

# The use of GIS to cartography the variation of the abundance of eggs and larvae of sardine in the Moroccan Atlantic area

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In this work, the Geographical information System (GIS) and the geostatistical techniques are used to analyze and cartography the spatio-temporal variation of the distribution of eggs and larvae of sardine (*Sardina pilchardus*) in the Moroccan Atlantic region. The spatio-temporal variation of eggs and larvae distribution was studied according to two cases :

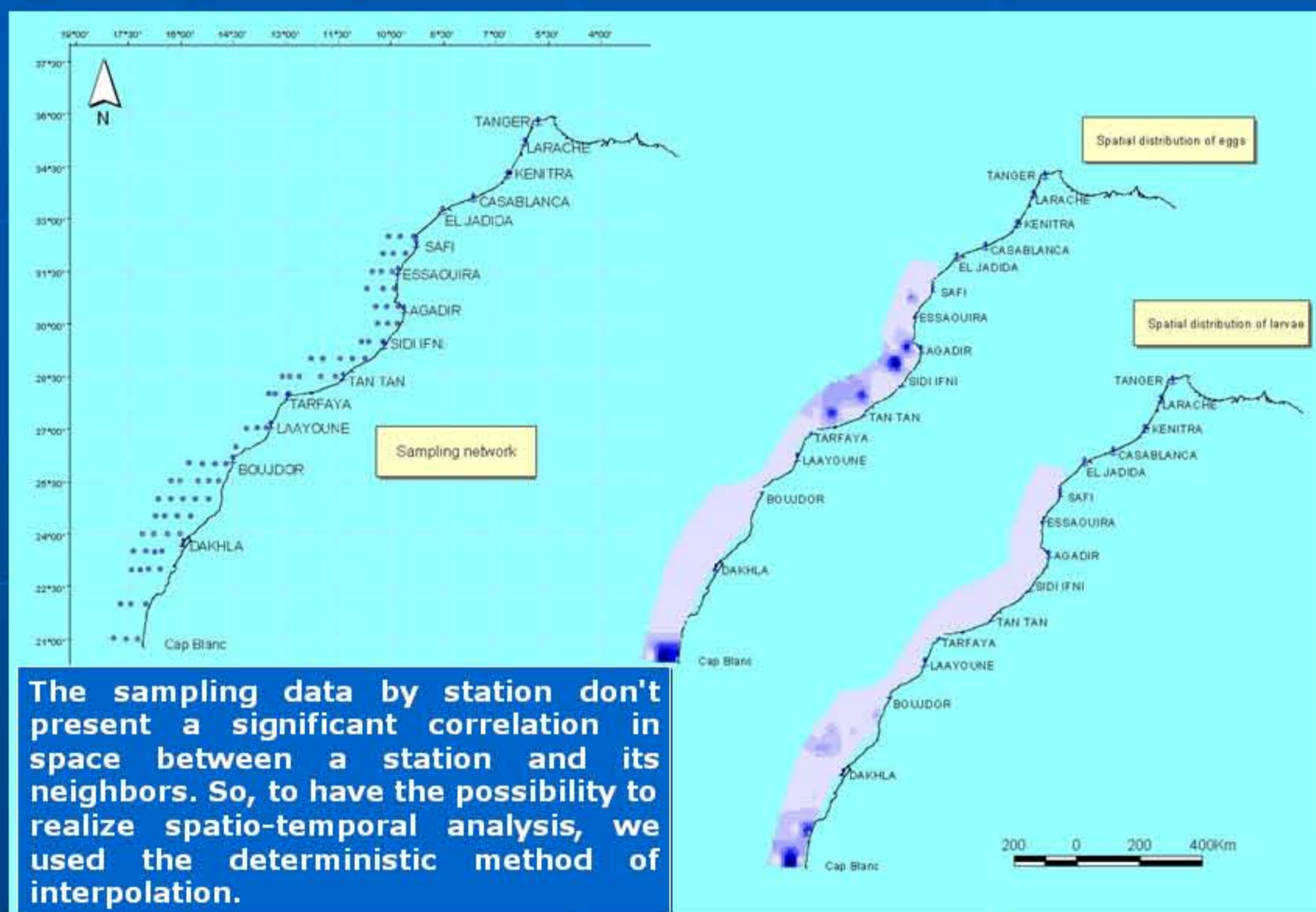
- the seasonal variation where the distinction between the season of winter and summer permits to define the different phases of the biology of sardine. The change of eggs and larvae behavior from one season to the other is susceptible to be accompanied by habitat change, hence of the geographical distribution.
- the interannual variation that can be the reflection of environmental parameters modification.

Data of 4 years of scientific prospecting surveys (1994-1997) have been used. The area of study is spreading from Safi (32°18' North) to Cap Blanc (21° North), and from the shore to 1000m depth.

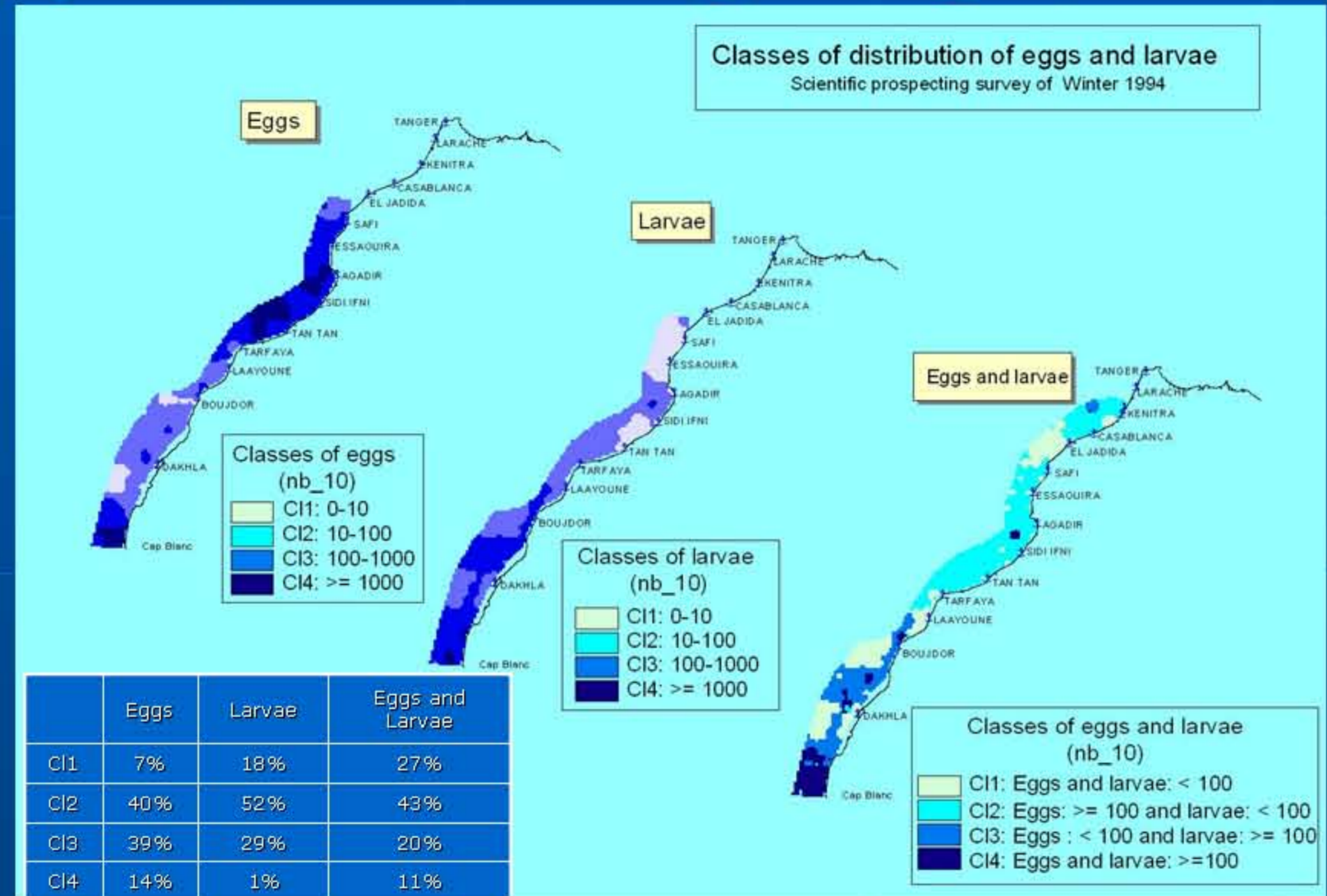
The following steps are used to cartography area of distribution of eggs and larvae of sardine :

- spatio-temporal exploration: the analysis of data of eggs and larvae densities by station of every survey permits to verify the spatio-temporal resolution;
- spatio-temporal modelisation: the interpolation on a grid of 0.092 degree followed by a classification in 4 classes of densities facilitates the identification of zones corresponding to various level of eggs and larvae concentrations;
- the spatial combination of data of eggs and larvae densities with environmental parameters permit to identify the influence of climatic condition variations on the distribution and the abundance of eggs and larvae of sardine.

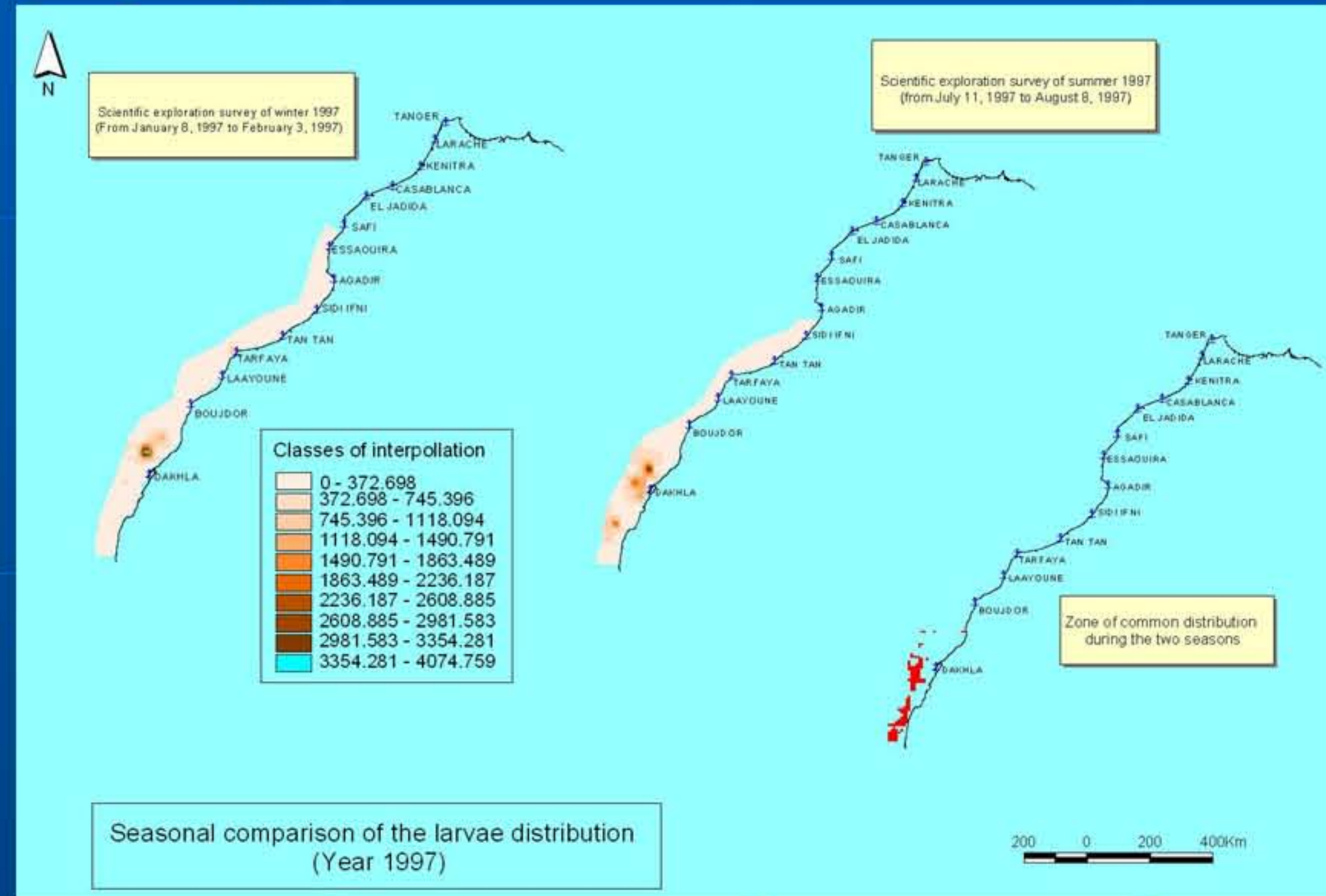
The simple representation of the variable by station (represented by a point) permits at first to verify the sampling network and to achieve a preliminary spatio-temporal exploration of data.



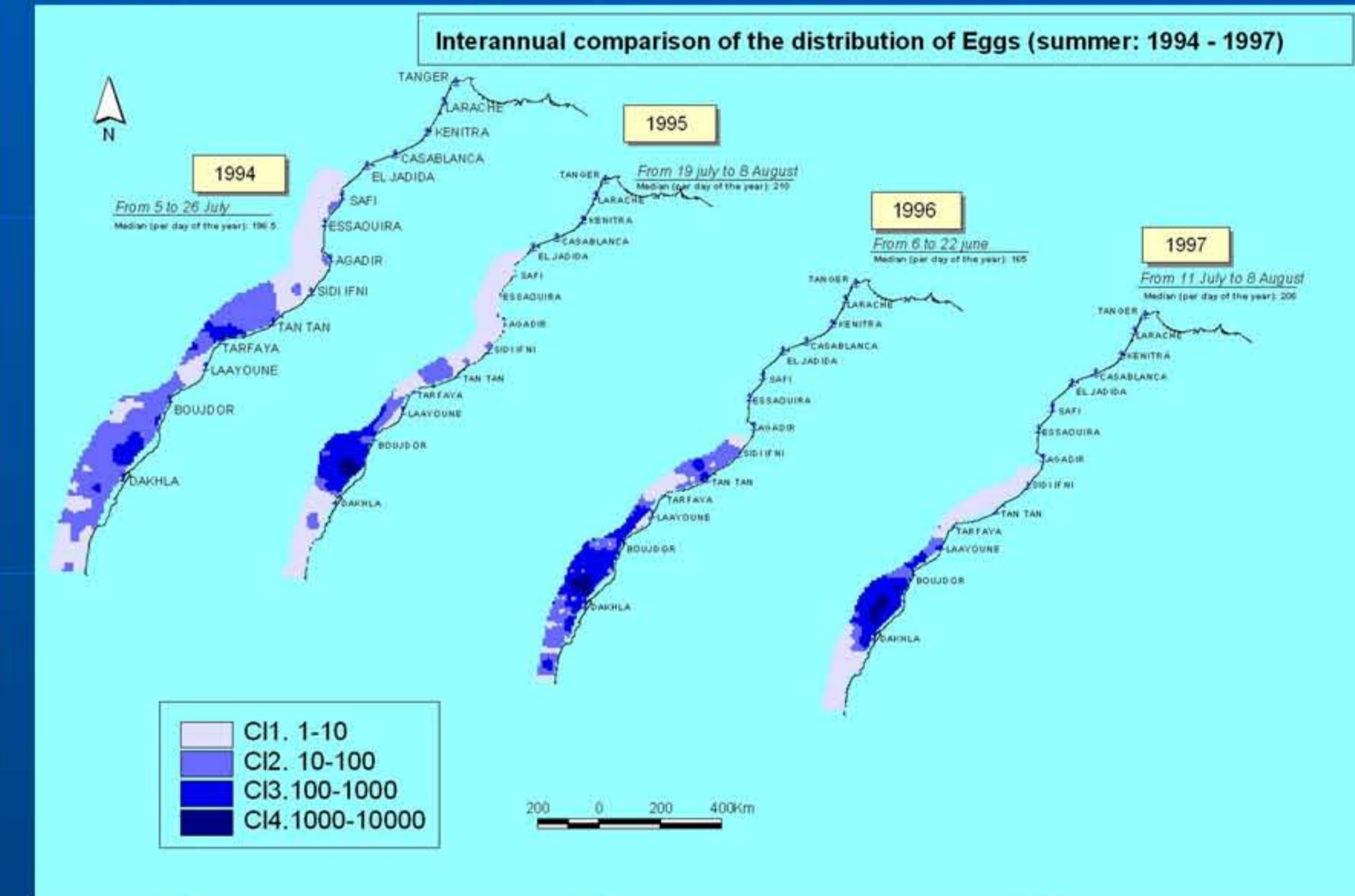
The classification in four classes of abundance allowed to identify areas of concentration of eggs and larvae. The combination between the two information layers made possible to locate area of strong presence of eggs and/or larvae.



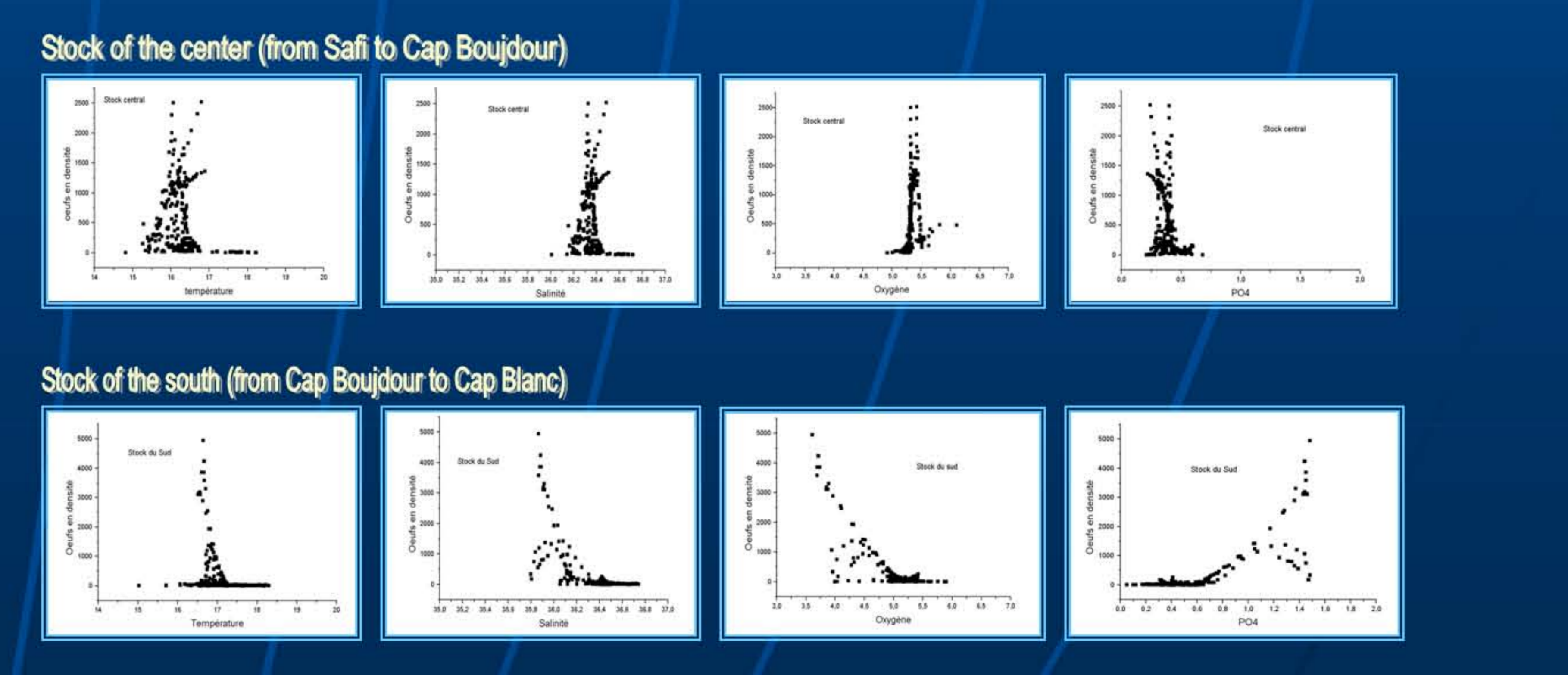
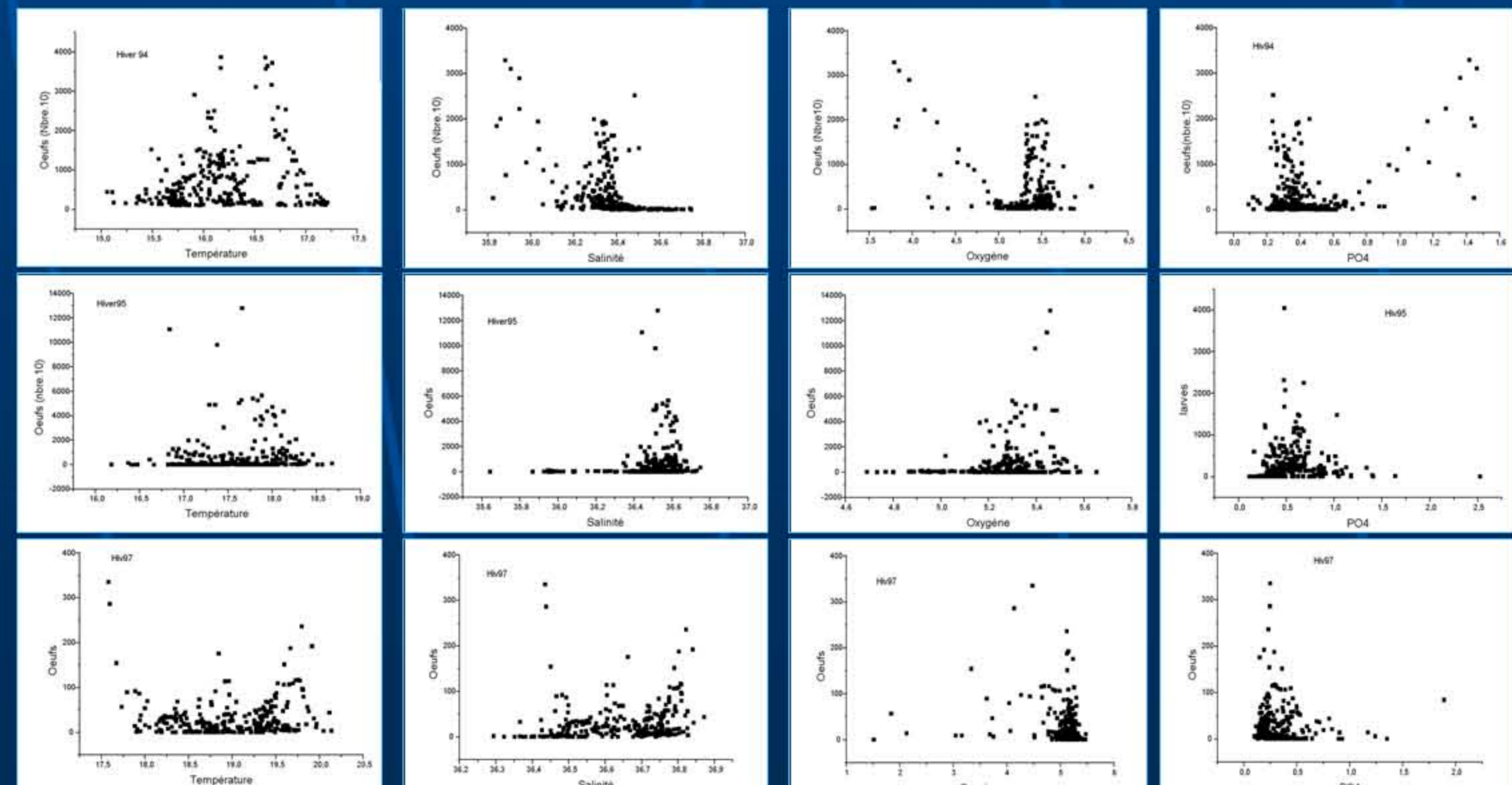
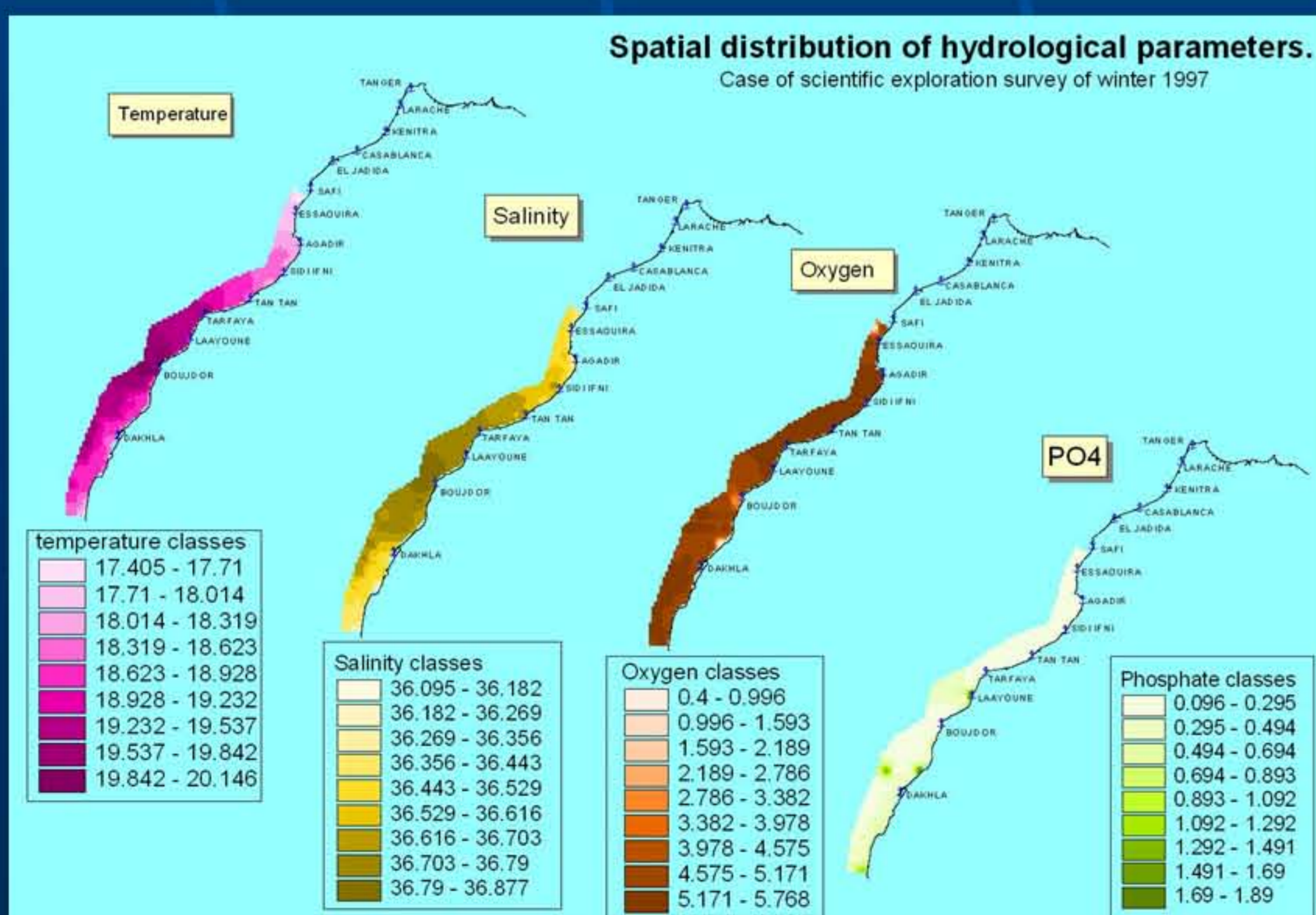
The spatial combination of the distribution of eggs and larvae during the winter and summer seasons allowed to locate the zones of presence of eggs and larvae during all the year.



The interannual comparison of the spatial distribution of eggs and larvae made possible to follow the abundance state of eggs and larvae of sardine during the four years of scientific prospecting (1994-1997).



The temperature, salinity, oxygen and the phosphate are the 4 hydrological parameters taken in the same sampling stations of eggs and larvae. The spatial distribution of these 4 variables is studied by using the same deterministic method of interpolation and the same space resolution in order to facilitate the spatial combination between the biological variables and the hydrological ones.



## Conclusions

In the field of fisheries research, the development of GIS coupled with others technological tools such as geostatistics allows the management of increasing amounts of information and encourages the scientists to reprocess the historical data for better understanding the space-time variation affecting exploited stocks.

## References

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