

Spatial and temporal variations in Diatoms from la Chaîne des Lacs urban watershed, Nord-Pas-de-Calais, France, in relation to water quality

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Map of sample localities. red squares = 2016 surface sediment and plankton samples, circles 2015 surface sediment. Green circles are richest in *Cocconeis*. Core location is near site 14.

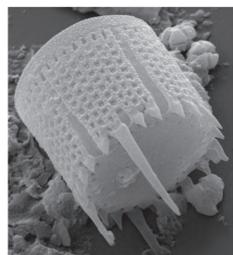
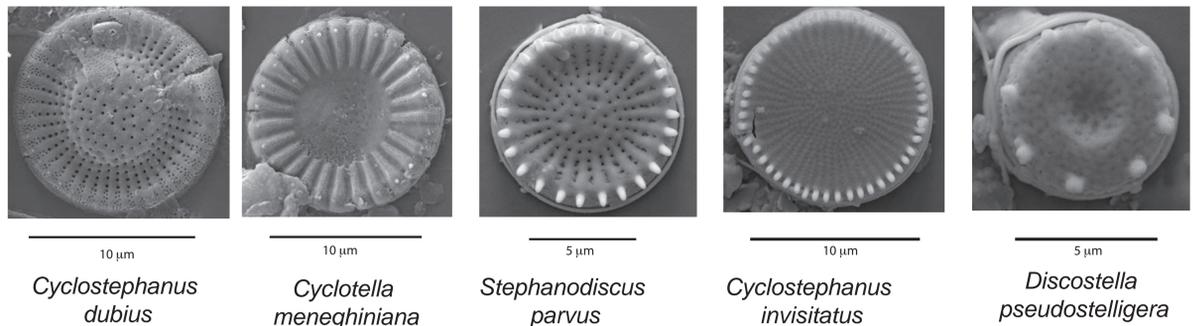
I. Introduction:

Diatom analysis was conducted on lake sediments in la Chaîne des Lacs to address both the present day water quality, and the evolution of this urban system over its 40 year history.

La Chaîne des Lacs is a series of shallow eutrophic artificial lakes established in the 1970's as a storm control system and urban Park in Villeneuve d'Ascq France. The main lake, Lac du Héron, has received recent attention because of water quality problems, including eutrophication, harmful algal blooms, and invasion by the macrophyte *Elodea* in 2012. A total of 17 sites were collected in la Chaîne des Lacs, 11 of which were in Lac du Héron, to document spatial variability, and a 26cm long sediment core addresses historical changes. We document the spatial differences in diatom distribution in the surface sediments (top 2 cm) and compare to living phytoplankton samples. Finally, we relate these results to water quality parameters of including trophic status and metals pollution.

II. Diatom flora:

The bulk of the diatom assemblage in Lac du Héron can be classified as both eutrophic and moderately metal tolerant, using modern national diatom indices developed and used by the French regional water agencies (Morin et al., 2012). Surface sediment samples within Lac du Héron show large spatial variations in % *Cocconeis placentula* whose habitat is epiphytic growth (Kutzing 1844) especially on *Elodea* (Kratsova et al., 2010). *Lemnicola hungarica*, associated with duckweed (Goldsborough, 1993) occurred in LH6 and site 4. Other variation is reflected in the phytoplankton composition both spatially, and interannually. *Aulacoseira muzzanensis* and *Cyclostephanus dubius* showed greater abundance in the open water habitats in Lac du Héron, whereas sites in la Chaîne des Lacs outside of Lac du Héron had greater *Cyclotella meneghiniana*.



Aulacoseira muzzanensis



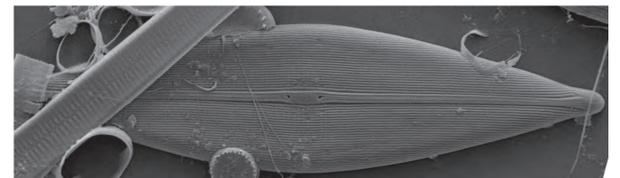
Gomphonema augur



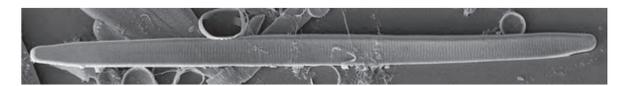
Halamphora veneta



Cocconeis placentula



Craticula cuspidata

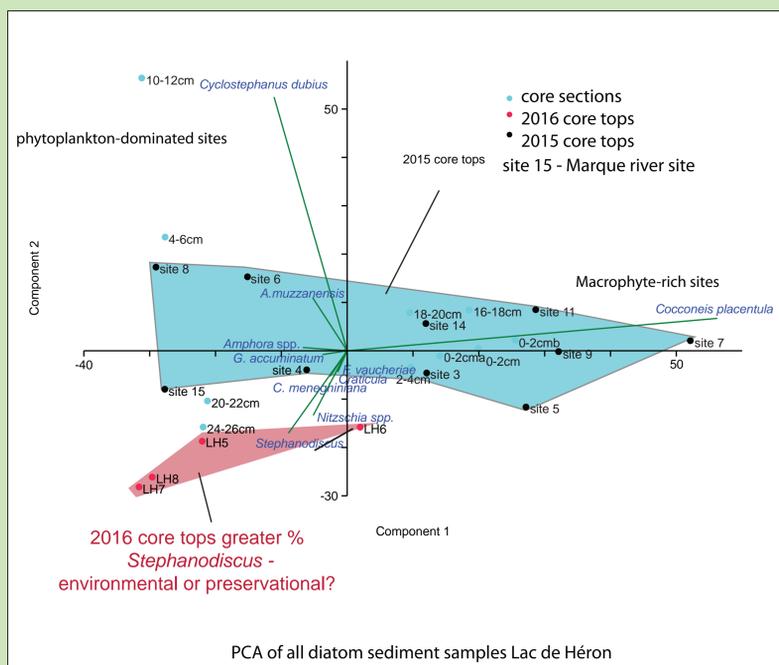


Ulnaria ulna

III. Spatial variations:

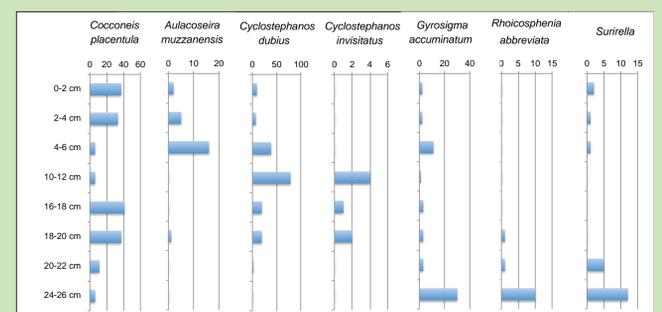
The following spatial variations are illustrated with PCA analysis:

1. With the exception of sites 6 and 8, all 2015 core tops from Lac du Héron are rich in *Cocconeis* and plot on right side of component 1 axis.
2. Site 4, isolated from main part of Lac du Héron, also has low *Cocconeis*.
3. Site 15 is distinct, from the Marque river to the east, with abundant *S. venter*, *Craticula*, *Nitzschia*, and *Amphora/Halamphora*.
4. There is an interesting temporal difference in core top samples. Those taken January 2015 have much lower abundances of the eutrophic *Stephanodiscus* than those taken in late March 2016, and may be either attributed to preservation of these small spring bloom taxa, or to interannual variations. (Compare LH5 vs. site 5)



PCA of all diatom sediment samples Lac de Héron

IV. Down-core variation:



No age model could be generated for the core, however a progression is seen.

- 0-4 cm rich in *Cocconeis placentula* likely coincide with increased *Elodia* growth.
- 4-12 cm phytoplankton dominated interval, less macroalgae
- 16-20 cm prior cycle of increased macroalgae?
- 20-26 cm are rich in littoral periphyton, early establishment of reservoir?

Goldsborough, L.G., 1993, Diatom ecology in the phytosphere of the common duckweed (*Lemna minor* L.) - Hydrobiologica 269/27: 463-471.
 Kutzing, T.F., 1844, Die Kieselschaligen Bacillarien oder Diatomeen, 152 S. 30. Tafel. Nordhausen.
 Kratsova, L.S., Izhboldina, L.A., Mekhanikova, I.V., Pomazkina, G.V., and Belykh, O.I., 2010. Naturalization of *Elodea canadensis* Mich. in Lake Baikal. Russian Journal of Biological Invasions, 1(3), pp.162-171.
 Morin, S., Cordonier, A., Lavoie, I., Arini, A., Blanco, S., Duong, T.T., Tornés, E., Bonet, B., and Corcoll, N., 2013. Consistency in Diatom Response to Metal-Contaminated Environments, in: H. Gausch et al. (eds.) Emergent and Priority Pollutants in Rivers, HbD. Env Chem, 19: 117-146.