

De Nederlandse kustwateren als milieu voor Nudibranchia

(Samenvatting)

door

C. SWENNEN

Van de 30 in Nederland gevonden soorten Nudibranchia komen er 28 autochtoon voor; twee soorten kent men slechts van aangevoerde drijvende substraten. De meeste autochthone soorten moeten zich hier pas in historische tijd hebben gewestigd, want zij zijn alle engszins gebonden aan vaste substraten, terwijl de Nederlandse kust en de zeebodem er voor van nature bestaan uit fijne sedimenten als zand, zand met slib, en slib (de „Texelse Stenen” worden hier buiten beschouwing gelaten). Door het maken van dijken, hoofden en havenwerken, het leggen van lichtschepen, boeien en vloten, het achterlaten van scheeps- en vliegtuigwrakken, het in zee werpen van sints, puin enz. is in de loop der tijden een milieu onstaan, waar soorten die oorspronkelijk slechts incidenteel voorkwamen zich op konden uitbreiden, en andere zich nieuw hebben kunnen vestigen.

Nudibranchia zijn weinig mobiel en leven op of in de onmiddellijke nabijheid van hun voedsel. Zij zijn stenophaag, d.w.z. zij voeden zich met een bepaalde soort of een bepaald geslacht van voedseldieren. Deze kunnen behoren tot de sponzen, hydroïeden, anthozoën, bryozoën, manteldieren of crustaceën. De horizontale verspreiding van de slakken valt in ons land met die van hun voedseldieren samen. Zo dringen de voedseldieren vrijwel niet verder in het brakke water binnen dan hun nudibranche vijanden. Wat de verticale verspreiding betreft bleken de zeepok *Balanus balanoides* en de hydroïedpoliep *Laomedea flexuosa* in het bovenste deel van de getijzone vrij te blijven van vrast door respectievelijk *Lamnelidopsis bilamellata* en *Tergipes despectus* dankzij hun grotere resistentie tegen uitdroging tijdens laagwater.

Wij kunnen het fauna-gebied verdelen in: (1) de zee van 2 m diep en dieper, (2) de zee ondieper dan 2 m en de getijzone, (3) het brakke water. In zoet water ontbreken Nudibranchia.

DE ZEE VAN TWEE METER DIEP EN DIEPER

Voor de zandige gronden van dit gebied heeft de herenietkreeft *Pagurus bernhardus* een voorkeur. Zij woont in schelpen begroeid met de ruwe zeeraap, die weer het voedseldier is van *Preclibona beachii*. Deze soort komt daarom nergens zo talrijk voor als juist hier. Op de kolonies van het bryozoëngeslacht *Alcyonidium*, die zich

vasthechten op schelpkleppen en *Echinocaulium*-schalen, is *Acanthodoris pilosa* hier tamelijk gewoon. Op wrakken, sints, steenkolen enz. treft men verder een aantal soorten aan, die elders rotsen bewonen.

DE ZEE ONDIEPER DAN TWEE METER EN DE GETIJZONE

Hieronder vallen de kustrook en een groot gedeelte van de Waddenze en de Zeeuwse en Zuidhollandse wateren. In dit gebied hebben *Embranchus exiguus* en *Tergipes despectus* hun optimum, omdat hun voedseldieren, hydroïedpoliepen van het geslacht *Laomedea*, zich in het ondiepe water het beste ontwikkelen. Deze poliepen hebben slechts weinig vast substraat nodig; voor grote kolonies zijn schelpfragmenten, krabbeschilden en zelfs de uiteinden van de sipho's van *Mysis arenaria* voldoende.

In dit gebied vallen ook onze „kunstmatige rotskusten”: dijken, hoofden, havenpielen enz. Het interessantste deel van een dijk is de voet. Hier liggen losse stenen opgestapeld, waardoor zich onder en tussen de stenen dieren kunnen vestigen, die lichtschuw zijn of zich door concurrentie met algen niet op de stenen kunnen vestigen. Dijken, waarvan de voet op de laagwaterlijn ligt, zodat het voorland niet tijdens laagwater droogvalt, herbergen altijd een of meer soorten Nudibranchia. Het rijkt zijn de dijken, die zodanig beschut liggen, dat bij storm de begroeiing niet door het zand wordt weggeschuurd: bijvoorbeeld bij Vlissingen, op de zuidkust van Schouwen, bij Den Helder en op de zuidoostkust van Texel. Hier leeft een groot aantal soorten op verschillende voedseldieren (zie lijst bidz. 58). Het is moeilijk de dichtheid van Nudibranchia in cijfers aan te geven. Bij het tellen van *Tergipes despectus* op kolonies van de hydroïedpoliep *Laomedea longissima* in de haven van Den Helder berekende ik in mei 1958 het aantal slakken per cm² substraat dat door de poliepen werd ingenomen op 43. De poliepen zijn echter mozaiekachtig over het substraat verdeeld, zodat men dit aantal niet met 10.000 mag vermenigvuldigen om het aantal slakken per m² te berekenen.

Op gunstige ogenblikken schatte ik het aantal exemplaren per m², gerekend over een aaneengesloten gebied van 20 m², van een aantal soorten Nudibranchia op de zeedijk van Den Helder (zie lijstje op bidz. 58 onderaan). Deze aantallen variëren sterk van maand tot maand en ook voor overeenkomstige tijden in verschillende jaren.

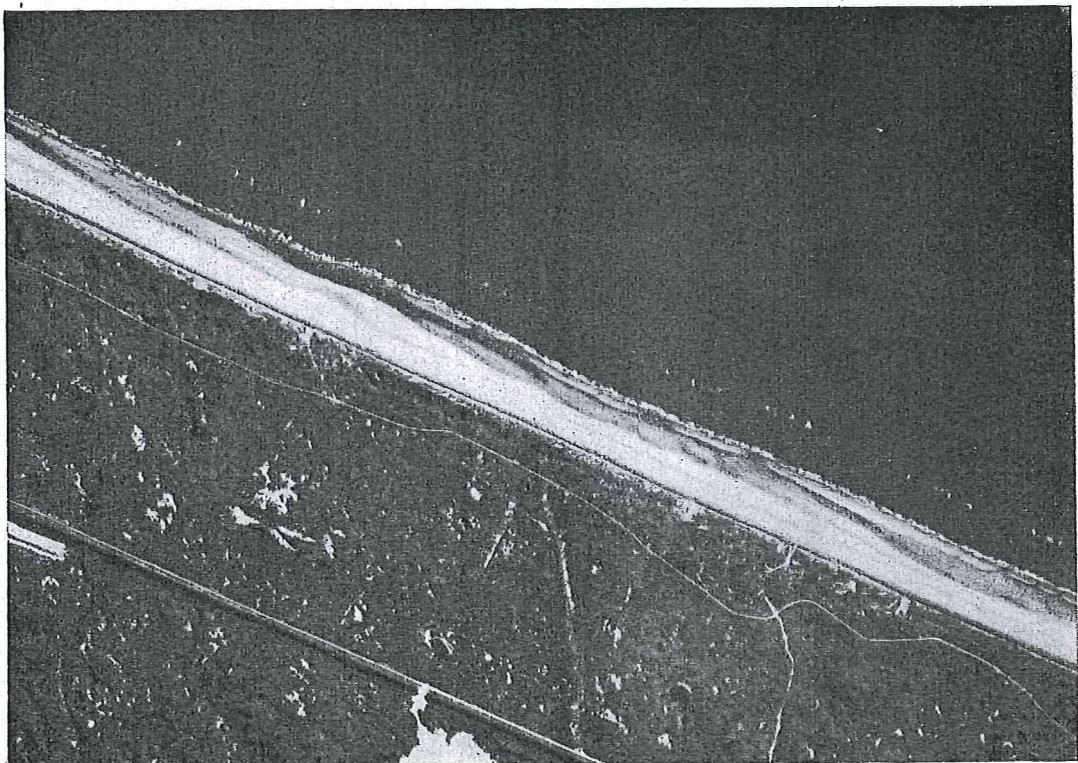


Fig. 1. Sandy beach in front of dunes, a type of shore characteristic of the Netherlands. (Zandstrand voor duinen, een typisch Nederlandse kustvorm).
Foto K.I.M. Aerocarro N.V., archief Topografische Dienst.

1. Fossil Mollusca. In this category all extinct species and sub-species can be placed without doubt. They provide evidence of submarine erosion of a number of tertiary and pleistocene beds along

our coast, as shown in Table 1. With almost equal certainty a number of species which are extinct in this region but which belong to the fauna of the Dutch Pliocene and/or Pleistocene can be placed in this group. One is often tempted to consider certain specimens of species belonging to our recent fauna as fossils because of their state of preservation, but such an assignment to this category always remains hypothetical. Sometimes small shells can be found in the original matrix preserved in the older whorls of large fossil gastropods (e.g. *Scaphella lamberti* (J. Sow.)). The study of these remains of the original matrix is even a well-paying method of finding undamaged small fossils. In this case the age can often be inferred from that of the gastropod shell examined, though the small fossils may be species still belonging to the recent Dutch fauna.

Table 1

horizon	place of erosion	localities where fossils are washed ashore	characteristic species
Eocene (Lower Lutetian)	off the Belgian coast	shores of Zeeland, mainly in the S, rarely Zuid-Holland up to Scheveningen	<i>Venericardia planicosta</i> Lam., <i>Turritella solandri</i> M. E.
Oligocene (Rupelian)	deep channels of Westerschelde	de Kaloort (Zuid-Beveland)	<i>Pycononte callifera</i> (Lam.)
Miocene (Anversien and Lower Diestian)	deep channels of Westerschelde	shores of Zeenwisch-Vlaanderen, Zuid-Beveland, and Walcheren	<i>Pycononte navicularis</i> (Br.)
Pliocene (Upper Diestian, Scaldian)	deep channels of Westerschelde	shores of Zeeland, rarely those of Zuid-Holland up to Hoek van Holland	<i>Pycononte cochlear</i> (Poli), <i>Scaphella lamberti</i> (J. Sow.)
Early Pleistocene (Poederlian to Ienian)	deep channels of Westerschelde and Oosterschelde	shores of Zeeland, mainly Walcheren, Noord-Beveland, and Schouwen	<i>Acrybia islandica</i> (Gmel.)
Upper Pleistocene (Bemian)	mainly deep channels in the S. and the N. of the Netherlands	along the whole coast, more frequently on the shores of the islands in the S. and the N.	<i>Venerupis aurea senescens</i> (Cocc.), <i>Bitium reticulatum</i> (Da C.)

There is evidence of considerable transport of light fossil shells by the tidal currents of our estuaries and by the main current in northerly direction along our west coast (cf. column 2 and 3, Table 1).

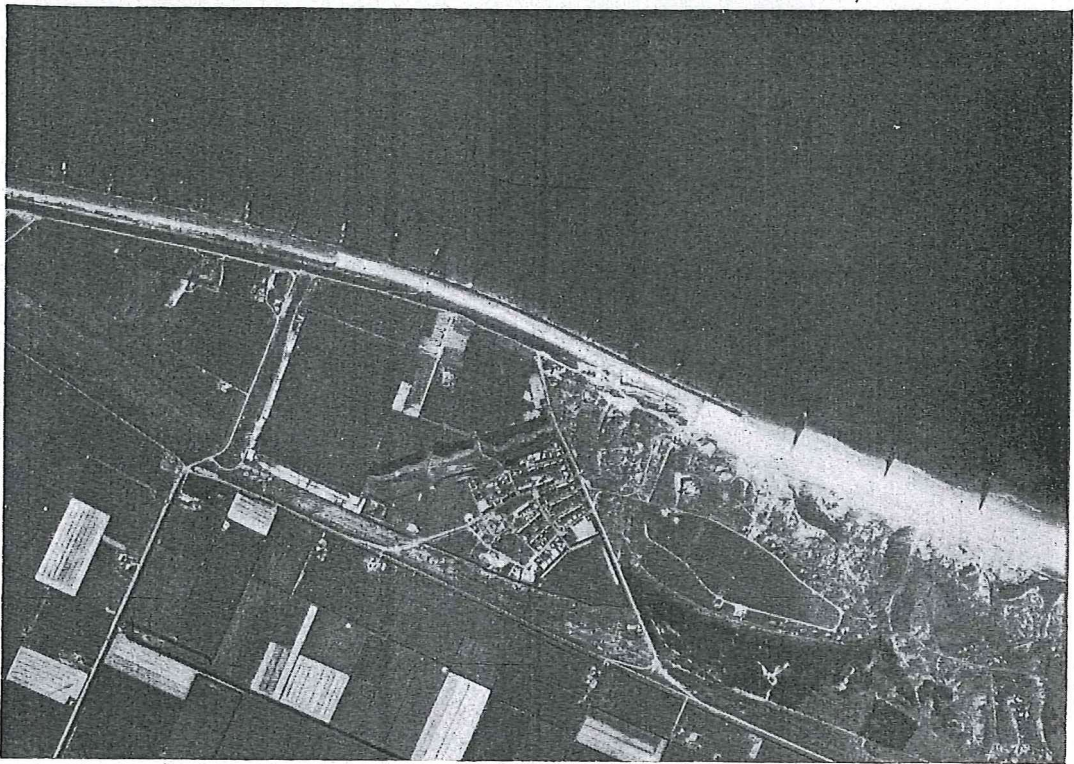


Fig. 2. Moles protect the coast where the dune area is narrow (above), and where dunes are lacking and replaced by a dike (below).
 Hoofden beschermen de kust waar de duinen smal zijn (boven) en waar zij ontbreken en door een dijk zijn vervangen (onder).
 Foto K.I.M. Aeroartro N.V., archief Topografische Dienst.

2. Recent Mollusca. Certainly recent are living specimens, or specimens with remains of organic substance, including the peri-

ostracum, and the ligament of bivalves. To this category brightly coloured shells showing their original colours can be assigned almost without doubt. As to the origin of recent specimens washed ashore distinction should be made between the material with a specific gravity larger than sea water, and floating material, specimens attached to floating objects included.

Heavy specimens when found on the beach in a very fresh condition, viz. just dying or still containing the animal, never have been transported over great distances. These specimens, therefore, can be used as evidence of the distribution of species along our coast. Fresh specimens of species living in shallow water are very often found washed ashore, but a gale like that catastrophic one of February 1, 1953, was necessary to prove us that *Venerupis rhomboides* (Penn.) and *Gari ferrenis* (Gm.) are living off the coast of the province of Zuid-Holland.

Numerous cases are known of shells belonging to tropical species having been picked up on the Dutch beach. It is an exception when their occurrence can be explained as readily as that of the cowries *Cypraea moneta* L. and *C. annulus* L. on the shores of the island of Walcheren since in 1738 a frigate of the Dutch East Indian Company was stranded near Westkapelle and lost its cargo of exotic render (VAN BENTHEM JUTTING, 1955). Generally speaking, tropical shells unless floating or fixed to floating objects cannot reach our shore by natural agencies; man must always have played a part in their transport.

The occurrence of fossil and tropical shells on the beach warns us to be cautious when trying to explain records of empty shells found washed ashore. It should be borne in mind that of a number of species which are generally considered indigenous, few, if any, specimens have ever been found living in the Dutch coastal waters. Their belonging to the recent Dutch fauna is assumed mainly because of the frequent occurrence of empty shells on the beach. Examples of such species are: *Tornus subcinctus* (Mont.), *Clabrus turtonis* (Turr.), *Cl. clabrotulus* (Kaanm.), *Lora turricula* (Mont.), *Chrysalida decussata* (Mont.), *Philine aperta* (L.), *Nucula nucleus* (L.), *Spi-sula elliptica* (Brown), *Lauraria lauraria* (L.), *Tellina pygmaea* Lov., *Solen marginatus* Mont., and *Saxicavella jeffreysi* Winckworth.

Floating material and specimens fixed to floating objects may have been transported over a considerable distance before being washed ashore. As the main current along our shore is directed to the north they generally come from the south. Some instances in which shells have probably been floating on the surface of the sea before being washed ashore may be dealt with here.

Phydia myosotis (Drap.) is mainly an inhabitant of the shores of our estuaries and Wadden Sea, though small colonies are known to have

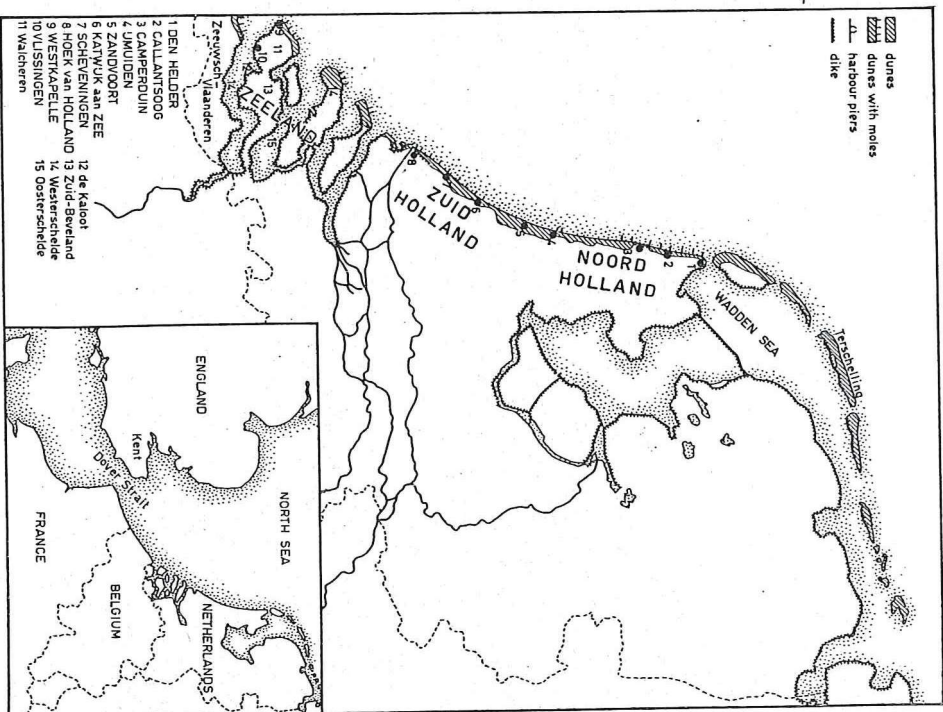


Fig. 3. The Netherlands, with the names of localities mentioned in this paper. (Nederland met de namen van plaatsen enz. genoemd in dit artikel).

empty shells were found washed ashore south of Scheveningen. It seems most likely that this "invasion" came from the south, probably from the estuaries in the south of our country, and that the shells temporarily existed at Karwijk aan Zee (1915, 1917), Scheveningen (1925), and IJmuiden (1950, 1951). Shells of this species are rarely found on the beach of the main land of the province of Zuid-Holland, but between June 15 and 22, 1940, hundreds of fresh looking

had been transported over a distance of at least some 25 km along the coast before being washed ashore.

A more striking example is that of the shells of *Sepia elegans* Orb., which are often, and those of *S. orbigniana* Fér., which are sometimes washed ashore in great quantities on the Netherlands beach. There is hardly any evidence that living specimens of these species ever enter the North Sea. Therefore it seems most unlikely that great quantities of them periodically meet their death near the Dutch coast, though it is recorded that remains of the animal were still adhering to shells of *Sepia elegans* washed ashore near Scheveningen on June 6, 1950. I have earlier called attention to the fact that sometimes specimens of *Lepus* spec., mostly *L. pectinatus* Spengl., hydroids, and once a serpulid have been found attached to these little cuttlebones. This proves that the shells had been floating some time before being washed ashore. Therefore these "invasions" of shells of *Sepia elegans* and *S. orbigniana* suggest a mass death of these species some time earlier, probably in the Channel, where they are both living. For floating from Dover Strait to the shore of the province of Zuid-Holland they need at least about a month (cf. VERWEY, 1942). These mass deaths must, consequently, have occurred at least a month before the shells are found on our beach. Though of both species "invasions" have been recorded in February and April, they generally occur in summer and autumn, from June to November, and mainly in August, September, and October. This seems to point to mass deaths of these species in the Channel mainly in spring and summer. Unfortunately no data on the biology of these species are available with which we can try to correlate these records.

A very interesting category of Mollusca found on the beach are those to which floating objects are fixed, or which belong to the epifauna of floating objects. These objects may be:

- (1) The clusters of egg capsules of the common whelk (*Buccinum undatum* L.), which are sometimes fixed to shells, or contain shells from the bottom where they were deposited.
- (2) Algae, such as *Fucus* sp. and *Himantobalia longata* (L.) Serchell, which often appear to be fastened to shells.
- (3) Algae, especially the basal parts of *Himantobalia longata* (L.) Serchell, which may have an epifauna containing Mollusca.
- (4) Bunches of cork as used by French fishermen for marking the place where they put their lobster pots.
- (5) All other floating objects, such as pieces of wood or cork, baskets, etc.

When the floating objects are fixed to the shells, as under (1) and (2), these are mostly empty. They often testify of a remote

origin of the object found. Thus, in some egg masses of *Buccinum undatum* washed ashore on the island of Terschelling shells have been found of the land snail *Cochlicella acuta* (Müll.), a species not living farther north than the Belgian dunes and the county of Kent in England.

Algae may be fastened to shells of *Patella* sp.; species of *Fucus* to those of *Patella vulgata* L., which is an indigenous species and needs not, therefore, have come from far away. But LUCAS (1954) has shown that the thallus of *Himantobalia* may be fixed to shells of *Patella depressa* Penn. and *P. abbatia* Bean (*P. aspera* Lm., non Roeding), two species from the Atlantic coasts of southern England and northern France never found living in the North Sea. Though the limpers thus found washed ashore occasionally contain remains of the animal, it seems improbable that they ever reach our coast in living condition.

The epifauna of the substrata (3), (4), and (5), however, is frequently found in very fresh condition and there can be no doubt that living specimens of many species not belonging to the Dutch fauna regularly reach the Dutch coast by means of transport by floating objects. The specimens found on these substrata are mostly small and generally belong to small species, although young specimens of large species are sometimes among them. The bivalves are for a great part species able to fix themselves by means of a byssus (Anonimidae, Mytilidae, Pectinidae, *Hiatella arctica* (L.)), but the inhabitants of holes and crevices and borers are also frequent (*Sphaeria bingbami* Turr., Pholadidae, Terebinthidae).

By studying the fauna of these floating objects the beachcomber is confronted with a phenomenon of biogeographical interest. It demonstrates ad oculos to him how inhospitable the Dutch coastal waters are to many species coming, mainly, from the south. Such species are sometimes found in such quantities that it is evident that they could have settled here, if circumstances had been more favourable. I once found a colony of 96 fresh specimens of *Cingula semistriata* (Mont.) in a bunch of cork washed ashore near Camperduin. Probably these specimens had reached the Dutch coast still alive. And there is a record of 300 specimens of *Helcion pellucidum* (L.) found alive on the thalli of *Himantobalia* on a stretch of 4 km of the beach near Zandvoort. Both these species do not belong to the Netherlands fauna.

KORRINGA (1942) pointed out that the ability of fixing themselves in clusters on floating objects must have played a much greater part in the rapid distribution of *Crepidula fornicata* (L.) in Europe than the planctonic larvae of this species did. I am convinced that the

ability of boring into wood and cork played a similar part in the rapid spreading of *Petricola pholadiformis* Lm. in the same area. It seems likely that some of the species now inhabiting the human structures like dikes, moles and piers along the Dutch coast once reached this habitat by means of transport by floating objects. This seems very probable for species such as *Nucella lapillus* (L.) which have no planctonic larvae.

Some species of bivalves have long been known from floating objects only, but LUCAS (1953) gave a number of records of living specimens found on other than floating substrata, mainly on our sea dikes. He dealt with the following species: *Heteranomia squamula* (L.) (3 records), *Kellia suborbiculata* (Mont.), *Sphaeria bingbami* Turr. (each 2 records), *Larsaea rubra* (Mont.) and *Hiatella gallicana* (Lm.) (each 1 record). It may be that these species are permanent inhabitants of these localities, but that they had so far been overlooked. It seems more likely, however, that at least of some of them only temporary colonies exist on our coast. These colonies might consist of specimens having reached our coast by means of floating objects, or the immediate progeny of such specimens. Probably such colonies would be too small to be self-supporting. A certain part of the species rarely found alive along the Dutch coast may consist of such temporary settlers. In one case only we are sure that a species is a temporary settler on the Dutch coast, viz. in that of *Littorina nerioides petraea* (Mont.). It seems, however, doubtful if floating substrata played any part in the settling of this particular species.

Littorina nerioides petraea was found at Scheveningen in 1916 and 1923, but had never been met with again on our coast, when in June, 1949, some hundreds of young specimens (length 2 mm) were found on poles of the dike near Den Helder. In autumn these specimens had reached a length of 8 mm, and colonies were discovered also near Callansoog and IJmuiden. These colonies were regularly checked. While in 1950 numerous specimens were still found in all three places, the colonies were declining in 1951. In 1952 near Den Helder and IJmuiden only a few specimens were found, while in 1953 in each of these localities only one specimen could be detected, just as in a new locality: Vlissingen. The last specimen was seen at IJmuiden on March 21, 1954. Since that date no more specimens of this species have been found in our country, although many collectors are paying attention to its possible occurrence (STOCK, 1950, SWENNEN, 1955). As *Littorina nerioides petraea* was never found washed on our beach on floating objects, I am inclined to consider the settling of temporary colonies of this particular species due to the transport of its floating egg capsules and planctonic larvae.

The main current along our coast is from south to north. It is, therefore, assumed that most of the floating material comes from the south. In accordance with this supposition many of the allochthonic species thus thrown on the beach appear not to live in the North Sea, but to belong to the fauna of the Channel. Many species could, however, just as well come from the North Sea, e.g. from the east coast of Great Britain, and some few species, like *Astarte sulcata* (Da C.) and *A. montagui* (Dillw.) almost certainly do not come from beyond Dover Strait. They may have been transported southward along the east coast of Great Britain and thus have met the stream from Dover Strait to the north.

Of some specimens found on the beach of our northern islands, like *Astarte montagui* (Dillw.) in an egg cluster of *Buccinum undatum* and *Teredo norvegica* Spengl. in wood, both on the beach of the island of Terschelling, it seems possible that they came directly from the north when circumstances were favourable.

As to the material coming from the south most species belong to the fauna of the Channel and there is no reason to suppose that the bulk of the material came from farther away. Two West Indian teredonids, however, *Teredo reynesii* Bartsch and *Bankia fimbriatula* Moll & Rooh have each on one occasion been found in wood washed ashore on our coast. The possibility that these objects reached our coast by natural agents cannot be ruled out, but in these cases I hesitate to accept this explanation for the following reason. If floating objects from the other side of the Atlantic would reach our coast now and then, one would expect that specimens of *Jambina* sp. and *Spirula spirula* (L.), which are so often floating on the surface of that Ocean, would periodically reach our beach also. The eager eyes of so many trained collectors notwithstanding, neither of them have ever been recorded from the Netherlands.

REFERENCES

This subject has been earlier discussed in my thesis (Amsterdam, 1937, also: N. Verh. Batafsch Gen. Rotterdam (2), vol. 10 part 3), where the older literature can be found. Additional facts have been borrowed from the volumes of the series "Fauna van Nederland", from papers published in Basteria and the stencilled bulletin "Het Zeepaard", and from the labels of specimens in the Rijksmuseum van Natuurlijke Historie at Leiden. The paper by J. VERWEY referred to was published in: Arch. Néerl. Zool., vol. 6 part 4, 1942.

Het Nederlandse strand als kerkhof voor weekdieren

(Samenvatting)

door

C. O. VAN REGTEREN ALTENA

De lange zandstranden van de Nederlandse kust lenen zich niet tot het levend observeren en verzamelen van weekdieren. Door de bouw van dijken, golfbrekers en havenspieren zijn plaatselijk kunstmatige rotskusten geschapen, waar in de getijdenzone wel enkele soorten levend te vinden zijn. Ook op de silken langs onze Zeeuwse en Zuidhollandse stromen en in de Waddenzee is het mogelijk een aantal soorten levend te bemachten, terwijl de dijken, schoeiingen en stelgers langs deze wateren ook soorten herbergen, die men langs onze Noordzeekust vergeeft zoekt. Maar de verzamelaar, die niet beschikt over een schip met speciale uitrusting, kan aan de Nederlandse kust slechts een gering aantal soorten in hun natuurlijke milieu aantreffen. Daarom is het zo veel soortenrijkere aanspoelsel van onze stranden zo populair bij de Nederlandse malacologen.

Men weet sinds lang, dat er onder de aangespoelde schelpen uitgestorven soorten voorkomen en dat zeestromingen dieren van ver buiten ons fauna-gebied kunnen aanvoeren. Daarom doen zich bij het vinden van een aangespoeld exemplaar steeds twee vragen voor, die lang niet altijd met zekerheid beantwoord kunnen worden: wanneer en waar heeft dit dier geleefd? Toch is het mogelijk een aantal categorieën te onderscheiden, waarin vele vondsten van het strand kunnen worden ondergebracht. Deze wil ik hier de revue laten passeren.

1. Fossiele weekdieren. Hiertoe kunnen met zekerheid alle uitgestorven soorten gerekend worden. Zij tonen de erosie onder water aan van tertiare en kwartaire afzettingen langs onze kust, zoals tabel 1 (blz. 65) laat zien. Bijna even zeker kunnen tot deze groep worden gerekend een aantal soorten, die in de omgeving van ons land uitgestorven zijn, maar wel tot de fauna van ons Pliocen of Pliстоocen behoren. Het is gewaarsdijk exemplaren van soorten, die recent nog hier voorkomen, op grond van hun conservatietoestand voor fossiel te verklaren. Wel moeten de schelpjes, die men soms nog in het moedergesteente in grote fossiele horens (zoals *Scaphella lamberti*) kan aantreffen, altijd fossiel zijn, ook wanneer zij tot recente Nederlandse soorten behoren. Vergelijk men de plaatsen van erosie met het gebied van aanspoelen, dan blijkt dat (vooral licht) materiaal over aanzienlijke afstand langs onze kust naar het noorden kan zijn getransporteerd voor het aanspoelt.