

Study of the effects of a fish farm on benthic macroinvertebrates. Application of standardised French method "IBGN" and analysis of biological traits for some taxa differing in feeding features.

Assessing river quality is now a major aim, due to the French Water Law (1993) and the European Water Framework Directive. It becomes compulsory prior to any use or management project.

Such an assessment involves many physico-chemical parameters, as well as biotic groups. So biological indices have been made to point out the quality of ecosystems.

This assessment report has been undertaken on the River Scorff and its tributaries. This river is being a major site for the UMR INRA-Agrocampus Rennes for more than thirty years.

To assess the effects of the last fish farm in activity on the river, and after its change in amount of production due to administrative requisition, the standardised method IBGN has been applied. The level of identification was the genus, in order to study biological traits for some taxa sensitive to pollution.

A between-year comparison of the results (before reduced produced and after it) allows to study its effects on macroinvertebrate communities.

Bioindication methods

The used standard is IBGN, a score method based on macroinvertebrates characteristics in sensitivity to pollution. A fixed sampling protocole has been involved to get a representative picture of ecosystem.

On each studied reach, eight samples have been collected using a Surber sampling net.

Each sample has been chosen considering both substratum and water velocity, after an inventory of different microhabitats types

Thus the eight samples have been separated and are considered to be representative of the reach.

The taxonomical unit considered into the standard is the family, except for difficult groups that are only considered to the class or embranchment levels. Only organisms belonging to the fauna list considered in the standard (138 taxa) have been collected.

For each reach, the taxonomical variety (total richness in individuals), the indicator group within the sample have been studied. The score is calculated considering the intersection between appropriate line and column.

In order to quantify the effects of Pont-calleck fish farm, six reaches have been chosen upstream and downstream from the fish farm sewage.

Many indices lead to a better data exploration and to analyse the structure of the macroinvertebrate communities.

Study results

The IBGN scores are very good on the River Scorff. They reach 20 from the most upstream reach down to the reach below the fish-farm effluent. On these reaches, the bioindicator taxon is *Periodes*. On the two most downstream reaches,

Such apparent good quality hides misfunctionings. Abundance is very high in the close downstream reach from the fish farm (11841 individuals versus 3190 to 4987 in other reaches).

The variety is high in all reaches: the amount of taxa is between 41 and 48. Such a high variety points out that the River Scorff has many potential niches.

The diversity H' is around the average to low on the River Scorff, showing that all those niches are not already occupied. It decreases a lot in the close-downstream fish farm reach, due to low variety compared to high abundance. The community is dominated by some taxa, namely Chironomidae and Oligocheta.

That diversity is always very far from its potential maximum. Thus it appears, with the redundancy calculation that the river does not work more than 44 % of its optimal functioning in the close-downstream fish farm reach versus 57 % to 65 % elsewhere. Meanwhile; the watercourse gets better, the redundancy becoming quite good in the far-downstream reach.

On the River Scorff, equitability J' is always below 0.8, showing that macrobenthic invertebrate communities are not equilibrated and that use of niches is not complete. Such an equitability is between 0.5 and 0.56 on the scorff except in the close-downstream fish farm reach, where it is 0.445. Such a decrease assesses once more the effects of the fish farm on macroinvertebrate communities.

Thus the fish farm goes on disturbing the river Scorff at a non-negligible level. It leads to local eutrophication. Thus in the close-downstream fish farm reach, the abundance is at its maximum and three times highest than in the other reaches. The S' richness is high in every reach, pointing out that the potential niches are numerous but poorly occupied in the close-downstream fish farm reach due to low H' diversity.

Between year surveys on the effects of Pontcalleck fish farm assesses improvement for pollution-sensitive taxa. Indeed a change within bioindicator taxa occurred assessing a better trophic quality, as well as an increase everywhere of the abundance of pollution-sensitive taxa. In the close-downstream fish farm reach, that abundance increased quite a lot, showing that the effects of fish farm is lower and

more local than during the previous years of study. Roughly, water quality is improving, unless the communities remain disturbed.

Analysis of biological traits for the macroinvertebrate taxa the more sensitive to pollution (belonging to the orders of Plecoptera, Trichoptera, Ephemeroptera) has been performed for 2004 results. It points out the kind of disturbance affecting the macroinvertebrate communities. Thus four traits have been selected from literature: the type of feeding habits (to know the type of used food), temperature (to assess possible effects of the fishfarm tanks), trophic level and saprobic value indicating water quality for organic matter).

Analysis of the first trait shows that for the close-downstream fish farm reach, there is an increase of micro-detritus and microalgae feeders; it could be a response not only to organic matters coming from the fish farm but also phytoplankton favoured by hotter water in the fish farm (see below).

With the temperature, there is an increase of thermophilous and euryecious taxa against taxa developing in colder waters. As such an effect was mainly observed in the close-downstream fish farm reach, it seems that a real temperature effect occurs on the River Scorff.

Analysis of trophic level shows a decrease in abundance for sensitive taxa to organic matter, while taxa developed in organic matter rich waters are increasing. Thus, the fish farm contributes to organic matter fluxes leading to local eutrophication.

Finally, thanks to a saprobic value approach, there is a decrease and even more a disappearance of some pollution-sensitive taxa in the close-downstream fish farm reach, assessing its impacts on the ecosystem.

Thus, the study of benthic macroinvertebrates on the River Scorff indicates a good water quality and improvement of macroinvertebrate communities.

Such an apparent good quality hides misfunctionings. The fish farm does disturb quite a lot the structure of benthic macroinvertebrate communities. It leads to a clear but local eutrophication. The analysis of biological traits is in agreement with these conclusions. The fish farm modifies the communities by the way of increasing water temperature.

Nevertheless there is an improvement regarding previous years of study. A sustainable fish production could be obtained, the polluted area being quite local and the intensity of effects reduced.