodicity of southern migrants and forms a valuable part of the whole of phaenological data on macroplankton and fish. For an explanation of the nets used by BEUMKES the reader is referred to the annual reports of 1960 and 1961 (fig. 1). In 1962 BEUMKES fished with three "fyke-kommen" placed at three different places indicated in the map, fig. 1. They were used from 19 March to 23 December, from 17 April to 28 November and from 20 April to 27 August respectively. Only the total of the animals caught is mentioned here (see Table I), while no measurements or other details are given, except the first and last dates of occurrence of a few migrants.

When the data for the two last years on horse-mackerel and sand-smelt are compared we find a time-lag of one month for the first catches in 1962. For *Caranx trachurus* the maximum for 1962 occurred in July instead of May-June, for *Atherina* the maximum for 1962 fell in May instead of April. As to the garfish first and last specimens in both years were caught at about the same dates; in 1962, however, the peak occurred in July–August instead of in June.

It seems especially worth while to attempt to convert BEUMKES'

TABLE I

Total catch of BEUMKES in numbers per month, as well as first and last dates of catching of a few migrant species

Species	*M*	*A*	*M*	*J*	*J*	*A*	*S*	*O*	*N*	*D*	*Total*	*First catch*	*Last catch*
ıyatis pastinaca	—	—	1	1	3	1	—	—	—	—	6	15-V	23-VIII
ıpea harengus	2	10	25	15	10	7	10	191	221	16	507		
ıpea sprattus	11	46	17	15	12	695	1785	2025	730	43	5379		
ıpea pilchardus	—	—	2	5	1	3	1	2	—	—	14		
ısa fallax	—	237	152	72	276	83	145	133	23	—	1121	2-IV	16-I
ıraulis encrasicholus	—	—	11	—	3	2	—	9	2	—	27		
ımo trutta	4	19	46	19	32	30	47	32	96	20	345		
ınerus eperlanus	12	7	1	—	—	—	—	—	12	2	34		
ıuilla anguilla	4	142	247	281	626	516	543	538	84	—	2981		
ıone belone	—	21	399	729	403	123	60	24	—	—	1759	19-IV	24-X
ıdus callarias	4	77	74	28	57	12	9	—	3	5	269		
ıdus luscus	—	3	1	3	1	1	—	—	1	—	10		
ıdus merlangus	—	55	138	114	98	3	15	15	18	—	456		
ıdus virens	—	—	—	—	—	5	19	11	9	5	49		
ıdus pollachius	—	6	5	—	5	10	—	—	4	—	30		
ıs mustelus	16	163	172	109	93	82	44	101	206	25	1011		
ıelurus aequoreus	—	—	—	—	—	4	—	—	—	—	4		
ıgnathus rostellatus	—	—	40	5	10	1	1	2	1	—	60	5-V	3-XI
ırone labrax	—	43	40	17	47	25	10	7	13	1	203	4-IV	21-XII
ıanx trachurus	—	—	6	522	2970	1014	961	490	1	—	5964	29-V	3-XI
ımodytes lancea	—	1	—	—	1	1	—	—	—	—	3		
ıchinus draco	—	—	—	6	—	—	—	—	—	—	6		
ıchinus vipera	—	—	—	—	—	1	—	—	—	—	1		
ımber scombrus	—	—	—	1	4	13	10	2	—	—	30		
ılionymus lyra	—	2	2	1	—	—	—	—	—	—	5		
ıtronotus gunnellus	—	—	1	—	—	—	2	—	—	—	3		
ırces viviparus	30	389	422	415	393	324	265	191	207	32	2668		
ıgil ramada	—	81	269	96	64	33	37	36	16	—	632	4-IV	23-XI
ıerina presbyter	—	46	403	66	90	145	212	49	—	—	1011	16-IV	15-X
ıgla lucerna	—	—	6	34	13	9	—	—	—	—	62		
ıgla cuculus	—	—	—	—	—	1	—	—	—	—	1		
ıtus scorpius	56	314	342	298	335	274	339	271	313	48	2590		
ıtus bubalis	—	1	1	—	12	—	—	—	1	—	15		
ınus cataphractus	6	13	6	2	3	—	—	—	1	—	31		
ılopterus lumpus	—	4	4	—	—	—	6	55	136	14	219		
ıaris liparis	—	1	—	—	—	—	—	—	8	8	17		
ınachia spinachia	—	—	—	—	—	—	—	—	—	2	2		
ısterosteus aculeatus	—	—	—	—	—	—	—	—	—	1	1		
ıuronectes platessa	101	2065	4831	2200	2312	2187	1278	457	175	38	15644		
ıuronectes flesus	258	3450	3763	1989	1184	835	515	418	148	52	12612		
ıuronectes limanda	17	2635	11994	1895	1769	488	235	117	89	14	19244		
ıphthalmus rhombus	—	19	24	48	88	12	26	3	21	3	244		
ıoglossus laterna	—	1	2	—	—	—	—	—	—	—	3		
ıea solea	—	18	59	280	738	412	268	72	6	—	1853		
ıia officinalis	—	—	1	22	6	—	—	—	—	—	29		
ımarus gammarus	—	—	1	—	—	—	—	—	—	—	1		
ıtunus holsatus	—	—	1	—	—	—	91	225	41	—	358		
ıcer pagurus	—	—	2	31	2	5	7	1	—	—	48		
ıcinus maenas	—	1303	4862	6475	3630	924	741	851	605	12	19403		
ızostoma pulmo	—	—	—	—	—	147	167	226	35	—	575		
ınea lamarcki	—	—	—	—	—	—	1	—	—	—	1		
ıysaora hysoscella	—	—	—	—	—	27	—	—	—	—	27		
ıocheir sinensis	1	—	1	—	—	—	—	—	—	—	2		

TABL

Species	Sex; Size (cm)	Locality
MIGRANTS SUPPOSED TO HAVE ENTERED THE NORTH SEA THROUGH DOVER STRAIT		
Petromyzon marinus		Zuiderhaaks and off Callantsoog
Scylliorhinus stellaris		Texel Hole
Squatina squatina		Sandettie bank
Raja montagui	23–69	Black Bank, Tea Kettle Hole, Texel Hole, nea buoys ST4, ET3, Pl. One Marsdiep?
Raja blanda (brachyura)	86–95	Texel Hole and near ET4
Raja naevus		Texel Hole and near ST4
Raja microcellata		Texel Hole and near ET4
Dasyatis pastinaca		Off Callantsoog, Zuiderhaaks, Westgat, Molen gat, Texelstroom
Acipenser sturio		Zuiderhaaks
Raniceps raninus	72–25	Off Petten, Zuiderhaaks, off Texel, Molenga Texelstroom, off harbour Den Helder
Hippocampus europaeus		Texelstroom
Spondyliosoma cantharus	16.5–37.5	Botney Gut, Tea Kettle Hole, north of Vli land, off harbour Den Helder
Trachinus draco		One specimen 20 II near lightship Texel
Trachinus vipera		Texel Hole, off Egmond and Petten, Molen gat, Texelstroom, Balg
Atherina presbyter	10.7–16.1	Once Texel Hole; off Bergen (N.H.), Callant oog and Texel; Zuiderhaaks, Molengat, Texe stroom, harbour
Trigla cuculus	23.5–34.5	Botney Gut, Tea Kettle Hole, Texel Hole are near buoys ST3 and ST4, near lightship Texe near harbour Den Helder?
Trigla lineata		Off Callantsoog
Solea lascaris	23–27.5	North of Borkum, Tea Kettle Hole, Texel Ho
Octopus vulgaris		Black Bank; south of buoy P2
Sepia officinalis	7–25.8	Texel Hole, near buoy ST3, off Egmond, Pe ten, Camperduin and Texel, Zuiderhaaks, M lengat, Texelstroom, Balg
Portunus marmoreus		Near byou ST4
Portunus puber		Texel hole, near buoys ST2 and ST3, off Ca lantsoog, Molengat
Thia polita		Black Bank, Molengat

Numbers per month											
	F	M	A	M	J	J	A	S	O	N	D
–	—	—	—	—	—	—	4	4	—	—	—
–	—	—	—	—	—	—	—	—	1	—	—
–	—	—	—	—	—	—	—	—	—	1	—
8	15	—	1	—	2	2	—	—	1	2	—
1	—	1	—	—	—	—	—	—	—	1	—
1	1	—	—	—	—	—	—	—	—	—	—
1	1	—	—	—	—	—	—	—	—	—	—
–	—	—	—	—	—	3	5	3	1	—	—
–	—	—	—	—	1	—	—	—	—	—	—
1	2	—	18	—	4	2	1	—	—	—	1
–	—	—	—	—	—	1	—	—	—	—	—
3	—	—	—	—	—	1	1	—	1	—	1
–	1	—	—	—	—	—	—	—	6	—	—
–	—	—	1	19	5	3	—	11	7	25	—
–	—	—	28	3	—	—	140	94	4	—	—
–	—	—	—	1	21	10	4	—	—	2	—
–	—	—	—	—	—	1	—	—	—	—	—
3	3	—	—	—	—	—	—	—	—	—	—
–	1	—	—	—	—	—	—	—	1	—	—
1	—	—	—	16	61	10	—	—	3	3	—
–	—	—	—	—	—	—	—	1	—	—	—
–	—	—	—	1	1	1	2	—	—	2	5
–	—	6	—	—	—	—	—	—	—	—	—

Species	*Sex; Size (cm)*	*Locality*
MIGRANTS SUPPOSED TO HAVE ENTERED THE NORTH SEA AROUND SCOTLAND		
Scomberesox saurus		Beach near Huisduinen, Marsdiepdike Den Helder
Ommastrephes sagittatus		Beach Huisduinen
"NORTHERN" SPECIES, LITTLE COMMON IN THE SOUTHERN PART OF THE NORTH SEA		
Raja radiata		Near buoy P1
Molva molva		Off Texel
Onos cimbrius	7.9–14	Off Bergen, Callantsoog and Texel, Zuiderhaaks, Molengat
Onos septentrionalis		See article in this issue by FONDS
Labrus berggylta		Texel Hole, dike Huisduinen, Noorderhaaks
Anarhichas lupus		Near buoys P1 and ST3, Texel Hole
Cottus bubalis	6.5–15.3	Off Petten, Callantsoog, Zuiderhaaks and Texel, Westgat, Molengat, harbour, Balg, Horntje
Eledone cirrosa		52°56′ N., 4°4′ E., Texel Hole area, near buoys P6, north of Terschelling, off Petten
Nephrops norvegicus		Botney Gut, Texel Hole, near Pitbuoy and buoys P1 and ST3.
Lithodes maja		56° N., 3° E. and 56°35′ N., 1°5′ E.

opinion on the behaviour of species into scientific terms. BEUMKES says that sea-trout (*Salmo trutta*), twait shad (*Alosa finta*), garfish (*Belone belone*) and thin-lipped grey mullet (*Mugil capito*) are species to be caught with onshore winds. They are animals of the leeshore. He compares them to a ship driven aground by a gale. In his terms herring and horse-mackerel are species seeking shelter. They can be caught with offshore winds. Garfish and thin-lipped grey mullet are pronounced surface fishes, the horse-mackerel prefers deeper water. But what is the connection between preference for a certain depth and on- or offshore winds?

Of course, acquisition of species from the fishing fleet was again continued. A list of the main species is given in Table II.

Special mention deserves the catch of a specimen of *Scylliorhinus stellaris*, the nursehound or greater spotted dogfish. It is the second specimen caught since 1932. The northern limit of this species is the English

Numbers per month

	F	M	A	M	J	J	A	S	O	N	D
–	—	—	—	—	—	—	—	—	—	—	3
–	—	—	1	1	—	—	—	—	—	—	—
–	—	1	—	—	—	—	—	—	—	—	—
–	—	1	—	—	—	—	—	—	—	—	—
2	—	—	5	6	—	—	—	—	—	—	—
–	—	—	6	—	—	—	—	—	—	—	—
–	1	1	1	—	1	—	—	—	—	—	—
–	—	1	2	1	—	—	—	—	—	—	—
6	—	7	6	22	1	1	—	—	—	5	1
1	—	1	—	2	—	—	—	1	1	—	—
–	—	18	1	1	—	7	—	—	—	—	5
–	—	—	—	2	—	—	—	4	—	—	—

Channel. A specimen of *Onos septentrionalis* from the Waddensea was already mentioned. Since this catch might mean that the species might also occur off our coast it was shown to fishermen, who then brought in 6 specimens, all of them caught between 13 and 20 April between Petten and Texel. After 20 April no more specimens came in; still, the species must have a distribution quite different from what has been assumed so far. No less than 6 specimens of the southern *Solea lascaris* were brought in, all of them caught in January.

In 1962 the first *Sepia officinalis* was brought in on 25 May; in 1961 the first date was 14 April, as many as 40 animals were received that year before May. The arrival of *Sepia* is always greatly dependent on temperature.

Research on the influence of radioactive isotopes in the sea made further progress, but also in 1962 the vacancy for a zoologist with physiological interests could not be filled, so that Mr. Duursma had to carry on all the work by himself. In connection with the problem of the transport of radio-isotopes by suspended matter in the sea the main subjects of investigation were adsorption, chemical bonds and exchange of some of the main elements, such as Ca, Fe and Mn, with such matter. Solubility of these elements as cations was determined at two temperatures and various pH values; their occurrence in suspended and bottom matter from various parts of the Waddensea, and the connection between their presence and the anorganic part of the suspended matter were studied. In order to obtain a better insight into the rate of uptake and exchange between sea water and suspended matter experiments were started with Ca 45 and Mn 54 and with various grainsize fractions of the anorganic part of this matter. The data point to sorption of the isotopes being greatest when the grainsize of the clay is not over 10 micron. Especially with Mn 54 the uptake by suspended matter with grainsizes below 8 micron is about 50 times the uptake of the coarser fractions, over 16 micron. There are some slight indications — but no more than that — that the observed binding is not only due to adsorption but also to exchange of ions. Since the rate of ion-transport is of much importance a mathematical computation of certain model-situations was started, in which the Mathematical Centre, Amsterdam, will do the more complicated computations.

Since in ion-exchange between the solid and the dissolved phase the surface of the solid matter is an important factor it might be of interest to get exact measurements of the adsorptive surfaces. The methods developed, however, proved to be not very exact. The best results were obtained by binding Congo-red from a 0.1 % solution to the suspended matter and dissolving the adsorbed Congo-red in aceton-water 4:1 after filtration and washing. Measuring in a colorimeter at a wave-length of 510 millimicrons was then possible.

Determination of organic matter in suspension by means of determination of loss on ignition was improved by regenerating $CaCO_3$ which in this procedure loses CO_2 and therefore increases the loss on ignition by which organic matter is measured. This regeneration was obtained by a wet treatment with $(NH_4)_2CO_3$. On evaporation the $CaCO_3$ is formed back quantitatively, while the excess $(NH_4)_2CO_3$ disappears.

In 1962 hydrographical research had to be carried out in the absence of Mr. POSTMA, who left in mid-February for the United States for a visit of a year. During his absence Mr. DUURSMA took over the supervision of the work, which does not mean that the independence of the analysts would not have been up to the usual standard.

Mr. POSTMA's research on the cycle of the nitrogenous compounds in the Waddensea was continued till July. Since it has been discussed in the previous annual report it will not be mentioned in detail. The necessary analyses were carried out by Miss BOSCH and Mr. BEKE. Mr. BEKE also devoted much time to developing an improved NH_3-determination in sea water, using data from various recent publications. Thus, he tried to avoid heating, which is necessary to obtain a coloured compound, by a special dosing of the chemicals, without attacking the principle of the well-known NH_3-determinations. Mr. BEKE did obtain results on behalf of a quicker routine, but he did not arrive at the required accuracy.

Miss BOSCH spent part of her time in experiments on the influence of current-velocity and turbulence on suspension and sedimentation of the finer fractions of bottom sediments. To this end the CREUTZBERG-roundabout was used, with which Miss BOSCH had some difficulties as to exact regulation of current velocity over a longer period.

On behalf of the research by Mr. EISMA, to be described below, Mr. DUURSMA worked out a few methods for a quick and at the same time sufficiently accurate determination of Fe, Ca, and Mg in sand; in the final phase of the determinations these elements are determined complexometrically.

Mr. ROMMETS compared recent methods for the determination of dissolved organic matter in sea water. Together with Miss BOSCH he obtained experience as concerns the determination of dissolved organic carbon in the apparatus recently constructed by Mr. DUURSMA and mentioned in the previous annual report. Mr. ROMMETS also tried to obtain routine in the so-called productivity determination after STEEMANN-NIELSEN with the aid of C 14.

In July and August Mr. ROMMETS took part in hydrographical research of the Geological Institute of Leiden in the Ria de Arosa in Galicia, Spain.

The research by Mr. EISMA on composition, origin and transport of coastal sands between IJmuiden and Den Helder, started October 1961 with the support of the Netherlands Organization for Pure Research, was continued in 1962. The chemical analytical and other work was mainly carried out by Miss ENGELHART and Miss BOERMAN. The problem concerned the peculiar difference in lime content of the sands north and south of Bergen (province of North Holland).

The distribution of the two types of sand occurring along the beach between IJmuiden and Den Helder could be examined more closely as to difference in mineralogical composition, Ca, Fe, and Mg content, and grainsize distribution. As to mineralogical differences it was found that local sorting of the sand by waves and wind may cause great local differences in the heavy fraction, of a specific weight over 2.88. The distribution of the sands was clarified by differences found to exist in chemical composition and feldspar-content. Since type and extent of water transport greatly influence the grainsize it was tried to find a workable method to discern chemically between the separate grainsize fractions of the two types of sand. In this connection determination of the Fe content with the aid of $Na_2S_2O_4$ was found to be the most satisfactory method, at least in the case of beach sands. By this method it could be established that the distribution of the coarser grainsize fractions of each of the two types of sand differ from that of the finer fractions, a fact which could be confirmed by an analysis of the grainsize composition. From these data conclusions could be drawn on the direction of transport.

Fe-determinations were also carried out on sands from the sea bottom between IJmuiden and Petten. With these sands there is always a risk that determination includes iron recently deposited on the grains or that the values are too low because films of iron have been recently dissolved in the sea bottom. Although the work has only just started it looks as if the just-named processes do not play any substantial part.

The picture so far obtained from the samples taken along the beach and in the sea of this part of the coast is only a preliminary one. The work will be continued in 1963 and special attention will be given that year to the origin of the sands.

II. NON-SCIENTIFIC PART

In 1962 the Institute to be built on the island of Texel once more accounted for a great part of the work. Further development of plans and more discussions with the Office for Building Programs took place, after which this Office turned out 3 reports, dealing with the architectural program, the construction of machinery, especially the sea-water installation, and the electrotechnical program respectively. These reports are to be the guiding principle for the architect, who in them finds exposed the wishes and demands for the future institute. They have already been studied by representatives of the Ministries of Education, Arts and Science and Financies as well as by Public buildings Service, but no definite decisions were arrived at in so far a decision in principle and a definite order to the architect are concerned. In this connection it should be mentioned that the Minister of Education, Arts and Science was advised on the project by the Scientific Committee for the Institute.

The consultation with the Service for Roads and Waterways on the construction of a private harbour at 't Horntje made some progress. At the end of the year the estimate and drawings for this harbour were completed. The harbour work will probably be put out to contract in the spring of 1963.

Construction of a jetty south of 't Horntje meets with difficulties since the gulley to the Mok is shifting due to construction of the ferry harbour.

It is to be hoped that it will be possible in 1964 to start building on Texel, so that part of the research may be transferred from the crowded building in Den Helder to Texel. It looks as if the institute as a whole will not be completed and put into use before 1970.

The Max Weber made 113 navigation days. Engine and clutch did much better than was to be expected from the situation in previous years. As already appeared from the scientific part of this report a series of trips was made every 2–4 weeks, weather permitting. These trips covered the greater part of the Waddensea and were alternately concerned with hydrographical work and bottom fauna research (especially fish).

Construction of the new ship, long 19 m, wide 4.20, and having a draft of 1.45 m, was awarded to the Amsterdam shipyard G. DE VRIES LENTSCH Jr. Ltd., in the beginning of July. The ship is to be launched in the beginning of March and is to carry out its trial trip in April. It will be equipped with ordinary and self-recording echo-sounding, a wireless receiving and transmitting set, radar, an alternate-current set of considerable capacity and other commodities. The Institute is greatly indebted to Ir. H. C. EKAMA, naval architect with the Study Centre T.N.O. for Shipbuilding and Navigation, anti-corrosion and fouling department, who during construction of the ship acted as our adviser.

In 1962 the following items were added to the instrumentary of the Institute: a precision thermostate with torsion balance, a micromanipulator, 9 Meopta microscopes, 2 stereo microscopes, a binocular microscope, a Siemens film projector, an Olivetti Tetractys calculating machine and an electric autoclave. To the instrumentary of the isotope department were added a gammaspectrometer, an oscillograph and a cryostate. For the workshop a milling machine was bought, with additional parts to follow in 1963. Furthermore an Ultrasonor boring apparatus was bought. The costs of these instruments amounted to about fl. 27.000, fl. 34.000 and fl. 13.000 respectively.

Thanks to the increase of the funds at our disposal the library could be better provided for than formerly. Fl. 2949.69 was spent on subscriptions to periodicals, fl. 2567.32 to manuals and books, fl. 947.64 to binding. In the amount of fl. 2949.69 for periodicals is included a sum of fl. 745.65 spent on Series E of Biological Abstracts, 1950–1961. The sum of 2567.32 for books includes the acquisition of the Reports of the Swedish Deep Sea Expedition for 446.20 Swedish krones.

As an exchange subject the new periodical, Netherlands Journal of Sea Research, contributed greatly to the enrichment of the library. In 1962 the 4th number of the Journal appeared, completing volume 1.

There were a good many alterations in personnel in 1962. Newly appointed were:

T. BOUWHUIS, employee, from 1st January on.
Miss P. DE KLERK, assistant laboratory worker, temporary for 1 year, 29 January.
CHR. SNIJDERS, sailor, 1 February.
H. HOBBELINK, photographer and draughtsman, 12 June.
A. G. KEURIS, instrument maker, 1 August.
P. BOER, assistant laboratory worker, 1 September.
Miss P. SLOT, typist for part-time work, 1 September.
J. W. JOOSTEN, administrative employee, 1 November.

On the other hand the following persons left the Institute:

J. BLAZER, employee, on 12 February, for military service.
W. H. DUDOK VAN HEEL, biologist, 15 April.
Miss T. DAUVE, typist, 16 June.
C. P. J. VAN LANGEN, instrument maker, 22 August.
B. SCHRIEKEN, laboratory worker, 1 October, on a 6 months leave to assist Mr. VAN HEEL.

On the 9th April Mr. DUDOK VAN HEEL took his doctors degree at Utrecht on his research on sound perception in Cetaceans. He left the institute on April 1st to continue his research abroad under the direction of Prof. Busnel, Paris.

Mr. DUURSMA visited the Marine Laboratory for Radioactivity Research, La Spezia, Italy, for which institute he had a duplicate made of the apparatus used by himself for C-determination in sea water. He gave instructions on its use and also visited the Reactor Centre at Ispra, Italy, and the Hydrobiological Institute at Pallanza. Mr. DUURSMA also visited the Radioactivity Department of the Deutsches Hydrografisches Institut at Hamburg, the Institutes for Radioactivity Research at Risø in Denmark and Kjeller in Norway and the Fishery Institute at Bergen in Norway.

Mr. DRAL and Mr. EISMA attended the symposium on marine biology and hydrography at Bremerhaven from 22 to 25 October, and they also visited the Institute Senckenberg am Meer at Wilhelmshaven on

26 and 27 October. The visit of Mr. Creutzberg and Mr. Weijers to Roscoff, 10–18 November, has been mentioned under Research.

Mr. Postma left in mid-February for a years' visit to Scripps Institution of Oceanography, La Jolla, California, where he is engaged in chemical research. This was made possible by a travelling and subsistence allowance of the above institute.

Foreign visitors to the Institute at Den Helder in 1962 included Mr. and Mrs Ernest Reese, University of Hawaii, Honolulu, Rudolph J. Miller, Cornell University, U.S.A., J. W. H. Lawson, University of Glasgow, Scotland (all temporary at the University of Groningen); Jan Pinowski, Institute of Ecology, Warsaw, Poland; R. Motais, Groupe de biologie marine du Commissariat à l'Energie Atomique, Saclay, Station Zoologique, Villefranche, France; Rich. A. Vollenweider, Hydrobiological Institute, Pallanza, Italy; Heinrich Kühl, Bundesforschungsanstalt für Fischerei, Wilhelmshaven, Germany; B. L. Bayne, Marine biology Station, Menai Bridge, Anglesey, Wales; Miss Fenella Craig, Oxford University, England; Pierre Tardent, Zoological Institute, University of Zürich, Switzerland; John Strickland, Nanaimo, British Columbia, Canada; J. E. Webb, Westfield College, University of London; Andrew Robertson, University of Michigan, U.S.A.; C. Ladd Prosser, University of Illinois, Urbana, Ill., U.S.A.; John S. McReynoldz, Harvard Medical School, Boston, Mass., U.S.A.; P. Lécher, University of Caen, France.

Cooperation with sister-institutes was good. Unfortunately the Max Weber was hardly able to take part in a measuring program of several ships organized by the Royal Netherlands Meteorological Institute in June, because the program coincided with the summer courses. The scientists of the Institute for Fishery Research and those of Den Helder met again for joint lectures. The T.N.O. Anti-fouling Laboratory next to our Institute profited greatly by its extension.

It should also be mentioned that the Royal Netherlands Academy of Sciences set up the Netherlands Committee for Sea Research, which will strengthen the ties between the various Dutch institutes occupied with marine research. In 1962 the Committee has been busy with plans for building a Netherlands research vessel capable of marine biological, physical, chemical and geological research.

The summer courses counted 39 participants, of whom 14 came from Groningen and 25 from Leyden. The course was given in duplicate by the whole scientific staff. Besides, the Zoophysiological Laboratory, Amsterdam, held a private course from 16 to 19 April, with 13 participants, and a second course from 24 to 28 April, with 19 students. Moreover, 24 first-year biologists from Utrecht visited Den Helder from 2 to 5 June.

Research students visiting Den Helder are dealt with in the scientific part of this report. The total number of man-days for research workers and course-participants amounted to about 1761, a very high number indeed since the average for 1947–'62 is 1167.

In 1962 expenditure on study material amounted to fl. 4977.21; on packing material another fl. 4349.47 was spent, which makes fl. 9326.68 in all. This sum includes fl. 600.— paid for macroplankton catches at the Texel lightship and fl. 861.— for aquarium food. In 1962 the receipts for study material amounted to fl. 11.484.98, while fl. 1781.58 was received for packing expenses. Thus the total of receipts is fl. 13.266.56. The credit-balance is fl. 3939.88.

Just as in 1961 those fishes caught by BEUMKES that were fit for consumption were turned into money. His receipts amounted to fl. 1499.55. At the same time living animals were daily brought to Den Helder, a good deal of the catch was used as food for the aquarium animals and for the birds, moreover, 600 kg of fish were frozen and stored for the winter. Besides, about 1630 kg of fish were put at the disposal of Texel's Museum as food for the seals. The total receipts on fishing by BEUMKES may be estimated at fl. 2500.—. Expenditure on nets and boat amounted to about fl. 2618.04. The scientific results of BEUMKES' work are dealt with in the scientific part of this report.

The van made nearly 12.000 km, including Mr. CREUTZBERG's trip of 2500 km to Roscoff and 1300 km on behalf of Mr. EISMA's work. It was often used for fetching inland water for elver experiments, to which end it covered some 3300 km.

The exact figure for expenses of the institute in 1962 is not yet known, but about fl. 335.000 was paid on salaries and about fl. 184.000 on material, so that the total will amount to something in the order of fl. 519.000. Another fl. 212.000 were spent on the new ship. The money to be spent on the new harbour and the new Institute in 1962 remained virtually untouched. F. 2597.91 was spent on reports from the Office for Building Programs and fl. 1238.28 on a report by VAN HATTUM and BLANKEVOORT on the construction of a sea-water conduit.

Den Helder, 20th March 1963. J. VERWEY

The Netherlands Zoological Society has issued the following publications, which are obtainable from the Director of the Netherlands Institute for Sea Research, Den Helder, against the following prices per volume, postage not included.

Tijdschrift van de Nederlandsche Dierkundige Vereeniging

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	6.—
Supplement to vol. 2 (Ser. I), 1888	6.—
Index to Tijdschrift, 1874—1909	1.20

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

Vol. 1—7, 1934—1947	22.—
„ 8, 1947—1951	25.—
„ 9—15, 1952—1963	30.—

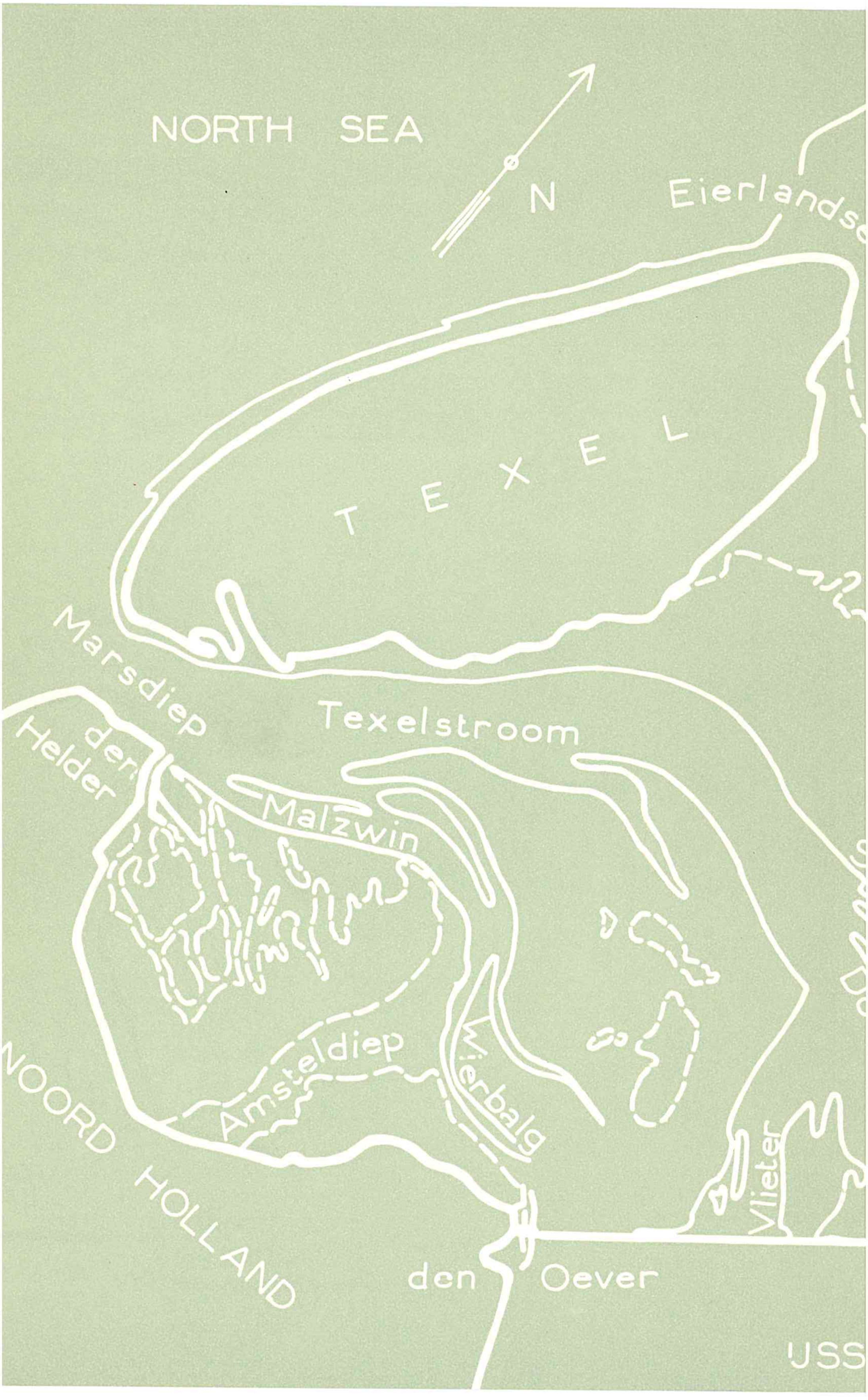
Supplements to vol. 3, 7, 10 and 13 come extra.

Netherlands Journal of Sea Research, specially devoted to the work of the Netherlands Institute for Sea Research.

Vol. 1—3, 1960—1966	20.—

Flora en Fauna der Zuiderzee. In Dutch. 4°. 460 pages, 1922. Out of print.

Supplement Flora en Fauna der Zuiderzee. In Dutch. 4°. 258 pages, 1936	10.—
Veranderingen in de Flora en Fauna der Zuiderzee sinds haar afsluiting in 1932. In Dutch. with English summary. 4°. 359 pages, 40 figures, 11 plates, many maps and tables, 1954 .	15.—
De Biologie van de Zuiderzee tijdens haar drooglegging, parts 1—6, 1928—1944 . . . . Per set	10.—



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