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I. SCIENTIFIC PART

A report of Mr. DE BLOK's research on the influence of tidal or lunar periodicity on the reproduction of marine animals was completed in the beginning of 1964. It deals with the work done in the years 1953–1963. Part of the data, especially those referring to molluscs, are now being prepared for publication.

In the animals of the North Sea there is no such outspoken reproductive periodicity induced by lunar phases or tidal movements as may be found in the animals of more southern distribution or along coasts having a greater tidal amplitude. A good example is the reproductive periodicity of the oyster, which KORRINGA could only demonstrate after having collected data over a great number of years. The investigations of Mr. DE BLOK were originally planned with the idea that, if North Sea animals were subjected to an outspoken tidal or lunar periodicity, it would be readily possible to demonstrate a periodicity in reproduction. We now know that nothing could be less true. Looking for clues governing monthly or bi-monthly reproduction gave no definite proof of the activity of certain factors such as duration, shifting or intensity of moonlight, changes in solar illumination as a result of tidal changes, tidal height (pressure), or other factors. Several particulars on reproductivity of the species examined were obtained, among which indications that the moon plays some part, but definite proof is still lacking.

A complication in periodicity-research in general is the fact that an obtained periodicity must be distinguishable from an endogenous one. To this end a lunar period of 34 instead of 29 days was used, springtide influence occurring every 17 days instead of every 14.5. In retrospect the drawback of the method used is that the experiment had to demonstrate discrimination between possible periods of 34 and 29 or 17 and 14.5 days, while observations on the reproductive rate could only be carried out every 2 to 4 days, because of the large amount of work involved. It would have been better to stage the experiments on a smaller scale and collect data daily.

This does not alter the fact that even then it might have been difficult to demonstrate a definite periodicity. The absence of any clear, directly demonstrable periodicity may also mean that the acting factors were not effectively presented or that certain factors of the artificial environment, such as food, composition of water, water movement, room for the animals to move about, were imperfect. This is very unlikely, however, since the production of larvae of the oyster for example ran into thousands.

As to the data proper, in some cases (*Odostomia pallida, Teredo* species) reproduction was found to be continuous, but in most cases separate emissions of eggs or larvae occurred. In both groups of data there were indications that in certain cases both the 17 day and the 14.5 day period may have influenced reproduction. For the oyster some indications were obtained that intensity of the moonlight may have played a part in producing periodicity in such a way that twice a month reproductive maxima would have occurred. This would agree with the emission of larvae of oysters in the Oosterschelde, which shows a peak 10 days after a full as well as a new moon. The moonlight period of the experiments, however, embraced a complete lunar month, not a half one. From this it might be concluded that an endogenous rhythm forced the animals to stick to this bi-monthly reproduction. The experiment would have induced a lunar rhythm, which was cut in two by the endogenous cycle. An external influence of the natural period was fairly clearly demonstrated for *Chiton cinereus*.

At a later stage of the experiments an attempt was made to switch over to species which show a very clear periodicity in nature. For this purpose *Teredo pedicellata* from the Mediterranean was used, which, however, did not show any clear-cut periodicity in the experiments. Another species was *Platynereis dumerilii*, which, because of difficulties in rearing, could not be obtained in sufficient numbers. Therefore, these experiments did not show any definite results either.

When not working on his data on periodicity Mr. DE BLOK spent some time in observing directed movements of *Littorina* species. Especially *Littorina littorea* seems to be a species whose photo-or geotaxis may change from positive to negative within a very short time, and Mr. DE BLOK is anxious to investigate the influence of certain specific antecedent conditions, e.g. wet versus dry environment, high versus low temperature, on the activity of the animals or on the direction of their movements. Experiments with *Littorina* on a vertical and a horizontal substrate in an aquarium with tidal movement showed that the greatest activity of the animals occurs when the water rises after the animals have been emerged for some time.

A short description by Mr. DE BLOK of a simple apparatus to reproduce any vertical tidal movement of a given amplitude or duration appeared in the Netherlands Journal of Sea Research. Simultaneously, a contribution by Mr. VADER on vertical movements of animals living in the bottom of tidal flats, studied with this apparatus, was published.

With the aid of Mr. BISSELINK, Mr. CREUTZBERG continued his research on the influence of temperature and salinity on the osmotic concentration of the blood in shrimps, but this work came to an untimely end when Mr. CREUTZBERG had to leave for Curaçao in June. For three years he will be director of the Caribbean Marine Biological Institute.

Mr. KRISTENSEN, who for the last three years was director of the Institute in Curaçao, re-entered the service of the Institute on the 1st of October. He had been on the staff for 10 years before. He gave some help to students, spent time in working out data collected in Curaçao and assisted in working out some data on macroplankton collected on the Texel lightship. In addition he started a compilation of former migration data on fishes and the cuttlefish.

Mr. WESTENBERG finished his paper on the test for comparing two relative frequencies. It was published in the Proceedings of the Royal Netherlands Academy of Sciences, vol. 67, pp. 441–466, and in Indagationes Mathematicae, Amsterdam, vol. 26, no. 4.

Mr. FONDS continued his research on the influence of temperature and salinity on the number of vertebrae of *Gobius minutus*, the common goby. Again he started from the eggs of a single couple spawning on plastic, which made it possible to divide the spawn in parts. Since in 1963 the larvae showed a high mortality he took precautions in filtering the water of one set of aquaria with closed circulation over sand and sterilizing it by means of ultra-violet light. In a second set of aquaria seawater obtained from the tanks of the Institute, after having been treated with ozone and filtered over norit, was added dropwise. Results of the ultra violet method were bad, those of the ozone method relatively good.

In 1964 experiments were done at one salinity and at 5 different temperatures. In each experiment about 250 eggs were used, of which 50–100 hatched, a number which differed for the various temperatures, which were 12°–14°, 13.5°–14.5°, 16°, 18° and 20° resp. After fixation of the number of vertebrae, which happens during embryonic development, the larvae were reared at one single temperature of 14°. They were fed with fresh marine plankton, retained by sieving through gauze with meshes of 120 micron. Of the larvae only an average of 8–9% survived. After having reached a size of 15–20 mm they were preserved in formalin. The number of vertebrae of the rays in the anal fins was determined after the animals had been coloured with alizarin. Since the eventual number of larvae per experiment turned out to be only 7–8 (in one case only 4) the results have a limited validity, but some indication (and no more) has been obtained that the lowest average number of vertebrae is found at temperatures of 15–16° and that it increases both at higher and lower temperatures. This is the so-called Tåningeffect. The small number of determinations of the number of rays in the anal fin does not permit any conclusion on the effect of temperature on these.

From 1 February to 1 May Mr. FONDS, by courtesy of the Bureau of International Technical Assistance, took part in the Guinea Trawling Survey, which was set up to obtain some idea of the size and composition of the fish-population along the coast of West Africa from Cape Roxo to the Congo, down to a depth of 400 m. It was very interesting to see the difference in composition of populations at various depths. The results of this research are to appear as a special report by the director of the Survey, Dr. J. WILLIAMS.

On request of the Zoological Museum, Amsterdam, Mr. FONDS also made bird-observations during this time and ascertained that the Pomarine Skua, *Stercorarius pomarinus*, was a common species in the area between Accra and Freetown. It seems that these birds winter there in great numbers. Shearwaters, however, were not seen at all.

For the National Museum of Natural History, Leiden, and the Zoological Laboratory of the Free University, Amsterdam, Mr. FONDS brought back some collections, comprising 200 species of fish and about 100 species of molluscs.

Mr. SWENNEN, who started working with the Institute officially on 16 November (actually on 1 November), was instructed to study the mutual relations of various species, especially in the Wadden Sea. Until now this subject was greatly neglected at the Institute. Assisted by Mr. SCHRIEKEN, Mr. SWENNEN continued his research on the relation between the eiderduck, the shore crab and the parasite *Polymorphus botulus*, belonging to the Acanthocephala. According to previous research by Mr. SWENNEN the parasite, living in the crab, causes a high mortality among eiderducks near Vlieland.

In the second half of 1964 Mr. SCHRIEKEN paid some attention to the relation between the crabs *Hyas coarctatus* and *Macropodia rostrata* on the one hand and sea anemones on the other hand. It seems that the crabs are readily eaten by *Tealia felina* and *Anemonia sulcata*, but at least *Macropodia* has some way of "appeasing" the anemone, whence it may establish itself under or against it. Moreover, the crab possesses a behaviour enabling it, when touching the disc of the anemone, to leave it without being eaten by the latter.

Mr. DRAL continued his research on the pumping and filtering mechanism of the mussel, reaching an important stage in 1964, so that the results can be published in 1965. This is especially due to the fact that Mr. DRAL could collect data with the help of the solid image microscope, designed by F. L. GREGORY, Cambridge, whom he visited for about a fortnight.

This year again Mr. DRAL's research was carried out with very young mussels (500–1200 microns), the transparent shells of which permit the gill-cilia to be observed without damaging the animals. Especially in the study of the latero-frontal cilia, which catch the food, the use of intact animals is of great advantage. A handicap is that the latero-frontal cilia can only be observed in the direction of their beat, so that they constantly disappear from view, a fact that hampered progress in this part of the research for many years. The solid image microscope of GREGORY differs from the conventional microscope mainly in its great depth of focus and three-dimensional image. This is brought about by a rapid vertical movement of the objective, while the ocular images move outwards and inwards synchronously with the vertical movements of the objective. This results in a changing convergence of the axis of the eye, giving a three-dimensional impression. In this way it is possible to follow the cilium through all stages of the beat so that the changes in form of the cilia can be observed.

From a physiological point of view the observations on the cilia yielded interesting results. While it had formerly already been found that the adjoining latero-frontal cilia beat alternately it now appeared that they can execute two different types of movement. One type works with a stiff effective beat and a slack recovery-beat, and represents the commonest type of ciliary movement. In the second type, already described by GRAY (Ciliary Movement, 1928), the transformations of the cilia are the same in both effective and recovery-beat, but they are carried out in opposite directions. This beat can be observed in parts cut out of the gills and exceptionally in the intact animal.

The part played by the lateral cilia in transporting water through the gills could also be investigated thanks to the co-operation of the foundation "Film en Wetenschap", Utrecht, enabling Mr. DRAL to film the activity of those cilia in intact animals and in fragments cut out of the gills in water of various salinities. It is hoped that by comparing the various pictures it can be ascertained what influences the mussel can exercise on the activity of the ciliary beat. The analysis of the pictures takes a great deal of time.

It was also attempted to gain further insight into possibilities at the disposal of the mussel to change the activity of the lateral cilia. The apparatus for stroboscopic illumination was again improved by the electronic engineer Mr. DE GROOT, and it led to very profitable observations. The behaviour of the cilia of quite young intact mussels and in fragments of gills of older mussels could be compared, in combination with measurements on the water transport. It appeared that no change could be observed in ciliary activity by changing temperature or salinity, but that the pumping rate underwent a change. The latter was comparable with a change in ciliary beat of the gill fragments. Apparently, the mussel can change its water movement according to circumstances, quite apart from the ciliary beat, while the ciliary beat as such would indeed be capable of changing the pumping rate.

From September to December research into the pumping and food-retaining mechanism of the mussel was also carried out by Miss VAN HEUSDEN, from Utrecht University. With the aid of colorimeter-observations she tried to trace the influence of differences in concentration of phytoplankton (*Chlamydomonas*) on pumping and food-retention. She worked with mussels of 3–4 cm, collecting the water passing through the mussel. It appeared from her research that up to a certain threshold value different concentrations do not cause any change in filtration behaviour. Above this value the percentage of retained *Chlamydomonas*-cells decreases, the higher the concentration the smaller the fraction retained. No appreciable influence on pumping rate could be ascertained. It may thus be concluded that the mussel tries to confine the amount of collected material to a certain maximum.

Another piece of research on the mussel was carried out by Miss MAAS, from Leiden University, under the supervision of Mr. DE BLOK. In 1952 already Miss GEELEN and Mr. DE BLOK tried to determine the preference of settling mussel-spat of various sizes and ages for threads of various thicknesses as well as the times that they spend on a thread before moving to another. Unfortunately, the threads then offered in experiments were not of the same material. Therefore the experiments were now repeated by an improved method.

Animals in the field were offered 2 m of nylon thread spun on a frame. The threads were of 5 different diameters between 0.12 and 1 mm.

The first fair-sized settlement of young mussels on the threads took place on 22 May. The animals had an average size of about 310 microns and they settled only on the two thinnest threads, those of 0.12 and 0.3 mm. Soon larger animals were settling too, generally on thicker threads. Although the data have not yet been adequately worked out it may be said that the average size of settling animals increases with increasing diameter of thread. At the same time, however, the average size of animals on each particular diameter of thread increased in the course of the first half of June. There are not enough data to prove this convincingly, but it seems that this increase in size was rather considerable and much greater than the differences in average size of mussels on threads of successive diameters at a given time. On the thinnest thread Miss MAAS found in the beginning of June an average thickness of 310 microns, in mid-June an average thickness of 410 microns. Yet, she found for both the beginning and the end of June a probable increase in average size with the diameter of the thread.

From other experiments it is apparent that there is a more or less continous increase with time in the numbers of mussels settling on the threads. This goes on till the settling has reached a certain density, which for a thread of 0.5 mm is of the order of 600 mussels per meter. DE BLOK and GEELEN assumed that the number of mussels per meter after some time reaches a maximum because all the animals leave their place of attachment within a given space of time. An alternative possibility is that the moving away from a particular thread may be the result of increased population density, and that this would apply particularly to the somewhat older animals, presumably because the 0.5 mm thread becomes too thin for them. Their place would then be taken by other mussels. The investigations will be continued in 1965.

The observations of Miss MAAS on the settlement of young mussels in experimental conditions shed a new light on the problem. It had been found in previous experiments that the mussel settles especially with a strong current and not at slack water, as the cockle does. Several years ago already DE BLOK and DRAL discovered that a young mussel may produce extremely thin threads, which are difficult to observe, and Mr. DRAL supposed that they might serve to "catch" the first substrate on which the young mussel settles. Mr. DRAL also supposed that those threads might have the same function as the gossamer of spiders; they could aid the transport of the animals and increase their action radius and their chances to meet a substratum. Miss MAAS directly observed the first settlement of young mussels by way of those filaments. In running water frames with threads as well as young mussels on the alga *Polysiphonia* were introduced. Mussels that had left the alga, when passing a thread, were observed to stop at a distance of 2–10 cm leeward of the thread, connected to it by a filament leaving the mussel just below the umbo. The mussel was able to haul in the filament and reach the place of attachment against the current.

Besides the research by Miss MAAS a fair amount of field work was done by others.

Mr. EISMA, now appointed as a geologist to the Institute, when taking bottom-samples in transects at right angles to the coast between Hoek van Holland and the island of Ameland, collected most of the animals encountered in the samples. In this work he was assisted by Mr. P. SMIT, from den Helder. The data on molluscs were plotted on distribution-maps, which clearly show that some species only live in a fairly narrow strip along the coast, others occur near the coast as well as farther offshore, and a third group of species is only found at a fairly great distance off the coast. Restricted to an area near the coast are *Cardium edule*, *Macoma balthica* and *Abra alba*; both near the coast and farther off *Spisula subtruncata*, *Tellina fabula* and *Venus gallina* occur; farther offshore *Abra* *prismatica*, *Astarte triangularis*, *Tellina donacina* and probably also *Gari fervensis* and *Dosinia exoleta* are found. The different distribution of these groups may be influenced by light, current, temperature and salinity, but the influence of these factors has not yet been investigated.

Miss VAN DER BAAN continued her research into the composition of the macro-plankton in the surface water near the Texel lightship. The observations (now in the 4th year) assume increasing value in the course of time. In 1964 the first "ephyrae" of *Cyanea lamarckii*, the blue *Cyanea*, were found on 5 December. In the previous years this date fell between 16 and 21 November, they were thus late. The water temperature on that particular day was 8.8°, in the previous years it was 8.9°, 9.8° and 11.4° C resp. In the end of 1964 and the beginning of 1965 the animals were even more numerous than in previous years. The last "ephyrae" were observed on 16 and 28 April. In other years this date varied between the beginning of March and mid-May. Therefore strobilation takes place between the latter half of November until March or May at the utmost, in the coldest period of the year.

The medusae of this species produced in winter and spring are colourless to light blue, the blue animals appearing later in the year. ÖSTERGREN supposed that the blue colour might arise at higher temperatures. It might be worth while to try to demonstrate this by experiments. Another promising subject for experimentation would be the possible connection between the temperature of the water and the sensitivity of the medusa to light. At night the very young *Cyanea* are more numerous at the surface than during the daytime; they apparently prefer low intensities of illumination. When they grow they become more heavy and it may be due to this fact that animals over 5 cm are scarce in the surface water in spring. There are observations which seem to indicate that the medusae may lie at the bottom, probably even attached to it. In June, however, medusae of every size over 1–2 cm appear suddenly, both in the surface water and washed up on the beach. It seems as if they now prefer higher quantities of illumination, which perhaps they might reach by stronger pulsations at the higher temperatures.

Aurelia aurita appeared very early in 1964, viz., from the 6th of January, while in the three previous years it appeared on 4 March, 9 March and 23 April respectively. The numbers were low; up to 22 January only 10 specimens had been caught. There was a gap till 27 February, after which animals occurred sporadically (22 specimens in all) till the end of April. Only after 4 May the numbers increased. The last ephyrae or post-ephyrae of 5 mm and below were found on 15 April 1964 against 2 April and 9 and 12 May in the previous years 1961–'63 respectively. It is interesting that there seems to be no connection in time of production of ephyrae between *Cyanea lamarckii* and *Aurelia*

TABLE I

Total catch of Beumkes in numbers (and partly in kg) per month from 24 III to 29 XII

Species	*M*	*A*	*M*	*J*	*J*	*A*	*S*	*O*	*N*	*D*	*Total*
Dasyatis pastinaca	–	–	1	–	2	11	1	–	–	–	15
Clupea harengus	4	± 170	± 250	11	–	–	4	36	27	5	± 500
Clupea sprattus	8	± 170	± 1350	± 1590	± 630	± 500	± 1100	± 1090	± 150	± 40	± 6620
Clupea sprattus (in kg)	–	± 18	± 138	± 471	± 770	± 355	± 50	± 23	–	–	
Clupea pilchardus	–	–	29	5	8	–	± 56	± 42	± 22	–	± 162
Alosa fallax	–	± 219	73	132	109	32	8	11	10	–	± 500
Engraulis encrasicholus	–	–	± 364	33	3	8	3	–	–	–	± 411
Salmo trutta	–	25	115	30	65	11	20	12	25	8	311
Osmerus eperlanus	26	31	1	1	–	–	1	25	37	9	131
Anguilla anguilla	1	12	135	217	166	129	± 262	± 260	58	3	± 1243
Belone belone	–	93	961	± 477	± 1295	± 310	± 175	–	–	–	± 3311
Gadus callarias	–	34	151	–	54	± 185	± 325	± 340	± 176	53	± 1318
Gadus luscus	–	1	–	1	3	–	–	–	–	–	5
Gadus merlangus	–	47	± 312	33	4	10	6	± 230	± 481	52	± 1175
Gadus virens	1	–	12	–	–	–	–	–	–	–	13
Gadus pollachius	–	–	–	–	7	± 64	± 344	± 581	± 315	± 134	± 1445
Gadus poutassou	–	14	± 1003	48	8	–	–	–	1	–	± 1074
Raniceps raninus	–	–	1	–	–	–	–	–	–	–	1
Onos cimbrius	–	–	–	–	–	1	–	–	–	–	1
Onos mustelus	2	7	12	20	12	27	86	129	± 138	± 117	± 550
Entelurus aequoreus	–	–	–	–	–	–	1	1	–	–	2
Syngnathus acus	–	–	4	–	3	–	1	4	–	–	12
Syngnathus rostellatus	–	–	49	30	8	1	1	–	–	–	89
Morone labrax	–	–	5	5	11	3	± 305	3	1	–	± 333
Caranx trachurus	–	–	± 394	± 535	± 1060	± 682	± 493	52	–	–	± 3215

Callionymus lyra	–	1	–	–	–	–	1	2	–	–	4
Centronotus gunnellus	–	1	–	1	–	–	–	5	–	–	7
Zoarces viviparus	9	121	± 248	±284	183	± 251	± 500	± 241	± 219	± 89	± 2145
Mugil ramada	–	32	± 180	83	11	3	± 25	± 447	12	–	± 793
Atherina presbyter	–	19	91	28	43	47	± 94	2	–	–	± 324
Gobius spec.	–	18	–	–	–	2	–	–	–	–	20
Trigla lucerna	–	–	38	84	9	–	7	1	–	–	139
Cottus scorpius	26	160	± 309	290	172	121	± 286	± 553	± 574	± 186	± 2677
Agonus cataphractus	–	10	9	–	6	–	2	19	3	1	50
Cyclopterus lumpus	1	7	5	–	2	–	9	12	8	14	58
Liparis liparis	3	–	–	–	–	–	–	–	–	18	21
Gasterosteus aculeatus	± 325	± 353	47	± 20	–	–	12	5	–	± 37	± 799
Pleuronectes platessa	15	± 108	± 238	± 887	± 848	± 1002	± 1130	± 630	± 299	± 37	± 5194
Pleuronectes flesus	58	± 555	± 1650	± 1079	± 752	± 513	± 643	± 418	± 241	27	± 5936
Pleuronectes limanda	4	± 209	± 759	± 481	± 252	± 338	± 2288	± 1248	± 433	± 176	± 6188
Pleuronectes microcephalus	–	1	–	–	–	–	–	–	–	–	1
Scophthalmus maximus	–	–	4	–	4	1	2	–	± 26	–	± 37
Scophthalmus rhombus	–	54	55	51	44	19	19	31	8	5	286
Solea solea	–	± 75	2	137	161	± 283	81	19	3	2	± 763
Portunus holsatus	–	39	15	8	–	4	15	56	2	–	139
Carcinus maenas	–	± 761	± 2650	± 3724	± 1011	± 1468	± 1894	± 2827	± 1655	± 365	± 16.355
Rhizostoma pulmo	–	–	–	–	± 1808	± 2037	± 2275	± 1147	–	–	± 7267
Cyanea capillata	–	–	29	35	± 222	62	6	–	–	1	± 355
Cyanea lamarckii	10	20	–	4	± 65	70	17	–	–	–	± 186
Chrysaora hysoscella	–	–	–	–	± 204	78	± 43	4	–	–	± 329
Sepia officinalis	–	–	–	2	–	–	–	–	–	–	2
Sepiola atlantica	–	–	1	1	2	–	–	–	–	–	4
Alloteuthis subulata	–	–	33	± 403	–	1	1	1	–	–	± 439

aurita; on the contrary: it rather seems as if retardation in one species means acceleration in the other.

In 1964 larvae of the stomatopod *Heterosquilla eusebia* were again found at the Texel lightship. A short paper on the occurrence of this species and of *Squilla desmarestii* in the southern North Sea by Miss VAN DER BAAN and Dr. HOLTHUIS will shortly appear in the Netherlands Journal of Sea Research.

Mr. VERWEY spent part of his time in the study of hourly macroplankton hauls from three different depths. It appeared from these that the vertical movements of the medusa *Rhizostoma pulmo* may be due to interaction between turbulence and light. The animals come towards the surface at night, while during the daytime they keep to or near the bottom, except during the hours of maximum current velocities.

It was also attempted to investigate the means by which *Rhizostoma* succeeds in sticking to coastal water, and counteracts transport to the open sea, but we do not know as yet how this is brought about.

Another interesting result of this macroplankton fishing at three depths is that in the winter months bottom animals such as the lugworm *Arenicola marina* and the worm *Nereis virens* were often found in surface waters. This had been found previously at the beginning of a cold spell, and WERNER (Helgol. wiss. Meeresunters. **5**, 93–102, 1954 and 355–378, 1956) found that under such circumstances many lugworms may be washed up in certain localities. The macroplankton observations indicate that those worms must have means of promoting their own transport. The case would be worth looking into.

Our fisherman BEUMKES continued his fishing from 24 March to 29 December 1964. He used two types of stake nets, viz., two "fykekommen", placed near Stuifdijk and Veerhaven from 24 III to 7 XII and from 24 IV to 29 XII respectively, and one "kom", placed near Schanser Waard from 14 IV to 2 XI. The types of nets are described in the 1961 Annual Report. The total catches by BEUMKES are tabulated in Table I. The identifications of the species of *Syngnathus* and *Ammodytes* may contain mistakes. The first and last catch of certain species in the years 1960–1964 are given in Table II.

A Table of the species brought in by fishermen (Table III) is given below. For the localities mentioned in this Table and the corresponding Tables in the foregoing Annual Reports the reader is referred to figure 1. A remarkable occurrence was the catch in 1964 of a great number (over 1200) of *Gadus poutassou*. This species was not previously known from the southern North Sea[1]. Its home is the Atlantic slope from North Norway and Iceland to the Mediterranean. It also enters Skagerrak and Catte-

[1] The specimen of *Gadus poutassou* mentioned on page 542 of the Annual Report for 1956 was found to have been wrongly identified.

TABLE II

First and last dates of catch for the years 1960–1964

Species	First dates					Last dates				
	1960	*1961*	*1962*	*1963*	*1964*	*1960*	*1961*	*1962*	*1963*	*1964*
Dasyatis pastinaca	–	26 IV	15 V	–	3 IV	–	1 IX	23 VIII	–	2 IX
Clupea pilchardus	11 V	10 V	20 V	29 IV	5 V	–	–	–	–	–
Alosa fallax	4 IV	3 IV	2 IV	16 IV	11 IV	21 XII	14 XII	16 XI	2 XII	30 XI
Engraulis encrasicholus	14 V	16 V	8 V	29 IV	1 V	6 VII	13 VI	3 XI	26 VII	14 IX
Belone belone	19 IV	18 IV	19 IV	25 IV	20 IV	3 IX	14 X	24 X	2 X	24 IX
Caranx trachurus	13 V	28 IV	29 V	23 V	6 V	26 X	16 X	3 XI	18 X	14 X
Mugil ramada	13 IV	25 III	4 IV	22 IV	17 IV	6 XII	15 XII	23 XI	29 XI	23 XI
Atherina presbyter	9 IV	25 III	16 IV	4 V	22 IV	4 X	30 X	15 X	14 X	16 X

Species	Locality
Migrants supposed to have entered the North Sea through Dover Strait.	
Petromyzon marinus	60°30′ N., 2°55′ E.; ferry harbour, Den Helder
Raja montagui	Silver Pit, Botney Gut, east of Cleaver Bank, w of Borkum Ston Black Bank, n of lightship Terschelling, near buoys P3, P4, ST3, ST S2, ET4, JE 12–13, Texel Hole, near Texel lightship, Westg near den Helder, Brokenbank (about 53°20′ N., 2°10′ E.)
Raja naevus	Silverpit, Botney Gut, Markhams Hole, West Hole, Tea Ket Hole, buoy ST4–5
Dasyatis pastinaca	Off Callantsoog, off Texel Hors (fyke Onrust)
Acipenser sturio	Silver Pit
Gadus poutassou	Off Callantsoog, several places Marsdiep inlet, fykes harbour D Helder and south Texel (Onrust), Waddensea: Vliestroom, Vlie
Merluccius merluccius	Off Callantsoog
Onos tricirratus	Black Bank, Texel Hole
Spondyliosoma cantharus	Near buoys ST3 and 4, Texel Hole, near Texel lightship
Atherina presbyter	Fykes harbour, Den Helder
Trigla cuculus	Black Bank, n of ET6, JE 12–13, Tea Kettle Hole, w of Bro Bank, off Terschelling, w of Texel lightship, Texel Hole, outsi Haaks Grounds
Trigla lineata	Silver Pit, w of Borkum Stones, ET–ST, n of buoy P1, near P2 a S2, Texel Hole, near Texel lightship, off Haaks Grounds, Callantsoog
Solea lascaris	West Hole, Tea Kettle Hole, Texel Hole
Sepia officinalis	Off Petten, off Callantsoog, around Texel Hole, off Haaks Groun near Texel lightship, fyke ferry harbour Den Helder
Crepidula fornicata	Northeast of buoy ST3
Portunus depurator	Botney Gut, s of Botney Gut, Markhams Hole, near buoys P and 4, ST3 and 4, Borkum Stones, Texel Hole
Migrants supposed to have entered the North Sea around Scotland	
Selache maxima	N of Texel Hole
Torpedo nobiliana	N of Texel Hole
Ommatostrephes sagittatus	Beach south of Huisduinen, fyke seadike Den Helder
Species considered little common in the southern part of the North Sea	
Raja radiata	Botney Gut, near buoy S2
Raja batis	Tea Kettle Hole, off Callantsoog
Onos cimbrius	W of Borkum Stones, near buoys P2, P3 and P4, w of ST3, off Koog (Texel)
Macrorhamphosis scolopax	60°30′ N., 3°35′ E. Two others were brought in at IJmuiden: from about 60 ° N. and 2° E. on March 7, one from unknown loca
Pleuronectes microcephalus	S of Tea Kettle Hole, w of Borkum Stones, near buoys P3 and Texel Hole, off Petten
Chimaera monstrosa	57°45′ N., 6°15′ E.
Eledone cirrhosa	West Hole, n of Brown Bank, Tea Kettle Hole, w of P1, P2– near buoys ST2 and 3, ridge of Terschelling, Texel Hole
Colus gracilis	Silver Pit, w of ST 3
Aporrhais pespelecani	Near buoys P3, S2, ST 1
Thracia convexa	29 II w of Borkum Stones, 22 fath., living specimen
Tritonia hombergii	Stony ground of Cleaver Bank
Nephrops norvegicus	Silver Pit, Pit buoy, Botney Gut, w of Borkum Stones, near bu P2, P3 and ST 3, Texel hole
Ebalia cranchii	W of Borkum Stones, northeast of buoy P3

Numbers per month												
J	F	M	A	M	J	J	A	S	O	N	D	Total
–	–	–	–	1	–	–	–	–	–	1	–	2
4	1	–	1	14	–	–	–	–	–	–	4	24
2	–	–	–	–	–	–	–	–	2	1	1	6
–	–	–	–	1	1	–	1	2	–	–	–	5
1		–	–	–	–	–	–	–	–	–	–	1
–	–	–	5	187	67	6	1	–	2	2	–	270
–	–	–	–	1	1	–	–	–	–	–	–	2
–	–	–	–	–	–	–	–	–	–	2	–	2
	–	–	–	–	–	3	2	–	–	1	1	8
–	–	–	–	2	8	–	–	–	–	–	–	10
	–	–	–	7	3	52	1	–	–	–	–	63
	3	2	–	3	3	1	–	–	–	–	–	15
	5	–	–	–	1	–	–	–	–	–	–	7
	–	–	–	20	9	–	1	1	2	–	–	33
			–	–	–	–	–	–	–	1	1	2
	6	8	7	–	2	–	5	14	6	–	24	78
	–	–	–	–	–	–	–	–	1	–	–	1
	–	–	–	–	–	–	–	–	1	–	–	1
	–	1	1	–	–	–	–	–	–	–	–	2
	–	–	1	–	–	–	1	–	–	–	–	2
	–	1	–	1	–	–		–	–	–	–	2
	15	8	–	–	–	–	–	–	–	–	1	29
	–	1	–	–	–	–	–	–	–	–	–	1
	5	1	–	–	–	1	3	–	–	–	2	14
	–	–	–	–	–	–	–	–	–	1	–	1
	7	11	15	6	2	–	–	–	7	1	5	60
	–	–	–	–	2	–	–	–	4	–	–	6
	–	2	4	–	–	–	–	–	–	–	–	6
	1	–	–	–	–	–	–	–	–	–	–	1
	–	9	–	–	–	–	–	–	–	–	–	9
	25	191	250	–	2	–	19	4	± 293	354	20	± 1273
	1	2	–	–	–	–	–	–	–	–	–	3

gat. The first specimens were caught near Den Helder in April, followed by large numbers in May and June. Single specimens were caught up till November. All animals were young, probably from spring or summer 1963. In the course of summer a strong increase in size took place, the animals probably feeding on small fishes of the herring group. During the daytime they were found near the bottom, at midnight they occurred at higher levels, up to the surface. It looks as if they prefer a low light intensity, as is the case with many species from the open sea. A strong influx of Atlantic water well into the southern North Sea may have occur-

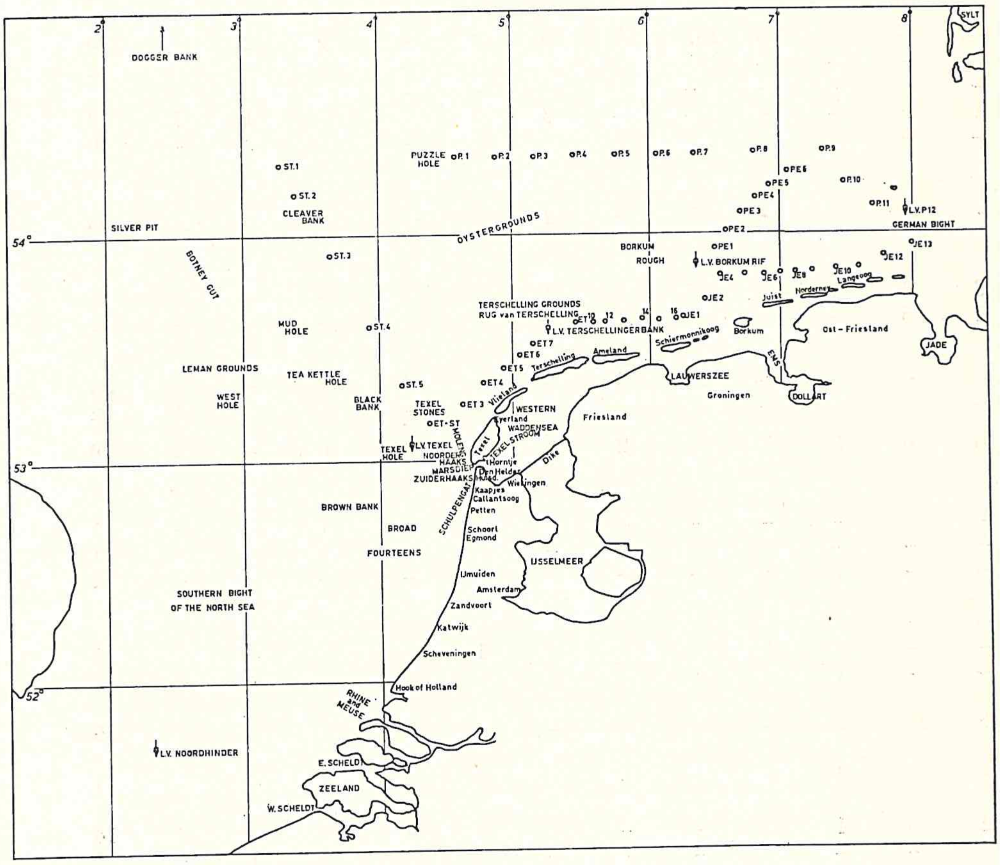

Fig. 1. Map of the southern part of the North Sea, with the chief localities mentioned in the lists of migrants received from fisherman. The letters of the buoys denoting safe fairways have the following meaning: P = Pitbuoys; St = Buoys along the Silverpit-Texel route; ET = Elbe to Texel; JE = Jade to Elbe; PE = Pit to Elbe.

red, which made it possible for the animals to enter. It is remarkable that the animals were chiefly caught within the Wadden Sea, even quite near to the Afsluitdijk. It looks as if lower salinities were less important to the species than high temperatures, a fact which is surprising for a species from the Atlantic slope.

Starting from 1964 the radioactivity department succeeded in employing a biologist: Mr. J. H. VOSJAN from Utrecht. After his appointment he first attended a course given by the ITAL, the Institute for Atomic Energy in Agriculture at Wageningen. This agricultural training course included, apart from practical work, a number of lectures on nuclear energy and its applications in agriculture and biology. Mr. VOSJAN then worked from March to the end of the year under supervision of Mr. J.A.G.DAVIDS in the Netherlands Reactor Centre at Petten, where special attention was paid to the accumulation of the fission product Yttrium-91 by the red alga *Porphyra*, and to the effect of ethylene diamine-tetra-acetic acid (EDTA) on this accumulation. EDTA is of interest as a chelator, i.e., it forms a soluble compound with metals. It might be possible to use EDTA to keep metals dissolved in sea water, which might be important in diluting radioactive waste discharged into the sea. It appeared from the experiments that in a concentration of 10^{-2}M EDTA the adsorption of Yttrium to *Porphyra* was considerably reduced, probably because an easily soluble Y-EDTA complex had been formed.

The problem is whether this effect of EDTA may also be found with physiologically more important elements than Yttrium and whether in this case too there is a decreased intake. In this connection it is of importance that R.JOHNSTON (J. Mar. biol. Ass. U.K. **44**, 87–109, 1964) found a greater production of living matter in algae by adding EDTA to sea water. Evidently, the plant profits somehow from the elements kept in solution by EDTA, in so far as these may have a physiological significance.

In further research special attention will be paid to the mucous layer of *Porphyra*, which can easily bind cations to its SO_4-groups resulting from the acid muco-polysaccharides. It will be investigated whether the accumulation-coefficients of *Porphyra* for various elements are connected with the affinity of the mucous layer for the same.

In 1964 Mr. DUURSMA continued his research into the kinetic phenomena of diffusion and sorption of the main cations, such as Fe, Mn, Ca, Co, Ni and Zn. The mathematical treatment of a number of models of molecular diffusion, diffusion plus adsorption, and adsorption plus absorption, was completed. The calculations of the models of adsorption and absorption were carried out by Mr. C. HOEDE of the Mathematical Centre, Amsterdam. Formulae were derived, enabling the determination of diffusion rates from measurements concerning the total amount of absorbed material under conditions of constant concentration in the boundary layer.

As a supplement to this theoretical work some additional experiments were carried out, in which conditions were similar to the marginal conditions in the theoretical models. The main experiment concerned the diffusion of ions into a sediment from a thin layer of water flowing over it. The experiment was staged by means of a set of connected flumes each 15 m long, with a diameter of 25 by 25 cm. Two tanks, each of 3.5 m^3, supplied the sea water and the ions added to it: Zn^{++}, Co^{++} and SO_4^{--}. The flumes were provided with a layer of about 8 cm of sand from the tidal flats; the layer of water was kept at 3 cm. The water circulated through the flume at a rate of 1 cm per second. The determinations demonstrated the decrease of ions in the water and the increase in the sediment over a certain time. This experiment was set up after a similar construction at the Institute for Atomic Energy, at Kjeller, Norway, where the intake of radionucleids by river clay was studied.

A preliminary investigation was carried out to study the uptake of Zn-65 by both organic and inorganic matter suspended in water. The idea is to carry out research throughout the year at a certain number of stations.

The theoretical considerations and their application, together with the mathematical calculations and a description of the chemical methods, will appear in the Netherlands Journal of Sea Research.

Mr. POSTMA and Mr. ROMMETS continued their production measurements according to the C-14 method in the Wadden area, which were started in 1963. A complete annual cycle was finished in the Texel inlet. Here the so-called primary production, measured by phytoplankton, fluctuates between 5 mg under a square meter per day in December–January and about 1000 mg in June. This production is limited to the uppermost 5 m of the column of water. Farther inward, halfway between the inlet and Den Oever, the production in June does not surpass 350 mg under a m^2 per day. These differences are mainly caused by a different amount of illumination due to different turbidity. For this reason the observations in 1965 will be extended farther up the Waddensea, where the concentration of suspended matter increases.

Miss C.J. BOSCH continued the laboratory research on conditions governing the churning up of bottom sediment by currents. This work has already been described in the previous annual report. Moreover, she carried out research on the amount of organic carbon and nitrogen in bottom samples from the Wadden Sea. This investigation is designed to gain some idea about the connection between the amount of organic matter and the grainsize of sand from the sediment. The relation between carbon and nitrogen gives some indication on the composition of organic matter.

At the end of November Mr. ROMMETS departed for a voyage of two months with H. Neth. M.S. "Snellius", surveying vessel of the Royal Dutch Navy, especially fitted as an oceanographic research-vessel for this journey. The ship partakes in an international program over a great part of the Atlantic. Besides assisting in this work Mr. ROMMETS took watersamples in two east-west sections of the Atlantic between the African westcoast and the Caribbean area. The samples will be analysed for dissolved organic matter. This research is carried out in consultation with Mr. DUURSMA and Mr. POSTMA. The technique, originally developed by Mr. DUURSMA, was supplemented, again in consultation with Mr. DUURSMA, by a determination developed by MENZEL and VACCARO (Woods Hole Oceanographic Institution).

Mr. TAN, who after his appointment in September 1963 spent some months in research on sulphur compounds in Wadden Sea sediments, gave up this work and started in 1964 on an investigation on the nature of the components which enable the elver to distinguish between ebb and flood, thus permitting the animals to enter inland waters in spring. Together with Miss Smit and with the help of the Department for Chemical Engineering of the Technological University, Delft, he devoted much time to the evaporation of IJsselmeer-water at low temperatures to obtain the attracting substance in a concentrated form. It is very likely that a fraction can be isolated from the water, which attracts the young eel at the elver stage. At the same time it appeared that after a certain time the elver does not react to this isolated factor anymore, although the reaction to IJsselmeer-water remains the same as before.

In 1964 Mr. EISMA continued his research into composition, origin and distribution of the Netherlands coastal sands. Up to May 1964 the analytical work was carried out by Miss A. M. M. ENGELHART, after that time by Miss Y. BOSCH.

In the previous Annual Report it was stated that the feldspar content of the sand forms a better indication for its origin than the iron content and that the iron content in the coating of the sand grains with the same feldspar content may differ two or three times.

The determination of the feldspar content in sands from bore-holes was continued and completed in 1964. The results gave an impression of the origin of the two different kinds of sand occurring along the Dutch coast: the southern and the northern kind.

The investigations last year on trace-elements occurring in the iron-film on sandgrains was continued by the Reactor Centre Petten by means of activation-analysis. This work was practically completed at the end of 1964. It shows that sands of different origin show a different content of Fe, Mn, Co, Al and Na. It has not yet been possible to prove that iron precipitates in the sea along our coast. The results will be published by Mr. DAS and Mr. VAN RAAPHORST of the R.C.N., and by Mr. EISMA.

The analytical method used to estimate the trace elements in sand after a few modifications turned out to be also applicable to shells. Following up the research on the influence of salinity on the numbers of ribs and the weight of *Cardium*-shells this method was used to start the analysis of a number of shells of *Cardium edule* from water with different salinities. At the same time Mr. MANUELS, who entered the service of the Institute in July 1964, started developing methods of analysis to determine Mg, Sr, phosphate, sulphate and nitrate in shells. In this way Mr. EISMA hopes to find a connection between salinity and the content of trace elements in shells.

Moreover, the mineralogical composition of shells of *Cardium edule*, *Mya arenaria*, *Macoma balthica* and *Mytilus edulis* from water of different salinity was determined by X-ray analysis. This was due to the co-operation of Dr. H. W. VAN DER MAREL of the laboratory of the Soil Survey Institute at Ede. Contrary to the results of DODD for the West coast of the U.S.A. (J. geol., Univ. Chicago, **74**, 85–89, 1966) it appeared that *Cardium edule*, *Mya arenaria* and *Macoma balthica* do not show any difference in mineralogical composition due to different salinities, and that the same holds for *Mytilus edulis*.

At the same laboratory at Ede the mineralogical composition of the iron-containing coating of some sandgrains from the Dutch coast was determined by Röntgen analysis. These data supplement the research by activation analysis carried out at Petten. Nothing can be said as yet about the results.

For a number of sands electron-micrographs and electrondiffraction spectra were also made of the coatings on the grains. This was done in the laboratory of the Forschungsanstalt für Landwirtschaft at Braunschweig–Völkenrode. In this way supplementary data on the mineralogical composition as found by Röntgen-analysis were obtained.

In order to understand the distribution of sediments along a greater part of the Dutch coast than had been investigated before a number of bottom samples were collected along transects perpendicular to the coastline between Hoek van Holland and the island of Ameland, up to about 25 miles offshore. The transects were about 10 miles apart, while the bottom samples were taken at a distance of $\frac{1}{4}$ to $\frac{1}{2}$ sea miles. The bottom animals, especially the molluscs collected during this work, were already mentioned. The data on the sand samples will appear in Mr. EISMA's thesis.

In 1964 Mr. WESTENBERG devoted much time to the historical geography of the western Wadden Sea. Unfortunately, the birth of the Zuiderzee happened before any maps of this area were made, and written data on this subject are extremely scarce. In the past year the search for historical facts was limited to data pertaining to the area west of the Vlie.

II. NON-SCIENTIFIC PART

The year 1964 brought the projects for the new building, which is to be built at 't Horntje on Texel next to the ferry harbour, in a more definite stage. A fair amount of time was spent by various members of the staff of the Institute in consultation on the allocation of the room and aquarium space in the new building. The design was practically completed at the end of the year. It is high time considering the fact that the building at Den Helder is progressively becoming more and more crowded, despite the completion in 1964 of an annex with four rooms, which houses 7–8 people.

The private harbour was completed. The mole bordering the harbour at the side of the Wadden Sea was substantially lengthened in 1964, when, during a northeastern gale, combined with abnormally low water, it appeared that disturbance of the local tidal flats might easily lead to silting up of the entrance gulley of the harbour. Due to the construction of the harbour the deeper sea bottom next to the harbour is also exposed to attacks by currents; Rijkswaterstaat has therefore extended the bottom protection outside the harbour.

The pontoon and bridge of the ferry Gorinchem-Sleeswijk, bought in 1963 to serve as a landing-stage, underwent an overhaul in 1964, when a number of alterations were carried out. In December they were towed to Den Helder to be fastened to the landing jetty in 1965.

For the *f* 100,000, which the Ministry put at our disposal to buy houses or building sites, a few building plots and cottages were bought, while in the middle of 1965 five houses in the new housing centre 't Horntje will become available to the Institute.

The new vessel, Ephyra, made 140 navigation days. After a year it is now possible to say something about the exploitation-costs of the ship. Of the 260 working days per year the ship was in use for more than half of the available time. The remaining 120 working days were not used because of bad weather, upkeep and repair, holidays of the crew or the restitution of overtime in the form of extra holidays. The expenditure on behalf of the ship in fact weigh on the above 140 days, which presumably will not be much exceeded in future. The costs amount to *f* 55,851 for salaries and charges of social securities and *f* 19,720 for running the ship, i.e., a total of *f* 75,571 in all. This means that every navigation day costs *f* 540, or *f* 290 if it is worked out for the 260 working days in a year. The costs of value-depreciation has not been included in this sum. It is clear that even for such a small vessel the costs are very high.

In 1964 the watertender supplied a total of 5800 m^3 in 61 days; this corresponds to 95 m^3 a day.

The motorflat Griend was in use on 102 days for various purposes.

The motorflat of the fisherman BEUMKES is now nearly 29 years old and should be replaced. In the budget for 1966 allowance has been made for the construction of a new flat.

There were some changes in staff, due to the following people leaving:

G.S.M. VAN ULDEN, administrative employee, 15 February
Miss A.M.M. ENGELHART, analyst, 31 May
Miss G. DIJKSTRA, laboratory aid, 15 June
Miss C.H. VAN DER AA, Typist, 17 August
Miss G.H. BAARD, analyst, 1 December
Miss D.F. VAN DEN BERG, apprentice-analyst, 16 December

Moreover, P. DE BOER, laboratory-aid, left on 8 April to do his military service.

For a short period the following people were temporarily employed:
A.G. SMIT, laboratory aid, from 1 April to 1 October
Mrs. EPHRAIM-WEYDEMA, typist, from 16 April to 1 July
Mrs. C.C.M.J. VAN DER JAGT-VINKEN, typist, from 17 August, 1964, to 27 January, 1965.

Newly appointed were:

D. EISMA, physical geographer, starting from 1 January. Since the end of 1961 Mr. EISMA worked with the Institute for account of the Netherlands Organization for the Advancement of Pure Research (Z.W.O.)
TH.G. MENTING, manager, also on 1 January
Miss E. SMIT, apprentice-analyst, on the same date
J.H. VOSJAN, physiologist with the radioactivity research, on the same date
W. HART, laboratory aid, 13 April
J. ZIPP, carpenter, 15 April
Miss Y. BOSCH, apprentice-analyst, 1 July
M.W. MANUELS, apprentice-analyst, on the same date
R.J.R. ANTHONYSZ, servicing mechanic, 15 July
Miss J. DEN HARTOG, apprentice-analyst, 1 October
C. SWENNEN, biologist, 16 November

Dr. F. CREUTZBERG on 17 June left for Curaçao, where for three years he became director of the Caribbean Marine Biological Institute in the place of Dr. I. KRISTENSEN. Mr. KRISTENSEN left Curaçao shortly after the arrival of Mr. CREUTZBERG, and, after a stay at Naples, he entered the service of the Institute on 1 October. Previously, he had already served the Institute for 10 years (1946–1956).

These many changes resulted in an overall increase in 1964 of 7 people. It is no wonder that the Institute now has a great lack of space. The extension of staff is, however, necessary in order to fill up the new Institute in 1970.

Mr. POSTMA attended the Conference on Estuaries held in Jekyll Island (Georgia) from 31 March to 5 April. He had been invited to give a survey on problems of sedimentation. Afterwards he spent some days at the Oceanographic Institute of the University of Miami, Florida. He moreover was one of the dutch representatives at the third meeting of the Intergovernmental Oceanographic Committee, held in Paris from 10 to 19 June. Mr. DUURSMA paid a short visit to the Atomic Centre of Mol in Belgium. Mr. KRISTENSEN attended the meeting of SCOR (Special Committee on Oceanic Research), held in Hamburg from 30 November to 4 December, including a symposion on the influences of climatic fluctuations on the marine fauna. From 20 July to 28 July Mr. EISMA attended the 20th International Geographic Congress in London. From 1 February to 1 May Mr. FONDS took part in the survey off the Gold Coast of Africa by the Guinea Trawling Survey, organized by the Bureau for International Technical Assistance. From 25 May to 10 June Mr. DRAL was in Cambridge (England) to investigate the movements of the cilia of the pumping and food-retention mechanism of the mussel with the aid of the solid image microscope designed by Dr. R. L. GREGORY of the Department of Psychology. From 15 July to 15 August Miss C. J. BOSCH took part in the research by Mrs. M. BRONGERSMA-SANDERS in the Ria de Arosa on the Spanish coast.

Besides these visits abroad there were intensive contacts, both at home and abroad, promoted by the activity of various research workers. The fortnightly colloquia also promoted this kind of contact. The presence of the T.N.O. laboratory on fouling research moreover promoted the total activity to a great extent.

Mr. MENTING, the manager, spent the year in getting gradually conversant with the Institute, its administration and finances, assisted by Mr. GOSLINGA for matters of personnel. This is going to relieve the director(s) of the Institute of an important part of their task.

In 1964 the Institute received the following visitors from abroad: Dr. GEZA ENTZ, Biological Institute, Tihany, Hungary; Mr. C. GROOT, Biological Station, Nanaimo, B.C., Canada; Prof. JUN-ICHI IWAI, Tohoku University, Sendai, Japan; Prof. H. KLEEREKOPER, McMaster University, Hamilton (Ont.), Canada; Mr. and Mrs. G. & N. MACGINITIE, Friday Harbor, Washington, U.S.A.; Dr. E.S. MACKAY, Lander (Wyo), U.S.A.; Miss KAREN TUOCK, Botanisches Institut, Bonn (West Germany).

Besides the ecological course, given in duplicate in June-July, a hydrographical course was given in September by the hydrographical department of the Institute. The first ecological course was attended by 14 biological students and 1 post-graduate participant, the second by 18 biological students. The hydrographical course was attended by 19 students, viz., 8 geologists, 4 geophysicists, 3 physicists, 2 biochemists, 1 mathematician and 1 biologist. In 1964 the courses lasted a week instead of 10 days. Besides, the Laboratory for Animal Physiology of the Municipal University, Amsterdam, ran courses for its own students from 23 to 26 March and from 31 March to 4 April respectively. These courses were attended by 17 and 18 students, respectively.

Only two students came to Den Helder for research: Miss M. MAAS, Leiden, and Miss H. VAN HEUSDEN, Utrecht. What has been said about this question in the previous annual report still holds. When looking at the problems and possibilities which Den Helder can now offer — except for the lack of room—it seems inconceivable that the number of students coming to Den Helder for a doctoral subject should be so small.

The number of man-days worked at Den Helder by people from outside the Institute was 639, against 1080 in 1963, 1761 in 1962 and an average of 1162 for the years 1947–1963.

Just as in previous years a considerable number of new instruments were bought in 1964, of which the most important are the second half of a Coleman nitrogen and carbon determination apparatus, a Cepa high speed centrifuge, and 27 reversing thermometers. The instrument makers built a Reineck box sampler for the geologist, and furthermore worked at an underwater photometer and completed a test specimen of a buoy with possibilities for registering turbidity, temperature and salinity. The workshop itself got a ribbon saw and a filing machine for metal and plastic.

The library was substantially extended again. Apart from the more than 600 periodicals that are now being received in return for the Archives Néerlandaises de Zoologie and the Netherlands Journal of Sea Research, and a small number of subscriptions to abstracting and other journals, another part of the Discovery Reports was bought as well as a great number of books on biological, chemical and oceanographic subjects, totalling about *f* 4,000.—.

Of the two issues of the Netherlands Journal of Sea Research planned