Temporal variability in the Pacific Oyster spatfall along the French Coast : a new monitoring project.

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In France, spatfall of Pacific Oysters occurs traditionally in two shellfish area of the south west of France: the Marennes-Oléron bay and the Arcachon basin. The spat collected in both sites ensures approx. 70 % of the need of the French oysters production (the other part is produced in hatcheries). But, since ten years, recruitment have become highly variable especially in Arcachon basin. For instance, in this site, spatfall (assessed at the end of the reproductive season) can vary between 50 oysters per collector to more than 20 000 oysters per collector (Figure 1). This huge variation arise questions from oysters producers and the French National Committee for Shellfish Culture want to get some explanations of the phenomenon.

It is well known that recruitment of bivalves shows large variability in time and space, depending directly on environmental factors such as temperature, phytoplankton or salinity or more indirectly on climatic conditions. For Pacific oysters, previous regional studies are available in Marennes oléron and Arcachon bays and show clearly that the reproduction of this species is highly dependent on temperature, phytoplankton (quality, quantity) especially in spring for gametogenesis and in summer for spawning and larvae survival. But these studies were only regional and this idea is now to approach the phenomenon on a larger scale. In the other side, there is now evidence of the ecological impacts of recent climate change in many environments and for many species including some European bivalves (e.g. *Macoma balthica*, Philippart et al., 2003) and a similar hypothesis can also be formulated for the Pacific oyster in France, since the reproduction ability of this species seems to "move" to the north of France. New sites are now investigated for spat collecting by oysters producers (e.g. Rade de Brest).

In that context, a national monitoring project is currently starting at Ifremer in 2008. More precisely, the major aim of this new project, named Velyger, is to monitor (1) gametogenesis, (2) larval abundance and (3) spatfall intensity for Pacific Oysters in several shellfish area in France (Arcachon, Marennes Oleron, Bourgneuf, Quiberon and Rade de Brest) and in relation with environmental and climatic factors. We expect from this project to give deeper information on the reproduction of this specie through a supra-regional approach and to confirm previous conclusion drawn in Arcachon or Marennes Oléron. Another aim of that project is to re-analyse the long historical time series of larval abundance (more than 30 years available at Arcachon and Marennes Oleron) in relation with environmental and climatic factors in order to test if the climatic changes that occur now are partly responsible of this new phenomenon. This project will also give 'on line' data to oysters producers to help them to anticipate as better as possible the variability of the reproductive cycle of the year.

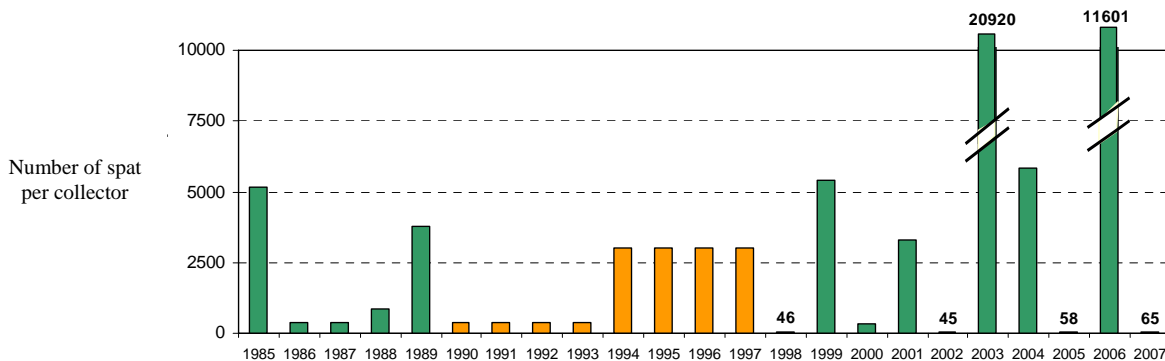The aim of this presentation is to give an overview and the first results of this project.

Figure 1 : Interannual variablity of spatfall for Pacific Oyster in the Arcachon Basin fron 1985 to 2007 (sources : Ifremer LER/AR). From 1990 to 1997, data were assessed only through investigation to oysters producers.

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Spatfall of Pacific Oysters occurs traditionally in two shellfish areas of the south west of France: Marennes-Oléron bay and Arcachon basin. Until 2000, spat collected in both sites ensured approx. 70 % of the need of French oysters production while the other part (30%) was hatchery produced.

Nevertheless, **since ten years, recruitment has become highly variable especially in Arcachon basin (Figure 1).** As a consequence, in 2008, natural spat supply dropped below 50 % and for the first time, spat from hatcheries became majoritary. This high variation arises questions from oysters producers and from their legal representation, the French National Committee for Shellfish Culture (CNC).
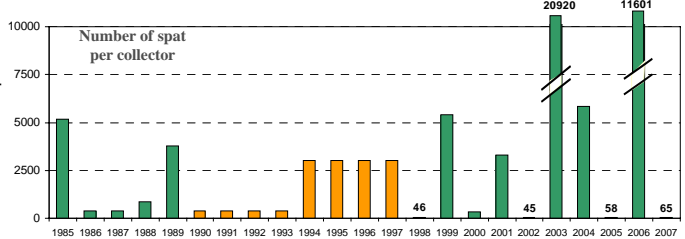

Figure 1 : Inter-annual variability of spatfall (assessed at the end of the reproductive season) for Pacific Oyster in the Arcachon Basin from 1985 to 2007: values can vary between 50 oysters per collector to more than 20000 oysters per collector ! From 1990 to 1997, data were assessed only through investigation to oysters producers (sources : Ifremer LER/AR).
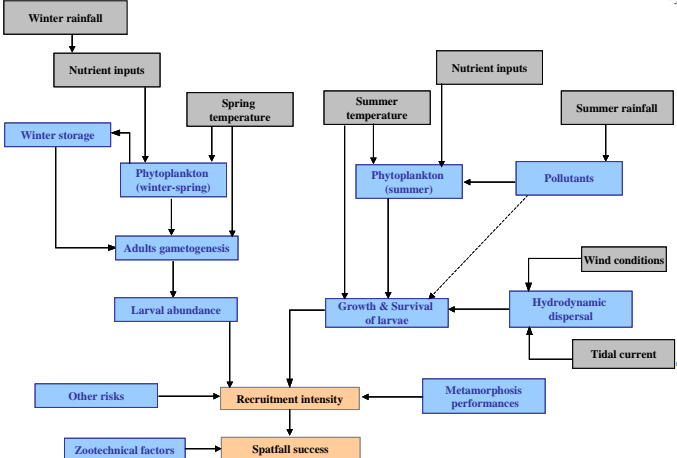

Figure 2 : Hydro-climatic implications in the success of recruitment and spatfall in *Crassostrea gigas* (adapted from Auby et Maurer, 2004). Climatic factors (in grey on the figure) drive completely the reproduction cycle of the Pacific Oyster.

Recruitment of bivalves is known to show large variability in time and space, depending directly on environmental factors such as temperature, phytoplankton or salinity and more indirectly on climatic conditions.

For Pacific oysters, preliminary regional studies carried out in Marennes oléron and Arcachon bays showed clearly that **the reproduction of this species is highly dependent on temperature, phytoplankton (quality, quantity) especially in spring for gametogenesis and in summer for spawning and larvae survival** (Figure 2). In that context, it is supposed that the higher frequency of hydro-climatic anomalies due to climate change (warm or cold summer – dry or rainy spring) is the major causes of the inter-annual variability of the spatfall (match-missmatch theory).
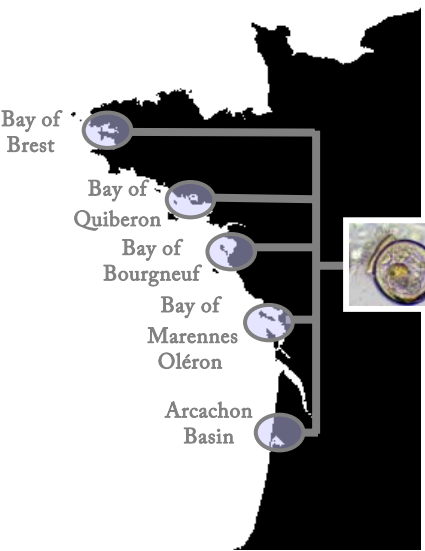

Figure 3 : Monitoring sites of the Velyger project. Note that in relation with climatic warming, the reproduction ability of this species "shifts" progressively to the north of France. New sites are now investigated for spat collecting by oysters producers (e.g. Bay of Brest).

In that context, a national monitoring project has been set up by Ifremer since 2008. More precisely, the major aims of this new project, named Velyger, is to monitor (1) gametogenesis (2) larval abundance and (3) spatfall intensity for Pacific Oysters in several shellfish areas in France (Figure 3) in relation with environmental and climatic factors.

We expect from this project to give accurate information on the reproduction of this species through a supra-regional and a long term approach and to confirm previous conclusions drawn for Arcachon or Marennes Oléron (e.g. Figure 4).

Another aim of that project is also to report 'on line' data to oysters producers in order to help them to anticipate as better as possible the variability of the reproductive cycle of the year.
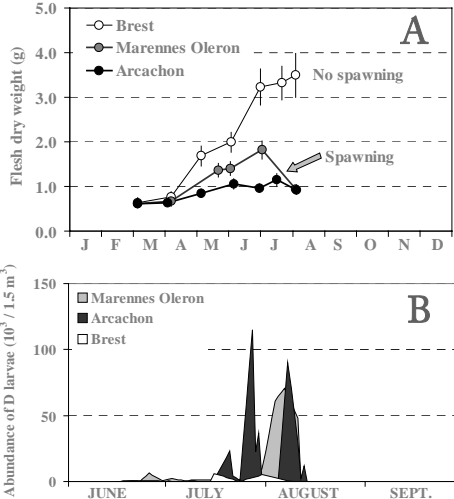

Figure 4 : Some examples of the first results obtained in 2008 by Velyger in 3 sites (from South to North : Arcachon, Marennes and Brest). A : latitudinal differences in gametogenesis and spawning. B : latitudinal differences in larval abundance (D-Stage) .

More informations on:
http://www.ifremer.fr/velyger

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