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Immigration, dissemination and ecology of *Elminius modestus* Darwin in the North Sea, especially along the Dutch Coast

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INTRODUCTION.

In 1947, BISHOP was the first to pay attention to the occurrence of the barnacle *Elminius modestus* DARWIN in British waters. This barnacle, which is a native of the coasts of southern and eastern Australia and New Zealand, i.e. of the temperate seas of the southern hemisphere, had been found by him in great quantities on test-panels in Chichester Harbour in July 1945. Soon after, several other records were published. CRISP and CHIPPERFIELD (1948) mentioned a number of localities; *Elminius modestus* appeared to be already widely distributed along the British coast (see fig. 1). STUBBINGS (1950) had the disposal of data of 1944 and from the size of the collected specimens he concluded, that *Elminius* must have occurred in Portsmouth as early as 1943. According to KNIGHT-JONES (1948), *Elminius* had by then become a pest in the oysterbeds off Essex. BOSCHMA (1948) recorded the barnacle from the Dutch coast where it had first been found in 1946.

Meanwhile, *Elminius modestus* has enlarged its area considerably, in the British waters as well as along the continental coast. This paper will chiefly deal with the immigration, the dissemination and the habitat of *Elminius modestus* along the continental coast.

IMMIGRATION INTO ENGLAND.

It is very likely indeed that *Elminius modestus* arrived in England on a ship's bottom. In no other way this barnacle can possibly have crossed the unsuitable tropics in such a short time. BISHOP (1947) also supposed that the barnacle had been introduced on a ship's hull. He wrote about this subject:

"It seems likely that *Elminius* has been carried from its native coasts to the south coast of Britain as fouling on a ship, and being a temperate water species, has been able to establish itself. This theory is supported by the occurrence in October 1946 of this species on the hull of the M.V. Waipawa at Liverpool, after service in southern Australia and New Zea-

*) Received January 9, 1953.

land. These specimens of *Elminius modestus*, associated with *Balanus amphitrite* DARWIN and *Balanus trigonus* DARWIN, were living in good condition, and fully grown (9 mm carino-rostral diameter), but the gonads were in a very early stage of development. All three species had successfully survived a fast passage at 17 knots for 30 days, via the freshwater lakes of the Panama Canal."

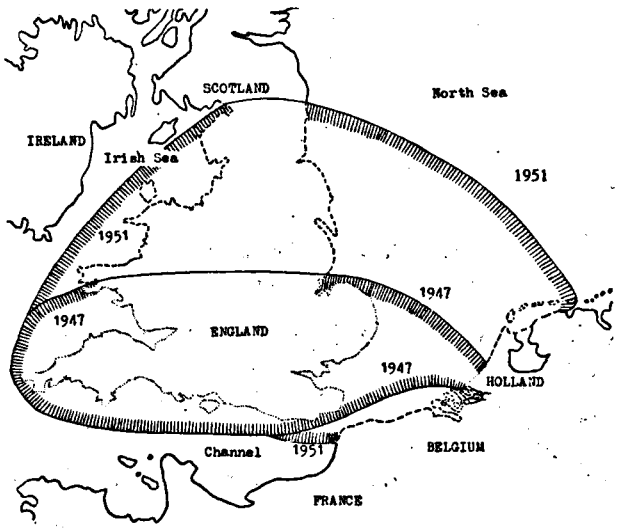

Fig. 1. Distribution of *Elminius modestus* DARWIN in western Europe in 1947 and 1951.

The occurrence of living *Elminius modestus* on the M.V. Waipawa demonstrates that this species can be spread by ships. However, there is not the slightest evidence for LEENHOUTS' (1948) and BLOKLANDER's (1949) conclusion that the species was imported by this particular ship. The little developed gonads even plead against this conception, as well as the occurence of *Elminius* in Portsmouth as early as 1943 (STUBBINGS, 1950).

When and where *Elminius modestus* first established itself we do not know, the species having been discovered too late. That will be evident from the first records:

Portsmouth; V-1944, 2 specimens (STUBBINGS, 1950).

Chichester Harbour, Sussex, VII-1944 (STUBBINGS, 1950); VII-1945, abundant (BISHOP, 1947).

N. Fambridge, Essex, X-1945, abundant (CRISP & CHIPPERFIELD, 1948).

So, in 1945 already, the species had a wide distribution along the English southern and eastern coast. CRISP and CHIPPERFIELD (1948) concluded from their data:

> "The present distribution of *Elminius* does not indicate clearly a recent dissemination from one or more centres, but appears to be that of a well-established species."

Since the records of CRISP and CHIPPERFIELD (1948) no papers have been published about further dissemination of the barnacle along the

British coast. Only CRISP and MOLESWORTH (1951) mentioned the two most northern localities : Blyth Estuary, Northumberland and the Solway and Loch Ryan in Scotland. In figure 1 we clearly see with what a forwardness *Elminius* has conquered the British waters.

IMMIGRATION INTO HOLLAND.

The first *Elminius modestus,* living on the Netherlands' coast, were recorded from the environs of the Hague in 1946 :

Wassenaarse Slag, 19-X-1946, leg. LUCAS and LEENHOUTS.

Loosduinen-Kijkduin, 8-XII-1946, leg. VAN DER MEULEN. (BOSCHMA, 1948).

The first record referred to one specimen. In the second locality the species occurred in great quantities. The largest specimen measured 8 mm carino-rostral diameter.

This establishment of *Elminius modestus* in the Dutch waters no doubt took place from England. Whereas this barnacle, for its migration from the southern hemisphere to England could only be carried by ship's bottoms, it might bridge over the shorter distances in the European waters in other ways also. Transport may take place with drifting objects, for example detached seaweeds, bunches of cork, wood, etc. The flotsam from the Channel is carried by the current in north-eastern direction far northwards. Several typically southern species occur on this material, for instance the algae *Gastroclonium ovale.* (HUDS.) KÜTZ., *Antithamnionella sarniensis* LYLE, *Cystoseira fibrosa.* (HUDS.) AG., the barnacle *Balanus perforatus* BRUG., the crinoid *Antedon bifida* (PENN.), etc. On this drifting jetsam *Elminius modestus* had been washed ashore ever since 1946 along the whole Dutch coast. These were almost always small specimens, in which the gonads were little developed. These animals are too young to spawn. When drifted ashore they soon die, being covered by sand or dried out. This explains why no simultaneous establishment along the whole coast followed (see also fig. 2); it is, indeed, unlikely that the species was immigrated to Holland by drifting objects.

As the enlargement of the area of the barnacle during the establishment in new territories takes place only by the planctonic larvae, it is possible that these larvae have moved from Britain to the continental coast. It is not probable, however, that the species in this manner has bridged over the distance of ca. 200 km between England and the Hague, whereas establishment of *Elminius* on the French coast, which lies nearer to Britain, had failed. **) The currents in the southern North Sea and the Channel are not favourable either for the larvae to reach the continental coast in a short time.

Carriage on a ship's hull is the last possibility. There remains one difficulty however : the gonads in the specimens on these hulls are little developed. Apparently the frequent navigation between the coasts of Britain, France, Belgium and Holland has helped *Elminius* to cross the sea to Holland only. According to KNIGHT-JONES and DUNCAN WAUGH (1949), who studied the larvae of *Elminius,* nauplii of the first stage

**) I am indebted to Prof. Dr P. DRACH, who informed me that he found *Elminius modestus* in several spots in the tidal zone of Roscoff (Brittany) in 1952. This indicates an additional immigration-centre on the French coast, as the species can not be supposed to have radiated from the Dutch centre as far as that.

were liberated by adults which had lived undisturbed for several days in a tank the water of which was being stirred continually. The nearest environment of navigating vessels is certainly not undisturbed and will be very unfavourable to the barnacles liberating their nauplii. Dispersal by means of a ship's hull is possible only in the case of a ship, which is infected by *Elminius* remaining in the same harbour for a long time. Then the gonads can develop and the nauplii can be liberated.

Everything points to *Elminius* having been introduced into Holland by a vessel. The first specimens were found close to the north of the Nieuwe Waterweg, the entrance to the docks of Rotterdam, where navigation is very busy. It is probable that *Elminius* first settled at Hook of Holland in 1945. It is a pity that the first observations are to scarce for ascertaining exactly the immigration centre.

DISSEMINATION ALONG THE CONTINENTAL COAST.

Since *Elminius* has established itself on the Dutch coast the species has extended its area considerable (fig. 2). During the first few years, this extension proceeded slowly. In 1947, the area was evidently enlarged a little only. This must be due to the very cold and protracted winter 1946—47 causing the seawater to be very cold in spring. Another cause no doubt will be the little number of specimens, living on the Dutch coast. Nevertheless it was obvious that *Elminius* had gloriously survived the rigorous winter.

Only after 1947 the rapid dissemination of the barnacle began, in northern as well as in southern direction. In 1948 the first specimens were found in the island of Schouwen by SWENNEN, while on the moles of IJmuiden a mass-population established itself, according to STOCK. The next year, *Elminius* settled down on the Hondsbosse Zeewering near Petten and on the breakwaters of Camperduin and Callantsoog. To the south, however, the species spreaded much more rapidly in 1949. KORRINGA recorded *Elminius* from the basin of the Oosterschelde and from the Zandkreek, while the species settled also in the island of Walcheren, near Vlissingen and Domburg. Furtheron, the barnacle had passed the Belgian border and reached the mole of Zeebrugge. In 1950 *Elminius* was very common in the waters of the whole province of Zeeland. Numerous localities were noted along the Oosterschelde as well as on the dikes of the Westerschelde. The dissemination along the Belgian coast could not be followed further. ***)

Also on the northern border of its area, *Elminius* made progress in 1950. The first specimens were discovered near Den Helder and near Oude Schild in the island of Texel. This ushered in a new phase, viz. the conquest of the Waddenzee. In 1951 it was obvious that the barnacle had enlarged its area in this estuarine territory very considerably. In the island of Texel it was rather common, according to LUCAS, while it was recorded from the island of Terschelling by SCHROEVERS. The eastern-

***) After the manuscript had been closed, a publication on the occurrence of *Elminius* in Belgium appeared: E. LELOUP and S. LEFEVERE. Sur la présence dans les eaux de la côte belge du Cirripède, *Elminius modestus* DARWIN, 1854, etc. Bull. Inst. roy. Sci. nat. Belg. vol. XXVIII no. 48, p. 1—6, fig. 1—6, Pl. I fig. 1—2, 1952. A list of localities is given together with some ecological notes, no new points of view on the dissemination of the species, however.

most locality reached by *Elminius* in that year is the island of Schiermonnikoog, where its occurrence had been ascertained by the author. On the Frisian coast a few specimens settled down.

The southern front of the area of distribution had passed the French border in 1950. BISHOP informed me that he found it near Wimereux (Pas de Calais) in September of that year. In July 1951 we observed *Elminius* in a few specimens in different localities between Cap Griz Nez and Le Portel, near Boulogne sur Mer. At present Le Portel is the southernmost locality on the continental coast, known to me. (See the foot-note on p. 3).

It is interesting to note that *Elminius* has spread much more rapidly in southern direction than northwards. I had espected that dissemination in northern direction would be more rapid, because the resultant direction of the tidal currents is northward. The planctonic larvae should be carried bij this current in northern direction. My observations show, however, the reverse to be the case. CRISP wrote to me, that the exposure of the coast perhaps comes in here. As, however, the coasts of Belgium and Holland do not differ in this respect, both being rather sheltered, the exposure can not be a factor in explaining the difference. In England, where the differences in exposure are often very great, this is most

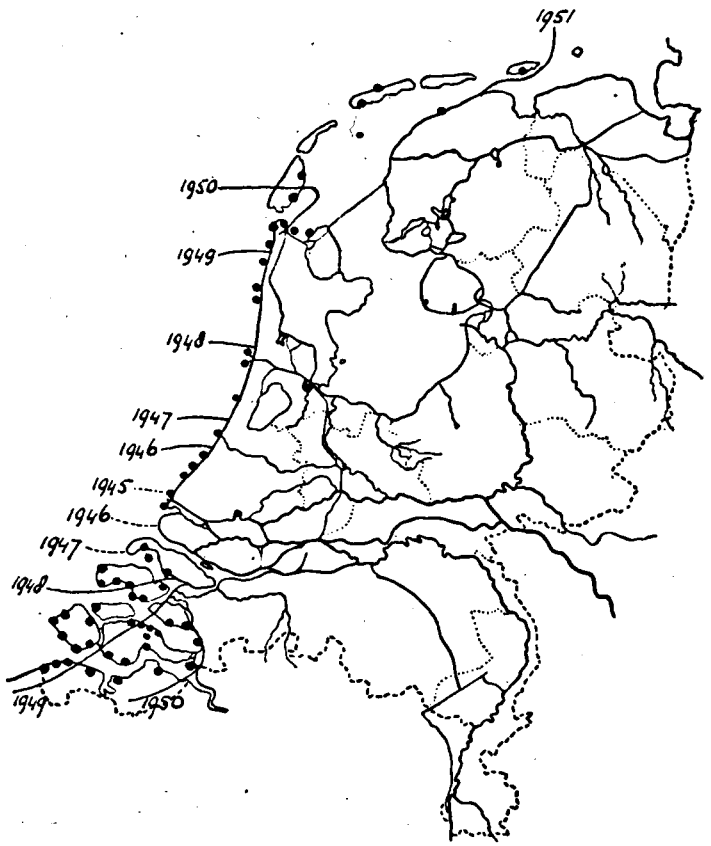

Fig. 2. Extension of area of *Elminius modestus* DARWIN in the Dutch waters up to 1951.

positively an important factor, which appears from the following facts, mentioned by CRISP in a letter:

"However it has spread to the south-west, stopped abruptly at Swanage, where the double tides prevail. To the west of Swanage the coast is very exposed and unsuitable to *Elminius* which therefore confines itself to a few harbours like Plymouth. It has spread northward on the east and west coasts, but more rapidly on the westcoast, although here it has evaded the more exposed regions."

I suspect the unfavourable circumstances along the sandy Dutch coast, on which breakwaters are the only substrates suitable for the establishment of *Elminius*, to be of influence. In agreement with this, the dissemination was very rapid in the shallow Waddenzee, where many suitable substrates are present, viz. musselbeds, shells and dikes. Perhaps climatological factors also act a part, but a conclusive explanation of this phenomenon can not be given yet.

INCREASE AFTER SETTLEMENT.

In some places it was possible to observe the settlement and the increase in number of *Elminius modestus* in detail. On 19-II-1950 MULDER and the author found two specimens on a breakwater of the Hondsbosse Zeewering. They had settled in 1949 already, probably in late summer, as the liberation of the nauplii starts in the course of April and the beginning of May. In March as well as July 1949 the species had not been seen here, however. A few *Elminius* were found again on 1-V-1950. On 10-IX-1950 the species was obviously rather numerous, while everywhere cyprid-larvae were still observed in the plancton. On 12-XI-1950 the barnacle was very common, according to STOCK. Thus a year after the establishment *Elminius* had become common.

This phenomenon was observed in all localities where, after ascertaining the first settlement, the next year again observations were made (Texel, Huisduinen, Domburg, Basin of the Oosterschelde). In places where the habitat is very favourable to *Elminius modestus* this barnacle becomes dominant within the same year in which establishment has taken place. This must have happened on the moles of IJmuiden and Zeebrugge.

In localities where *Elminius* settles it reaches maximal sizes between 6 and 8 mm carino-rostral diameter in the same year. Hitherto larger specimens have never been found by me in first-year populations. In second-year populations much larger specimens occur. Here the maxima lie between 11 and 12 mm. The largest specimen, found up to the present, has been collected on a breakwater near Huisduinen on 21-XII-1951; it measured 12.2 mm carino-rostral.

By means of the above-mentioned differences in abundance between the first-year and second-year populations and of the differences in maximal size of the barnacles in these populations, I could ascertain the year of settlement in many cases. Especially in following the migration in southern direction, this method has proved valuable.

LIST OF LOCALITIES WHERE *ELMINIUS MODESTUS* LIVES ON THE CONTINENTAL COAST:

Netherlands:

Province of Friesland: Island of Schiermonnikoog, 3-VI-'52, DEN HARTOG, on *Mytilus edulis* and a stake on the mudflat. The sizes of the the 4 specimens varied between 7 and 8 mm, so they settled already in 1951. During a visit of the author in VIII-'51 no *Elminius* was found. On the Frisian coast the barnacle is known from Noorderleegh, 28-IX-'52, TULP. Here also the species settled down in 1951. Island of Terschelling, 14-VIII-'51, SCHROEVERS, 1 specimen on the western mole of the port of West-Terschelling, near high water mark; summer '51, VAN HUISSTEDEN, some specimens in the basin, west of the port; XI-'51, MULDER, a few specimens on the beach-piles 13, 14, 15 and 16. In VII-'50 *Elminius* was not found, during an excursion of MULDER and the author, no more than by MULDER and SWENNEN in VII-'51.

Province of Noord Holland: Island of Texel, 2-VII-'50, STOCK, 1 specimen on the dike near Oude Schild; 14-IV-'52, DEN HARTOG, rather many specimens in the same locality; 3-VIII-'51, LUCAS, rather many *Elminius* near de Cocksdorp, Eyerland. Wieringen, 17-II-'52, SWENNEN, very many specimens near the Quarantaine. Balgzand, 4-VIII-'51 DEN HARTOG, one specimen on *Littorina littorea*. Den Helder, 19-XI-'50, SWENNEN, between *Balanus balanoides*; 30-III-'51, SWENNEN, between *Balanus balanoides*; 30-III-'51, SWENNEN, a few specimens; 21-XII-'51, DEN HARTOG and SWENNEN, rather many specimens. The eastern part of the dike is fairly free from *Elminius*. Huisduinen, 21-XII-'51, DEN HARTOG and SWENNEN, common. Beach-pile 8, 5-I-'50, SWENNEN, on a breakwater. Callantsoog, 5-I-'50, DEN HARTOG and SWENNEN, very common on the piers, between 2 and 8 mm. Hondsbosse Zeewering, 19-II-50, DEN HARTOG and MULDER, 2 specimens on a breakwater; 1-V-'50, DEN HARTOG, a few specimens; 10-IX-'50, DEN HARTOG, rather numerous; 12-XI-'50, STOCK, very common. Camperduin, 22-I-'50, VAN DER GOOT, on a pier. IJmuiden, 24-XII-'48, STOCK, Mass-population on the south-side of the southern mole, all specimens were smaller than 1 cm; X-'49, MULDER, a great many on the northern mole; 15-I-'10, DEN HARTOG, very numerous on the northern mole; 26-II-'50, DEN HARTOG and MULDER, many specimens on both the moles; 1-X-'50, STOCK, very many on the southern mole; 4-XI-'50, MULDER, very common on the southern mole near the beach.

Province of Zuid Holland: Beach-pile 75, 3-I-'49, MULDER, large specimens. Katwijk, 28-X-'49, LUCAS, northern and southern mole, sluice-wall of the Oude Rijn; 10-II-'51, LUCAS, idem. Wassenaarse Slag, near beach-pile 96, 19-X-'46, LEENHOUTS and LUCAS, 1 specimen on a wreck, it measured 9 mm, on wood: 31-I-'48, LUCAS and VAN URK, a few specimens on piles. Scheveningen, 6-XII-'47, LEENHOUTS, one specimen on a breakwater. Beach between Kijkduin and Loosduinen (Terheiden), 8-XII-'46, VAN DER MEULEN, in large

numbers on piles of concrete, the largest specimen was 8 mm. Kijkduin, 18-X-'47, VAN DER MEULEN, on a beach-pile. Hoek van Holland, 16-X-'49, LUCAS, northern mole. Island of Rozenburg, De Beer, no date, LUCAS, southern mole. Island of Goeree-Overflakkee, 30-VII-'51, STOCK, on the western pier of Ouddorp, very common; 3-VIII-'51, Sandflat, south of Goeree, near gas-buoy "Hals" red 4, several specimens on *Mytilus edulis*.

Province of Zeeland: Island of Schouwen, 10-VIII-'48, SWENNEN, one specimen on the Westbout on *Nucella lapillus*; 24-VIII-'50, DEN HARTOG, LUCAS and MULDER, many specimens in the same spot; 10-VIII-'48, SWENNEN, one specimen near Stompetoren; 23-VIII-'50, DEN HARTOG, rather many specimens in the same spot; X-'49, VIERGEVER, wreck on the beach; 17-VIII-'50, STOCK, Flauwers, sluice; 17-VIII-'50, STOCK. Dike west of Zierikzee; 26-VIII-'50, DEN HARTOG, LUCAS MULDER and SWENNEN, Dike near the Kistersinlaag, very many specimens; 28-VIII-'50, DEN HARTOG, Canal of Zierikzee; X-'50. VIERGEVER, Beachpile near Watergat; 29-XI-'50. VIERGEVER, pier of Zierikzee; VIII-'51, MULDER, many specimens near Bruinisse. Island of Tholen, IX-'50, VIERGEVER, one specimen on the Koffiehoek; 26-III-'51, VIERGEVER, idem; 27-X-'51, DEN HARTOG and MULDER, rather many specimens in the same spot; 28-X-'51, DEN HARTOG and MULDER, many specimens on Gorishoek on stones, algae and *Littorina*-shells. Island of Noord Beveland, 15-VIII-'50, STOCK, on pile near Sophiapolder; 15-VIII-'50, STOCK, on the landing bridge of Kamperland. Island of Walcheren, autumn '49 DE VUYST, some specimens near Vlissingen; 9-VIII-'50, DEN HARTOG and MULDER, on stones on the beach near Vlissingen; 12-VIII-'50 DEN HARTOG and MULDER, Vlissingen, on a pontoon and on piles; IX-'51, MULDER, Vlissingen, on a pontoon on a depth of ca. 1m; 15-IV-'50 VAN DER FEEN-VAN BENTHEM JUTTING, Domburg, on *Mytilus edulis*; 11-VIII-'50, DEN HARTOG and MULDER, pile-works near Domburg; 11-VIII-'50, DEN HARTOG and MULDER, Westkapelle, a few specimens; 9-VIII-'50, DEN HARTOG and MULDER, Beach between Dishoek and Zoutelande; 13-VIII-'50, DEN HARTOG and MULDER, Ritthem, on *Mytilus edulis, Littorina littorea* and birch; 13-VIII-'50, STOCK, Rammekens, on wreck; 13-VIII-'50, STOCK, Veere, (landside of the sluice; 15-VIII-'50, STOCK, Veere, landing bridge. Island of Zuid Beveland, 9-XI-'49, KORRINGA, on Yerseke Bank, plot 183, according to fishermen also in the Zandkreek, in 1950 in different localities in the whole region of the Oosterschelde; 22-VIII-'50, DEN HARTOG and MULDER, very common in Katse Veer; 23-III-'51, MULDER and SWENNEN, Wemeldinge; 30-VIII-'51, MULDER, very many specimens in the same locality, in Kattendijke, Yerseke and Yersekedam, in the Zandkreek enormous quantities; 4-X-'50, Swaneveld, one specimen in the Kanaal door Zuid Beveland, on a tunicate; 3-VIII-'50, DEN HARTOG and MULDER, many specimens in Ellewoutsdijk; 4-VIII-'50, DEN HARTOG and MULDER, very many on the mole of Borssele; 10-VIII-'50, STOCK, on the mole of Hansweerd. Zeeuws Vlaanderen, 12-VIII-'50, STOCK, pier near the

Zwarte Polder ; 15-VIII-'50, DEN HARTOG and MULDER, many specimens near the sluice south of Cadzand ; 16-VIII-'50, DEN HARTOG and MULDER, Pier north of Cadzand ; 11-VIII-'50, STOCK, mole of Walsoorden.

Province of Noord-Brabant : Bergen op Zoom, 1950, KORRINGA ; 28-X-'51, DEN HARTOG, a few specimens near the Schans ; Ossendrecht, 24-X-'51, MULDER, on stakes on the mudflats.

Belgium:

Province of West Vlaanderen : Le Zoute, 18-VIII-'50, DEN HARTOG, on piers, common ; Zeebrugge, 18-VIII-'50, DEN HARTOG, pier by the end of the Kanaal van Dudzele, a few specimens ; 19-VIII-'50, DEN HARTOG and MULDER, southside of the mole, near the beach, mass-population with very large specimens (see the foot-note on p. 4).

France:

Departement du Pas de Calais : Cap Griz Nez, 11-VII-'51, DEN HARTOG, ca. 20 specimens on a stone ; Audreselles, 6-VII-'51, 2 specimens in a *Balanus balanoides* population ; 7-VII-'51, DEN HARTOG and SCHROEVERS, 4 specimens near low water mark ; Ambletuse, 5-VII-'51, SCHROEVERS, one specimen between *Balanus balanoides ;* Wimereux, IX-'50, BISHOP ; Boulogne sur Mer, DEN HARTOG, one specimen on the northern mole, near Fort de la Greche ; Le Portel, 15-VII-'51, ENGEL.

ECOLOGICAL OBSERVATIONS ON *ELMINIUS MODESTUS*.

On the continental coast *Elminius modestus* behaves as an intertidal form. Below low water mark as well as above high water mark only a few specimens occur. Between low and high water on the contrary the barnacle is very common, its maximum, however, lying between mean high water and mean sealevel.

As an example a zonation diagram of the mole of Zeebrugge is given (fig. 3). The southern side of this mole was surveyed from the beach on 19-VIII-'50. There *Elminius* reaches to 50 cm above mean high water, but rather sparsely, together with the gastropod *Littorina saxatilis rudis* (MATON) *f. tessellata* DAUTZ., which reaches to ca. 150 cm above high water. (The maximum of the latter lies, however, from high water mark to 50 cm above.) From high water mark to 25 cm below *Elminius* is very abundant and covers the substratum completely. *Balanus* does not live so high, thus there is no competition. From 25 to 100 cm below mean high water mark *Elminius* competes strongly with *Balanus balanoides* (L.). *Balanus,* which for a year formed the whole belt, has already decreased to a great extent and at present *Elminius* is in the majority. The lower limit of this belt is formed by the sand of the beach.

Something alike has been observed on the southern mole of IJmuiden and in the Zandkreek (Zeeland). On the British coast similar observations have been made. SOUTHWARD wrote to me on this subject :

„It is interesting to note that in the Plymouth area, where I find *Balanus* to be greatly decreased in number compared with 1934 (observations of H. B. MOORE, up the estuary of the Tamar in places which formerly supported *Balanus balanoides* in densities of 10,000 to 20,000/m², there is now a similar density of *Elminius modestus*, and only a few *Balanus balanoides*." So there the barnacle has ousted *Balanus*.

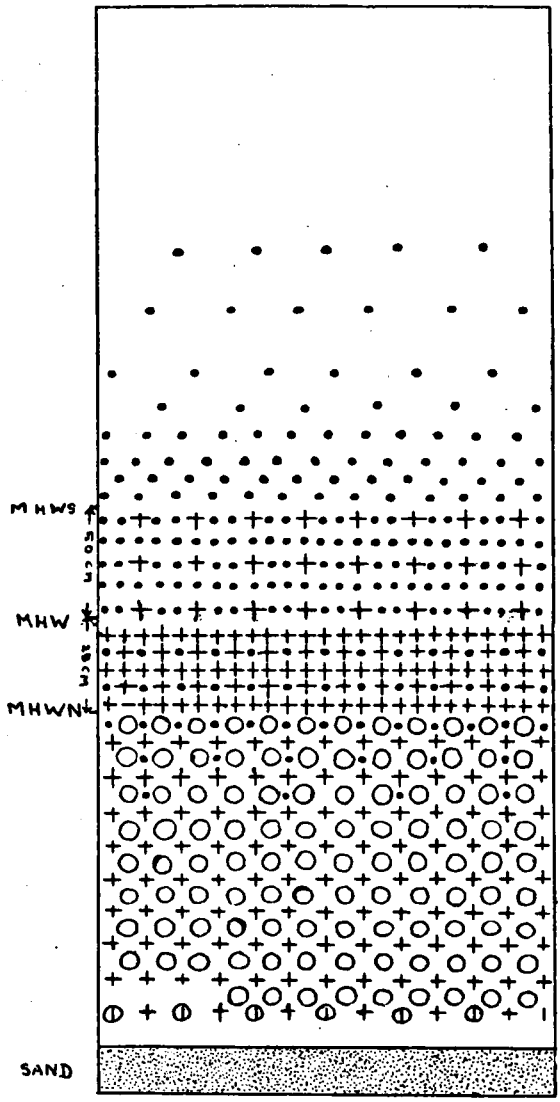

Fig. 3. Zonation on the southern mole of Zeebrugge. ● = Littorina saxatilis rudis tesselata, + = Elminius modestus, O = Balanus balanoides, M.H.W.S. = Mean High Water Spring, M.H.W. = Mean High Water, M.H.W.N. = Mean High Water Neap.

Also in localities where algae-growth occurs it is very abundant on the level, dealt with above. Especially in the *Enteromorpha-Porphyra*-association, the *Fucus spiralis*-association and the *Fucus vesiculosus*-association the species is sometimes extremely abundant. The first-mentioned community is extremely common along the whole Dutch coast on breakwaters and pile-works, in rather exposed places as well as in more protected localities. The vegetation is composed chiefly of the algae *Entermorpha compressa* (L.) GREV., *Enteromorpha minima* NAEG. (above mean sea level), *Ulva lactuca* L. and *Porphyra umbilicalis* (L.) J. AG. Between these seaweeds many barnacles, mainly *Balanus balanoides* and *Elminius*, live together with juvenile *Mytilus edulis* (L.). More mobile animals in this vegetation are *Littorina saxatilis rudis* (MATON), *Hyale prevostii* (M. EDW.), *Ligia aceanica* L. and juvenile specimens of *Carcinus maenas* (L.). In this habitat *Elminius* is often very numerous, as well as in the *Fucus spiralis-* and *Fucus vesiculosus*-association. In other associations like those of *Ascophyllum nodosum* (L.) LEJOL. and *Fucus serratus* L. the species is common too, but the numbers are not as high as in the associations mentioned.

The substrates, on which *Elminius modestus* has been found, are numerous and of very diverse nature. It has been observed on:

stone: basalt; granite, limestone, concrete, tiles which are used for oyster collectors;
iron: buoys, staves, vessels, pontoons;
wood: piles, boxes, planks, stakes, beams;
cork;
seaweeds: *Fucus vesiculosus* L., *Fucus serratus* L., *Chrondrus crispus* (L.), STACKH, *Himanthalia elongata* (L.), SETCHELL;
living gastropods: *Nucella lapillus* (L.), *Littorina littorea* (L.), *Littorina obtusata* (L.), *Patella vulgata* L., *Crepidula fornicata* (L.):
bivalves: *Mytilus edulis* (L.), *Ostrea edulis* L.;
barnacles of its own species and on *Balanus balanoides* (L.);
crabs, tunicates and on empty shells.

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