

XII. - *Mytilicola intestinalis* in relation to other invasions of aquatic animals

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The penetration and extension of *Mytilicola intestinalis* in different parts of N.W. Europe has raised the very important question whether this species will be able to maintain itself as a permanent resident or that it will disappear again.

There are very great differences in environmental conditions of the original habitat in the Mediterranean and the habitat that it newly has occupied in N.W. Europe, especially with regard to temperature. In many regions in its new habitat the temperature of the water in winter will often fall to below 0° C... sometimes for long periods. This never occurs in the original habitat.

One is, therefore, inclined to suppose that an extremely low temperature, covering the whole new habitat, might involve a general mortality and the end of *Mytilicola* in these regions. We know, however, already now that this hope is vain.

In the German Wadden Sea where *Mytilicola* is known to be living since 1938, it has been exposed to 2 extremely severe winters, 1941-1942 and 1946-1947. We do not know if this exposure has caused a great mortality, but it is certain that a sufficient number has survived to maintain the existence of the species.

Now that *Mytilicola* has shown to be able to stand low temperatures we cannot expect that climatic factors will cause the end of this species in our northern waters.

It is fairly certain that there are no other abiotic factors that will help us in getting rid of *Mytilicola*. A very low salinity winter will occur in all the different regions simultaneously, and this would be necessary to kill all *Mytilicola's* accepted that it would be affected by a low salinity.

There is, therefore, no reason to suppose that abiotic factors will cause the end of *Mytilicola* in our regions and the next question is if other factors of unknown character will cause its disappearance.

It is impossible to answer this question. The only thing we can do is to trace the fate of other animals that are known to be invaders like *Mytilicola*. This could give us some indication of what we may expect in the case of *Mytilicola* by analogy.

The steadily increasing traffic is a great help to many organisms to extend their natural boundaries. In many cases they will not find suitable conditions and they will disappear again without leaving any trace. But sometimes they will succeed in settling in their new environment.

A few cases I shall describe here; I shall restrict myself to aquatic species, to the Netherlands and to recent times. With all these restrictions it is still possible to enumerate a sufficient number of invaders to get an idea what their fate generally is.

A notorious invader in N.W. Europe in the beginning of this century was *Eriocheir sinensis*. The first individual was found in the Aller, a tributary of the Weser in 1912 (Panning, 1950). It extended very rapidly in Germany, and it soon became a great nuisance to the freshwater fisheries. In 1931 its presence was stated in the Netherlands (Kamps, 1937); in 1934 it was already found in great numbers and 4 years after the first individuals were found, it caused already serious damage to the fishermen. Since that time the extension did not go on as rapidly as before, and great fluctuations in frequency occurred. Evidently the reproduction is often hampered by adverse conditions.

It is supposed that an equilibrium between mortality and reproduction has been reached at present. Until now no signs of a definite decline can be observed.

Crepidula fornicata, the slipper limpet, reached the Dutch territory from England where it was imported with American oysters, probably about 1880 (Orton, 1937).

In 1929 two living *Crepidula*'s were found on the Zealand oyster beds. In 1930 hundreds of them were caught, and 2 years later the situation was already growing alarming (KORRINGA, 1942). In few years millions of individuals have developed out of the very few invaders that first had settled in these waters. The annual increase, therefore, must have been enormous.

It is impossible to state if this reproductive capacity is still the same at present as the activity of the oysterfarmers has made the conditions much less favourable than in the first years. On a great part of the oysterbeds a thick layer of *Cardium* shells had accumulated many years through and they provided a very favourable substratum for *Crepidula*. These shells were removed as completely as possible.

Although it is unknown if the reproduction capacity is still the same as in the first years of its extension, it seems likely that a kind of equilibrium is obtained now between reproduction and mortality. The mortality is for a great part caused by the different kinds of control that have been developed.

Among the fishes *Lucioperca sandra*, the pike-perch, came into the Netherlands both by natural means and by the aid of man. It has been transferred from the more eastern parts of Europe to the river Rhine about 1885. In 1888 the first individual was caught in the Netherlands. Soon it became one of the common fishes in our country.

While all the other invaders are harmful or at least valueless, *Lucioperca* is a much appreciated addition to our fauna. Therefore, its extension has been furthered as much as possible by protective measures. Now that it is established, however, there is no reason to suppose that it would be more liable to extinction than the autochthonous fishes when these measures would be abolished. Its foreign origin seems to be no handicap for its reproduction and growth in its new environment.

Petricola pholadiformis was found in our waters for the first time in 1907. Originally it is an American species. It has not extended so much that, unlike the 3 preceding species, it has evoked the interest of the layman. It is more commonly occurring now than the related autochtone species *Pholas candida*. It is even stated that this last species has decreased in number after the invasion of *Petricola*.

In the list of species enumerated above I have restricted myself to the Dutch waters. I should like, however, to add in this connection *Urosalpinx cinerea*, the American oyster drill, that was imported on the English oysterbeds. It thrives well there and does much harm to the oyster culture. It maintains itself despite all the attempts of the oyster farmers to root it out.

In very recent time 2 other invaders have been observed on the Zealand oysterbeds that have shown to be able to reproduce here, viz. *Polydora hoplura* and *Elminius modestus*. Both species have not yet lived long enough here to prove if they will be sufficiently adopted to their new environmental conditions. Particularly they have not yet been exposed to an extremely cold winter. Up to now nothing can be said about their future extension.

From the species mentioned above the first 5 (*Eriocheir*, *Crepidula*, *Petricola*, *Lucioperca* and *Urosalpinx*) have demonstrated to be able to maintain themselves during a period of many years. No one of them shows any sign of decline, either by decrease of reproductive capacity or in falling a victim to an unfavourable biotic factor.

Against these 5 species no single one is known to have disappeared after it has shown to be able to stand the new environmental conditions.

Although the number of 5 species is too small for generalizing their behaviour suggests that *if a species once is established and has been able to stand the extremes of its new environmental conditions, it shows all characteristics of a permanent resident.*

To these species of invaders must be added *Mytilicola intestinalis* now. We know already that this species has been able to maintain itself in the German Wadden Sea during the most severe winters that occur in our regions. We do not know any other abiotic factor that could cause a general mortality.

The fate of the group of 5 invaders described above cannot give us much hope that factors of another character would cause the disappearance of *Mytilicola* in our regions. This would be the first case in the history of the invaders in our country.

The chance that we get rid of *Mytilicola* by natural means is small. This may give us a stimulus to exert ourselves as much as possible in our action against this new enemy.

May this meeting contribute successfully to this action.

LITTÉRATURE

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