

Introduced Species

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Introduced Macrozoobenthic Species at the German North Sea Coast – A Review

Abstract

Recently, for the German North Sea coast, an intensive analysis of all available information about the establishment of anthropogenically introduced macrozoobenthic species has been undertaken by the Federal Institute of Hydrology. The review about the present knowledge resulted in a brochure containing informative sheets on each species. In total, 26 recently established macrozoobenthic species could be identified but up to now, no relevant ecological or economic effects by introduced macrozoobenthic species could be shown for the German North Sea. It is presumed that many unused possibilities exist for the establishment of further non-indigenous species, which may result in an increasing similarity of the biocoenosis in different marine areas.

It is recognized that a number of non-indigenous species have become numerically dominant in invaded communities and have caused damage to environmental and commercial interests. However, in comparison to an extensive literature basis documenting the history and impact of invasions in freshwater and terrestrial habitats, relatively little information is available for marine invasions, especially for the macrozoobenthos of German coastal waters. Finally, when species are identified as non-indigenous, information about their time of arrival, source, vector, rate of spread, current distribution, and effects on resident communities often remains poorly resolved. However, such information can possibly help clarify changes in the benthos biocoenosis in relation to observed trends like eutrophication or climate change.

Introduction

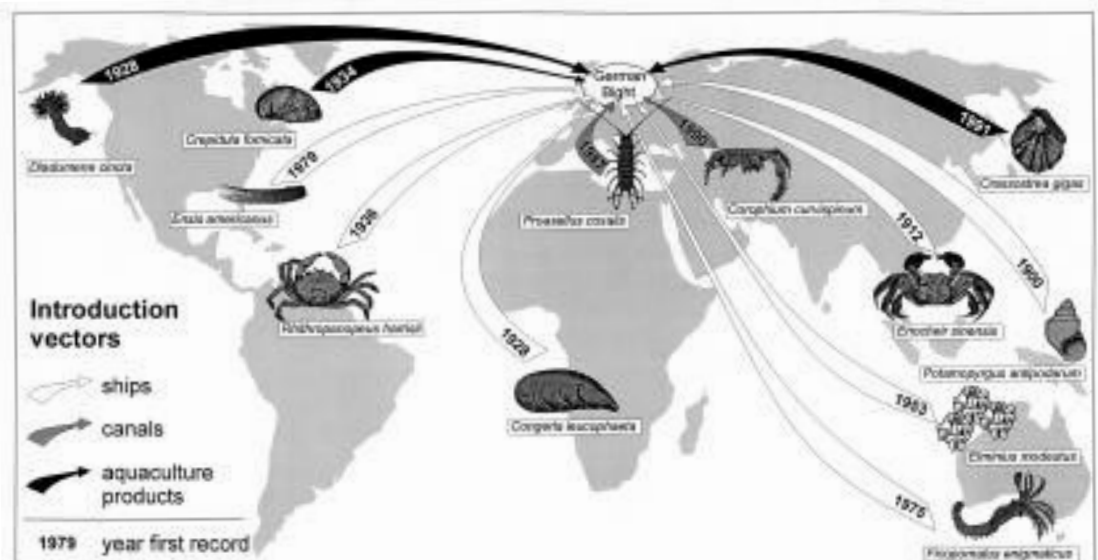
All over the world, marine and estuarine systems are subject to invasion of non-indigenous species at an increasing rate, which results in a greater uniformity of biocoenoses on a global scale. However, their ecological and evolutionary significance is still poorly understood. Biological invasions consist of natural range expansion (dispersal by natural mechanisms, e.g. by currents, by birds) and human-mediated introductions (transportation often crosses natural barriers by human activity, e.g. in ballast water, by construction of canals).

Definitions of Introduced Species

A number of definitions of introduced species have been provided, our following one may have the best applicability:

- A "neozoon" (plural: neozoa) is an animal species, that reached, after the year 982 AD (first introduction of American organisms in Europe; trans-Atlantic cruise of Eric the Red), under direct or indirect anthropogenic involvement, a specific area and has lived there wild-ly for at least three generations (= established

Global map summarizing assumed introduction of macrozoobenthos neozoa (a selection) into German coastal waters of the North Sea (German Bight including brackish canals and brackish water basins).



reproduction community) or over a longer period (at least 25 years) up to now.

- In the case of species where direct or indirect anthropogenic involvement for occurrence (e.g. in the area probably always existent), and/or the current setup of a reproducing population is to be strongly doubted, the term "neozoon incertum" (plural: neozoa incerta) can be used.
- A third type of a non-indigenous animal is the "neozoon simulatum" (plural: neozoa simulata). It is an animal species that appears without recognizable connection with human activities in the appropriate area and also reproduces (= natural expansion of the area).

[Etymology: neo = new, zoon = animal, incertum = uncertain, simulatum = apparent]

A Review and Directory

A recent study has been undertaken by the Federal Institute of Hydrology to receive an overview of macrozoobenthic neozoa in coastal waters of the

German North Sea (Nehring & Leuchs, 1999). The study reviews the present knowledge and resulted in a directory containing informative sheets on each species. In a concluding discussion, reasons for successful establishment of these species at the German coast, their verified or presumed ecological and economic effects as well as their status in relation to nature conservation interests are explained. The brochure is available in German via the authors. In the following, the main findings are given:

- In total, 26 recently established macrozoobenthic species could be identified, in which human influence is directly or indirectly responsible for the introduction (Tab.1). They belong to the taxonomic groups of Cnidaria (4 species), Arthropoda (8), Mollusca (9), Annelida (3) and Tunicata (2).
- The main area of origin is the Atlantic coast of North America (9 species). In general, neozoa only became established if they were introduced from similar latitudes.

Table 1
Macrozoobenthic neozoa at the German North Sea coast.

Neozoa actualia		Time of introduction
Cnidaria		
Anthozoa	<i>Diadumene cincta</i>	1928/29
Hydrozoa	<i>Bimeria franciscana</i>	1910/14
	<i>Cordylophora caspia</i>	19 th cent.
	<i>Nemopsis bachei</i>	1942?
Arthropoda		
Amphipoda	<i>Corophium curvispinum</i>	1980s
	<i>Corophium sextonae</i>	1997?
	<i>Gammarus tigrinus</i>	1957
Isopoda	<i>Proasellus coxalis</i>	1980s
Cirripedia	<i>Balanus improvisus</i>	19 th cent.
	<i>Elminius modestus</i>	1953
Decapoda	<i>Eriocheir sinensis</i>	about 1910
	<i>Rhithropanopeus harrisi</i>	1910/14
Mollusca		
Bivalvia	<i>Congeria leucophaeta</i>	1910/14
	<i>Corbicula fluminalis</i>	1980s
	<i>Crassostrea gigas</i>	1986/91
	<i>Dreissena polymorpha</i>	19 th cent.
	<i>Ensis americanus</i>	1978
	<i>Mya arenaria</i>	10./11. th cent.
	<i>Petricola pholadiformis</i>	about 1900
Gastropoda	<i>Crepidula fornicata</i>	1931/34
	<i>Potamopyrgus antipodarum</i>	about 1900
		First finding
Annelida		
Polychaeta	<i>Ficopomatus enigmaticus</i>	1972/75
	<i>Marenzelleria cf. viridis</i>	1990s?
	<i>Marenzelleria cf. wireni</i>	1980s?
Tunicata		
Ascidea	<i>Aplidium nordmanni</i>	1990s
	<i>Styela clava</i>	1997?

Neozoa incerta		First finding
Cnidaria		
Anthozoa	<i>Cereus pedunculatus*</i>	1921
	<i>Haliplanella luciaeluciae</i>	1920
Hydrozoa	<i>Bougainvillea macloviana*</i>	1895
	<i>Gonionemus vertens*</i>	1947
Arthropoda		
Decapoda	<i>Callinectes sapidus*</i>	1964
	<i>Orconectes limosus</i>	1980s
Xiphosura	<i>Limulus polyphemus*</i>	1866
Mollusca		
Bivalvia	<i>Teredo navalis</i>	1791
Annelida		
Polychaeta	<i>Aphelochaeta marioni</i>	1938
	<i>Microphthalmus similis</i>	1965
	<i>Nereis virens</i>	1923
	<i>Polydora ligERICA</i>	1932
	<i>Tharyx killariensis</i>	1972
* recently extinct		
Neozoa simulata (a selection)		
Arthropoda		
Isopoda	<i>Idothea metallica</i>	1994
Cirripedia	<i>Lepas anatifera</i>	1830s
	<i>Lepas fascicularis</i>	1865
Decapoda	<i>Palaemon longirostris</i>	1920s
	<i>Portunus latipes</i>	1935
Annelida		
Polychaeta	<i>Sabellaria alveolata</i>	1972

barnacle *Balanus eburneus* might be mentioned here as potential candidates.

In addition, at this time the indications support the thesis that warm water species generally tend to immigrate into the German Bight and establish themselves here. Maybe these are indicators of climate modifications (higher water temperatures in winter?). Therefore, the German North Sea coast will receive non-indigenous species by natural mechanisms (mainly currents) also in future. To what extent, the species introduction by direct or indirect human activities is to be considered as essential here, whether it would be prevented or whether the free way of "nature" would be supposed, is the subject of current discussions on a national and international scale, whose final summary - each can still add to this - is to be awaited full of suspense.

References

Nehring, S. & H. Leuchs, 1999. Neozoa (Makrozoobenthos) an der deutschen Nordseeküste - Eine Übersicht Bundesanstalt für Gewässerkunde Koblenz, Bericht BFG-1200, pp. 1-131.

The documentation will be published in May 1999 and can be obtained for free from the authors.

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