

## Preface

In February 1998 a workshop was held on 'Exotic invaders of the North Sea shore' at the Wattenmeerstation Sylt, an island research station that used to belong to the Biologische Anstalt Helgoland (BAH) and is now part of the Alfred-Wegener-Institut für Polar- und Meeresforschung (AWI). Thanks go to the circumspect gang of organizers, and to all of the 37 participants in the workshop for their lively discussions. The speakers are thanked particularly for their contributions and for providing manuscripts, now published in this volume of *Helgoländer Meeresuntersuchungen*.

As an introduction to the theme, an overview of 80 species of marine exotics is given which were introduced by man and then became established in the North Sea region (Reise, Gollasch & Wolff). This paper greatly benefitted from various contributions by the participants of the workshop. Primarily because of scant observations and ongoing misidentifications, little reliable information on exotic protists is available (Elbrächter). Most of the algal introductions were associated with imports of Pacific oysters and occurred preferentially in the southern North Sea (Maggs & Stegenga; Fletcher & Farrell). Many of the alien red algae contain anti-grazing compounds which may contribute to their invasive success. The most recent newcomer is the large kelp *Undaria pinnatifida*.

By multiple introductions of various races, the North Sea oyster *Ostrea edulis* has been genetically altered and is now largely superseded by cultures of the Pacific oyster *Crassostrea gigas* (Drinkwaard). Originally introduced with these oysters was the hardy ascidian *Styela clava*, but then the further spread may have been accomplished by attaching to drifting *Sargassum muticum* – itself introduced with Pacific oysters – or to the hulls of ships (Lützen). Also, the Asian crab *Hemigrapsus penicillatus* seems to be hitchhiking on ship hulls (Gollasch).

Most exotic invertebrates which invaded the North Sea tramped across the North Atlantic in the ballast of ships. The clam *Mya arenaria* arrived almost at the onset of transatlantic seafaring and also successfully invaded other foreign coasts (Strasser). Not all exotic invaders need to be transferred by man. The isopod *Idotea metallica* dwells on drifting seaweeds which are often transported by currents over long distances. Establishment around Helgoland succeeded presumably because recent winters were particularly mild (Franke, Gutow & Janke). Change of shore habitats by man prompted invasions also by native species such as the periwinkle *Littorina saxatilis* (Wilhelmsen).

Exotic invaders do not seem to have unique properties. However, their life stages often have a wide range of tolerances, and they show extended breeding seasons and high fecundity. A typical example of this is the barnacle *Elminius modestus*, originating from the South Pacific (Harms). Another master of high tolerance is the introduced polychaete *Marenzelleria cf. wireni* (Schiedek). An invasion of this American species into the Ems estuary shifted the macrozoobenthos from being dominated by bivalves to a domination of polychaetes (Essink). Also recently introduced, the razor clam *Ensis*

*americanus* established a dense filter feeding assemblage of high biomass where none occurred before (Armonies & Reise). Although there is little evidence of direct competition, these invaders fundamentally altered the trophic pathways in the benthos. For the Asian green alga *Codium fragile* it is suggested that the composition of the recipient community may determine the success of an invasion (Chapman). Similarly, the paucity of species in brackish waters is assumed to ease the establishment of introduced exotics in the fauna of the North Sea estuaries (Wolff).

None of the recently introduced exotics seem to have caused ecological or economic catastrophes in the North Sea. However, taken together these species have gradually altered the coastal biota with implications on ecosystem functions, and since no one can tell the effects of the next species about to arrive, it is urgent to further implement the prevention of deliberate and unintended introductions to the North Sea shore. To improve our understanding of why this should be done and which preventive measures are the most appropriate, more research on the subject of exotic introductions is needed.

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