

The decline of natural oyster beds

by

Dr. P. Korringa

(Governmental Institute for Fishery Research, Bergen op Zoom)

We can hardly believe now that immensely rich oyster beds once fringed many of the coasts of western Europe. Though some authors exaggerate by trying to make us believe that once a nearly uninterrupted cordon of natural oyster banks existed, there are reliable data available to convince us, that many natural oyster beds of the French and Scotch coasts were very rich indeed, and that the banks along the English, Dutch, German and Danish coasts were by no means negligible.

These oyster beds disappeared no doubt by overfishing and but a few poor remains, scattered along our coasts, economically of little or no importance, remind us of the once very important fisheries on the natural oyster banks. Only in France and Holland new methods were adopted in time, and an intensive oyster culture, spreading prosperity in the regions concerned, took the place of the old free fishery on the natural beds, raising the yield to an unexpected level. In Holland and France a self-supporting oyster culture is thriving and there is no reason to grieve for declined and disappeared natural beds. Listen to Lambert (1946): „Les grands gisements ont disparu. Faut-il s'en plaindre? De l'affaiblissement ou de la disparition des immenses bancs, qui formaient jadis, tout le long de nos côtes, un cordon presque ininterrompu, est née l'ostréiculture, une des plus belles industries de notre pays.”

Britain and Germany stuck to the system of free fishery on the natural beds, omitted to offer the young fry adequate collector material on a large scale, and tried to restore the declining oyster beds by regulating the oyster fishery. Wistfully one regrets the once rich banks along the national coasts, enviously one looks at the prosperous oyster culture in France and Holland, and it seems hardly possible to acquiesce in the present conditions.

Quite recently both British and German scientists (Gross & Smyth 1946, Hagmeier 1941) tried to contrive a plan to restore the old glory of the natural oyster beds. I am pretty sure, however, that both plans will lead to a serious disappointment, as both made the same mistake: they overrated the reproductive power of our European flat oyster, *Ostrea edulis* L. Both British and German investigators fully recognize that overfishing was the cause of the decline, but they cannot understand why a revival of the natural beds failed to come after the termination of the fishery and even after the relaying of passable quantities of French or Dutch oysters.

Hagmeier tells us how Dutch and French oysters were relaid on the German oyster banks in the Wattenmeer, and how disappointed one was to find practically no spat there the next season. Hagmeier thought that the French or Dutch oysters were to blame for this failure, and that only German oysters are apt to produce viable spat in the Wattenmeer. Hagmeier suggests to concentrate the few remaining German oysters on the most favourable spot of the German natural oyster banks, so that the eggs of the mother-oysters get a better chance to be fertilized than in their present scattered position on the depleted banks (in which he is certainly right), and cherishes the hope (certainly in vain) that from this centre a general revival will start. In case too few German oysters would be found, Hagmeier suggests an importation of about 500,000 oysters, but to choose Norwegian or Danish oysters and to avoid French and Dutch ones, which once led to so terrible a disappointment.

Gross and Smyth agree that overfishing caused the decline of the British beds and cannot believe, that it is a general change in environmental conditions, which prevents their revival now that many of the nearly depleted beds are left in peace. Since one oyster can produce from 500,000 up to 1,000,000 eggs, a rapid propagation should be expected on the banks, which are no longer disturbed by fishermen. As this is evidently not the case, something must be wrong with the oyster itself. They are inclined to believe, that the scanty remains of the once so rich oyster beds are not apt to a general revival because the population has gradually become genetically too uniform, so that the oysters are on the average less adapted to present conditions and less adaptable to long-term environmental changes. Relaid French oysters come from southern and warmer areas and are therefore considered as less suitable in helping to restore British oyster beds. The remedy suggested by Gross and Smyth is a mass-hybridisation of at least twenty varieties from different geographical communities and particularly from northern rather than southern communities, which hybridisation could be carried out in the large tanks now being used with success in oyster breeding. „Such a stock might not only yield better results when cultivated, but might also increase in numbers on suitable grounds and lead to a gradual repopulation of our coasts.”

Both British and German plans require an investment of only a moderate sum of money, and open prospects of a general repopulation of the natural oyster banks. Hagmeier even hopes to turn the German oysters into a cheap popular foodstuff and suggests to prohibit any importation of foreign oysters for consumption.

When can one expect a general repopulation of natural oyster banks, supposed that natural conditions did not change there materially and

fishery is omitted? As soon as natural reproduction surpasses natural mortality. Mortality in oyster populations is far from negligible, as many enemies try to make away with them, especially in the first few years of their life. Moreover oysters are smothered by moving sands or by silt since they are unable to move from the spot, while many others are killed in severe winters.

The possibilities for natural reproduction in the oyster are generally highly overrated. Indeed, 500,000 up to 1,000,000 larvae in one incubating mother-oyster is an enormous and promising number! But this is only the beginning! During several consecutive years I had the opportunity of collecting a great number of quantitative data on larval development, on attachment of the spat, and on the further development of the young oyster, in the Oosterschelde, the centre of Dutch oyster culture (Korringa 1940). The number of planktonic oyster larvae, which make their appearance in the water, appeared to be proportional to the number of mother-oysters present in the area concerned. I hope to show these data for a period of ten years before long. A high percentage of the pelagic larvae is destroyed by plankton-eating animals; in the Oosterschelde about 10 % in each tidal cycle. The currents disperse the larvae to a high degree and many are swept away to districts, where the chance to find a suitable substratum is negligible. The water in the basin of the Oosterschelde performs an almost perfectly oscillating movement, which ensures such a satisfactory retention of the larvae, that only about 4 % of them are swept away to unfavourable districts in the course of one tidal cycle. I do not doubt that hydrographical conditions are far less suitable in the great majority of other estuaries, which results in a far higher percentage of disappearing larvae. Water temperature influences the rate of development of the larvae, low temperatures slowing it up. It will be clear from the foregoing, that any protraction of the pelagic stage decreases the percentage of the larvae that reach the full-grown stage. In the Oosterschelde, where water temperatures and water renewal are highly favourable, about 2½ % of the larvae reach maturity at 18° C, about 5 % at 20° C, and about 10 % at 22° C.

Granted! Even in case these figures are lower owing to a greater dispersion by tidal currents, the number of full-grown larvae is by no means negligible in case there are enough mother-oysters. But now the great stumbling block is coming. Mature larvae are to find a suitable piece of substratum to attach on within a limited space of time; if they don't succeed, they perish. Only hard and clean objects can be used with success for this purpose, and such objects are extremely scarce on the sea-bottom. Shells and gravel are usually covered with a film of silt or organic growth and on such objects the glue of the byssus-gland

will not stick, so that fixation is impossible. Oyster farmers provide the larvae with suitable collector material and scientific research can help them to choose the right moment to plant the cultch by predicting the spatfall. But even though they planted for instance, in the year 1939 in the basin of the Oosterschelde (containing about 675,000,000 m³ of water at high tide) about 6,000,000 limed tiles and 4,000 m³ of mussel-shells, only a small percentage of the mature larvae succeeded in attaching themselves, namely about 1%! To the mature larvae, in search of a suitable substratum, the sea-bottom is an immense desert, provided with but a few scattered oases in the form of clean collectors; but only 1% of the mature larvae are successful in their search, the others perish in the desert.

Many of the newly settled spat perish in the first weeks of sedentary life, probably mainly through smothering by silt or sand or by other organisms of a more stalwart nature settling down on the same piece of substratum. In spite of all the cares of the oyster farmers, it is considered normal if 10% of the spat that originally settled down in the summer-months is still present on the collectors in the month of October. And then winter is approaching, and in the next summer season crabs, starfishes and drills will feed on the delicate young oysters, but all these losses are trifling compared with those in the perilous period during which it was urgent to find a collector!

From the foregoing it may be concluded that the „useful effect” is not very great in the propagation of *Ostrea edulis*. In the Oosterschelde, which can be considered as very suitable to oyster culture, and where many collectors are planted, only about 25 out of a million larvae are found back on the collectors as spat in autumn in years characterized as normal if 10% of the spat that originally settled down in the year by a profuse spatfall.

Let us return now to a natural oyster bed with a depleted population. The number of larvae produced is dependant on the number of mother-oysters. If hydrographical conditions are not extremely favourable, many larvae will be swept away with the currents, before they reach the mature stage, while plankton-eating animals levy daily a heavy tribute. How are the mature larvae to find any cultch if it is not provided to them by oyster farmers? Practically the only hard and clean objects there, are the thin new shell-edges of the growing oysters themselves and only the larvae which are lucky enough to detect that place, so to say under their mother's skirts, save their life. (In the North Sea fresh pieces of cinder appear to suit them too.) This is the reason why oysters are so often found in clusters on natural banks in stead of single. That was already so in the far-off days with a rich oyster population on the banks. Very many larvae were produced there and the oysters themselves provided the

cultch in the form of their clean new shell-edges. Natural banks could thrive even on less favourable spots thanks to a great number of oysters present in the community. Then man interfered; he fished for oysters and was not satisfied with a moderate yield. He overfished the beds and the phenomenon described above contributed to a rapid decline, for large oysters were fished away, diminishing the number of mother-oysters and the quantity of natural cultch, but in the same time innumerable young oysters, attached on the shells of the larger ones, were destroyed. This depletion process is accelerated as soon as oysters become so scarce on the natural banks, that fertilization possibilities diminish and only part of the maternal eggs are able to develop into larvae. That means the end of a natural oyster bed in case it is too isolated to receive larvae from other populations. As far as I know, no data about the number of fertilized eggs in mother oysters on depleted banks have been collected so far.

What can we do to stop the decline? In case the population is poor, and that will not be the case when too few larvae reach the mature of cultch is only profitable if enough spat is collected to pay the charges and that will not be the case when too few larvae reach the mature stage. A couple of extremely severe winters following 1939 reduced the oyster population in the Oosterschelde, so that only about 10,000,000 mother oysters (oysters of 20 gram apiece and more) were still present for a few consecutive years. We managed to work it up again, but we know now, that we were then pretty near the minimum quantity of mother-oysters necessary to plant cultch profitably; and that in the famous Oosterschelde! It will be clear from the foregoing why I do not believe in the success of British and German plans to restore the natural oyster beds, as both want to start with a very limited number of mother-oysters and do not utter a word about the planting of cultch material.

Is there no hope for revival of once so prosperous oyster beds? There is a possibility, but only if one is inclined to invest quite a lot of money in it, and to work on a large scale. In the first place a suitable spot should be selected, ensuring a restricted dispersal of the larvae and a suitable temperature for larval development. A wide area of bottom surface should be selected, ensuring a restricted dispersal of the larvae and a suitable temperature for larval development. A wide area of bottom surface mother-oysters should be planted there, more according as hydrographical conditions are less ideal. Cultch should be planted on a large scale and in due time; in deciding the right moment to plant it scientific investigations can help a great deal. If the area concerned is free from *Crepidula*, shells of *Cardium* a.s.o. can be used as collectors, if *Crepidula* is present only a rapidly desintegrating shell, like that of the mussel (*Mytilus edulis*) can be used or one should utilize removable collectors like limed tiles, bags of wire netting filled with shells, bundles of limed birch-rods or

cementcoated cardboard-collectors, the latter three only applicable in places sheltered from wave action and strong currents.

In my idea it is not very important from which country the mother-oysters arrive. The majority of French oysters do not come from the extreme south of France (Arcachon) as the British authors assume, but from the Morbihan in Brittany. These oysters are at least partly descended from Dutch oysters brought there in tens of millions after the tremendous and mysterious mortality in 1921 (the French oyster farmers knew how to repopulate a depleted area!). It is true, Brittany oysters are more sensitive to low temperatures than Dutch oysters, but I possess strong indications that this sensitiveness is not hereditary. In fact I repeatedly observed that it disappears after the first winter in a colder climate. In the second winter Brittany oysters appeared to be as hardy as our natives. I should not advise going too far north, for the Norwegian pollen represent glass-house conditions and according to our experience Norwegian oysters are more sensitive to low temperatures than our native oysters.

Against my dissertation the objection can be raised that my suggestions do not aim at a revival of natural oyster beds, but at the foundation of oyster culture. Indeed, that is true. Oyster culture is probably possible in several suitable places of the European coast, but natural oyster beds, once severely overfished, are doomed. Only in a few spots they eke out their existence receiving a supply of larvae from neighbouring centres of oyster culture. I fully agree with Lambert (1946) saying: „ils doivent leur persistance à la proximité de nombreux parcs, qui leur envoient le naissain nécessaire. Ainsi la situation a complètement changé, jadis les gisements alimentaient les parcs, actuellement certains ne subsistent peut-être que grâce à eux;” but I do not share the view of Ranson (1943), expressing anew the old erroneous idea: „Les huîtres des bancs naturels sont seules susceptibles d'assurer la pérennité de l'espèce.” The three most important European centres of oyster culture, the basin of Arcachon, the Morbihan estuaries and the basin of the Oosterschelde, where „wild” oysters are practically lacking, are there to support my view.

References

- Gross, F., & Smyth, C. C., 1946. The decline of oyster populations. *Nature*, vol. 157, pp. 540—542.
- Hagmeier, A., 1941. Die intensive Nutzung des nordfriesischen Wattenmeeres durch Austern und Muschelkultur. *Zeitschr. f. Fischerei u. Hilfswiss.*, vol. 39, pp. 105—165.
- Korringa, P., 1940. Experiments and observations on swarming, pelagic life and settling in the European flat oyster, *Ostrea edulis* L. *Arch. Néerl. Zool.*, vol. 5, pp. 1—249.
- Lambert, L., 1946. Les huîtres des côtes françaises. *Pêche mar., pêche fluv. & piscicult.*, vol. 29, pp. 31—33.
- Ranson, G., 1943. *La vie des huîtres*. Paris, Gallimard, 260 pp.